Philadelphia Regional Port Authority

Commonwealth of Pennsylvania

Southport Marine Terminal Project Final Environmental Assessment and Mitigation Plan

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LIST OF ACRONYMS

µg/kg	micrograms per kilogram
µg/m^3	micrograms per cubic meter
µmohs/cm	microsiemens per centimeter
AAL	American Analytical Laboratories
ACM	asbestos containing material
AET	AET Environmental, Inc.
AQCR	Air Quality Control Region
bgs	below ground surface
BMP	Best Management Practice
CAAA	Clean Air Act Amendments of 1990
CDF	confined disposal facility
CENAP	U.S Army Corps of Engineers, Philadelphia District
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
CO_{2eq}	CO_2 equivalents
COPC	contaminant of potential concern
CSXT	CSX Transportation
CWA	Clean Water Act
cy	cubic yard
dB	decibel
DCNR	Department of Conservation and Natural Resources
DGS	Department of General Services
DRBC	Delaware River Basin Commission
EA	Environmental Assessment
EBS	Environmental Baseline Survey
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
ft	feet, foot
GHG	greenhouse gas
HA	Herpetological Associates, Inc.
HAP	hazardous air pollutant

LIST OF ACRONYMS
(Continued)

HBI	Hilsenhoff Biotic Integrity
HFC	hydrofluorocarbon
ILA	International Longshoremen's Association
IRP	Installation Restoration Program
JD	Jurisdictional Determinations
LBP	lead-based paint
LOS	level-of-service
Magnuson Act	Magnuson-Stevens Fishery Conservation and Management Act
mcy	million cubic yards
MDL	method of detection limit
MLLW	mean lower low water
mph	miles per hour
MSC	Medium Specific Concentration
MUTCD	Manual on Uniform Traffic Control Devices
NAAQS	National Ambient Air Quality Standards
Navy Yard	Philadelphia Naval Shipyard
NEPA	National Environmental Policy Act
NFA	no further action
NRHP	National Register of Historic Places
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
NPL	National Priorities List
NS	Norfolk Southern
NSP	Neshaminy State Park
O_3	ozone
PADEP	Pennsylvania Department of Environmental Protection
PAID	Philadelphia Authority for Industrial Development
PARHP	Pennsylvania Register of Historic Places
PATCO	Port Authority Transit Corporation
PCB	polychlorinated biphenyl
PFBC	Pennsylvania Fish and Boat Commission
PFC	perfluorocarbon

LIST OF ACRONYMS
(Continued)

PGC	Pennsylvania Game Commission
PGL	Policy Guidance Letter
PHMC/BHP	Pennsylvania Historical and Museum Commission/Bureau for Historic Preservation
PIDC	Philadelphia Industrial Development Corporation
PLM	Polarized Light Microscopy
PNDI	Pennsylvania Natural Diversity Inventory
ppm	parts per million
PRM	Potomac-Raritan-Magothy
PRPA	Philadelphia Regional Port Authority
PWD	Philadelphia Water Department
RCRA	Resource Conservation and Recovery Act
RELA	Real Estate License Agreement
RMG	rail-mounted gantry
ROD	Record of Decision
RTE	Rare, Threatened, and Endangered
RTG	rubber-tired gantry
SAV	submerged aquatic vegetation
SCP	Scientific Collection Permit
SCR	Sediment Characterization Report
SDDC	Surface Deployment and Distribution Command
SEPTA	Southeastern Pennsylvania Transportation Authority
SF_6	sulfur hexafluoride
SIM	selected ion monitoring
SIP	State Implementation Plan
SNS	shortnose sturgeon
SO_2	sulfur dioxide
SO_X	sulfur oxides
SQO	Stream Quality Objective
SVOC	semivolatile organic compound
T&E	threatened and endangered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TEM	transmission electron microscopy
TEM-CC	TEM Community Center

LIST OF ACRONYMS
(Continued)

TEUs	twenty-foot equivalent units
TOC	total organic carbon
TP	total phosphorus
TPH	total petroleum hydrocarbon
tpy	tons per year
TSS	Total Suspended Solids
USEPA	U.S. Environmental Protection Agency
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
VPA	Virginia Port Authority
WQC	Water Quality Certificate
WSS	Web Soil Survey

EXECUTIVE SUMMARY

Introduction

The Commonwealth of Pennsylvania ("Commonwealth"), acting through the Department of General Services ("DGS"), and the Philadelphia Regional Port Authority ("PRPA"), an independent agency of the Commonwealth, are proposing the development of a new marine terminal (Southport) in the City of Philadelphia, PA. The proposed Southport site (Figure 1-1) extends along the Delaware River, from the east end of the former Philadelphia Naval Shipyard to the existing sheet pile bulkhead just south of Pier 124. The Southport development would be approximately 116 acres, with capacity at full build-out for an annual container throughput of 1.34 million twenty-foot equivalent units (TEUs). Southport is projected to create thousands of new, family-sustaining jobs and inject substantial new business and tax revenue into the regional economy.

The federal action involved in this project is the issuance by the United States Army Corps of Engineers (USACE) of a Joint Permit under Section 404 of the Federal Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act to authorize the discharge of dredge and fill material and construction within navigable waters of the United States. USACE is the federal agency responsible for complying with the National Environmental Policy Act (NEPA) before taking the federal action—issuing the Joint Permit. DGS and PRPA are the co-applicants for the Joint Permit and the CWA Section 401 Water Quality Certificate (WQC), and the Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit. The CWA Section 401 certification and Chapter 105 permit are administered by the Pennsylvania Department of Environmental Protection (PADEP). In addition, the activities authorized by the Joint Permit have been evaluated for consistency with the Pennsylvania and New Jersey Coastal Zone Management Programs.

The preparation of this environmental assessment (EA) has relied on an interdisciplinary team using a systematic approach to analyze the affected area, to estimate the probable environmental effects, and to prepare the document. Applicable sections of the July 2010 Draft EA have been revised and comments incorporated in this September 2012 Draft Final EA.

Purpose and Need

Due to projected growth in East Coast cargo volumes, increased shipping traffic due to expansion of the Panama Canal and impending capacity constraints at other East Coast ports, the proposed Southport terminal would enable the Port of Philadelphia to provide an efficient, competitive facility that can respond to increased market demand, particularly for the import/export of containerized cargoes. The Panama Canal expansion will likely result in post-Panamax ships calling on the larger, East Coast container ports that are already congested. This in turn could easily displace some of the smaller Panamax vessels, causing shippers to redirect cargoes to less-congested facilities in Philadelphia. The new Southport terminal would especially be in a good position to alleviate projected short- and mid-term capacity constraints at other East Coast ports. Development of the proposed terminal is consistent with the region's economic initiatives to take advantage of increased demand for containerized cargo-handling capacity, resulting from the expanding Asian markets and future widening of the Panama Canal. The proposed Southport development would foster trade and enhance commerce by providing an efficient, cost-competitive facility for the import and export of goods.

Alternatives

A project alternatives analysis was undertaken prior to and during the preparation of this EA to evaluate all practicable alternatives. Commencing in 2003, PRPA conducted a series of comprehensive studies to evaluate potential areas for port development, which led to the selection of Southport as the most appropriate location for a new marine terminal. After selection of the Southport location, a comprehensive planning and formulation process was conducted to optimize the site. During this process, 12 main alternatives were considered, and some were further refined, to optimize the available land for ship berthing and container yard operations, while minimizing the level of impact to wetlands and the Delaware River. Ultimately, the preferred alternative was selected based on its ability to meet the economic development goals of the project while avoiding or minimizing environmental impacts to the greatest extent practicable.

Preferred Alternative

The preferred alternative of the Southport Development Project is Option B (Figure 1-2). This alternative would provide approximately 116 acres of land for the construction and necessary improvements required to develop and operate a state-of-the-art marine terminal capable of handling two Panamax-class container ships simultaneously. The construction of 3,043 ft of pile-supported marginal wharf, dredging and shoreline stabilization would permanently impact approximately 8.88 acres of the Delaware River and approximately 5,500 linear ft of existing shoreline. The shoreline along the southern end of the project site would be protected with a revetment and stone riprap similar to the existing shoreline but with better structural properties. The project would include over 43 acres of permeable gravel surfaces to provide the necessary areas for container storage and yard operations. An additional 73 acres would be paved to provide an operating area for horizontal transport of containers to and from the wharf, as well as to and from trucks. The impervious surfaces would necessitate an extensive stormwater collection and management system, including the construction of catch basins and a stormwater treatment and drainage system. Approximately 1,000 ft of an existing stormwater conveyance channel would be relocated with a new outfall near its present location. An extension of Columbus Boulevard along with associated improvements would provide dedicated vehicle access to the terminal. The clearing, grading, paving, building construction, and associated infrastructure necessary for this alternative would permanently impact 3.75 acres of freshwater wetlands and 8.88 acres of intertidal/subtidal/deepwater habitat. Initially, an area of approximately 35 acres of deep water would be dredged to -40 ft MLLW (plus an optional 2-ft overdredge) to provide two ship berths and the resulting 1,008,000 mcy of dredged material would be placed at the Fort Mifflin CDF, or other approved disposal facility. Subsequent dredging may result in removing an additional 298,000 cy to a depth of -45’ MLLW (plus an optional 2-ft overdredge). Once fully built out, the terminal would have a throughput capacity of approximately 1,340,000 TEUs per year.

Environmental Consequences

Short-term and long-term environmental consequences to resources potentially resulting from the Southport Development Project Preferred Alternative were considered, including the physical

conditions, groundwater, surface water quality, air quality, aquatic resources, wetlands, terrestrial resources, Rare, Threatened, and Endangered (RTE) species, recreation, cultural resources, socioeconomics, transportation, and noise. Cumulative impacts, short-term versus long-term productivity, the irretrievable and irreversible commitment of resources, and mitigation associated with the preferred alternative were also evaluated.

Significant short- and long-term positive socioeconomic impacts are expected from the proposed project in terms of increased revenue to the Philadelphia area. The Southport Development project is projected to generate nearly 18,073 direct, induced, and indirect jobs annually. It is estimated that 7,310 direct jobs would be generated, and these job holders would receive about $325.3 million of direct personal earnings for an average salary of approximately $44,500.

Clearing, grading, and construction of the terminal are not expected to affect the geology that underlies the project site, but impacts to soils and sediments would occur. The existing grade of the site would be raised to an elevation of +11.4 ft, requiring 789,000 cy of clean fill material and paving. Dredging of the Delaware River to create berthing areas and access to the federal navigation channel would require the removal of up to approximately 1.3 million cy of sediment. Although the adjacent river bathymetry would change, the cross section at this point of the river would be minimally impacted from the dredging, which accounts for an increase in 16% of the total cross section, none of which is part of the main flow conveyance of the river.

There are no anticipated significant short- or long-term impacts to groundwater, surface water quality, and floodplain areas. The proposed action is not anticipated to have negative impacts on the New Jersey Coastal Plain Sole Source Aquifer (SSA). Although activities associated with dredging and construction of the proposed terminal could have short-term impacts to surface water quality, they would be temporary and not significant. Turbidity associated with dredging is expected to reach background levels within an hour or less after dredging ceases. Implementation of Best Management Practices (BMPs), including standard erosion control measures and a stormwater management system, would nullify many of the potential effects to the surface water quality in the vicinity of the project. Impacts associated with the loss of floodplain area resulting from fill would be negligible. The flood storage volume within the floodplain that must be filled is more than offset by the volume removed during dredging.

A few areas within the main project footprint would require excavation or cut sections. Disturbance of site soils would be limited to excavation of sediment ponds constructed as part of the erosion and sediment control during the initial stages of fill placement. In addition, construction of the main access roadway involves two areas that require cut sections and excavation of site soils totaling approximately 1,000 cy. The recent Phase I Site Assessment (WESTON, 2010) does not indicate that impacted soils are present within the footprint of the sediment ponds or along the alignment of the proposed access roadway. Excavated soils would be reused as construction fill and would not increase the risk of any on-site contamination. If off-site disposal is required, applicable PADEP regulations regarding sampling analysis and disposal of impacted soils would be followed.

The proposed action is located in the Philadelphia-Wilmington-Atlantic City air quality control region, designated as Subpart 2/Moderate Nonattainment for ozone (O_3). For the Clean Air Act Amendment General Conformity Rule, NO_x and volatile organic compound (VOC) emissions are regulated as precursors of ozone. The proposed action is also located in the Philadelphia-Wilmington air quality control region designated in nonattainment for the annual and 24-hour NAAQS for fine particulates ($PM_{2.5}$), for which NO_x and sulfur dioxide (SO_2) also are regulated as precursors. The most stringent applicability threshold levels under the General Conformity Rule are 50 tons per year (tpy) for VOC emissions and 100 tpy for NO_x, $PM_{2.5}$, and SO_2 emissions, respectively. All emissions resulting from construction of the proposed action are below de minimis levels and less than the 10% level that the United States Environmental Protection Agency (USEPA) would consider regionally significant.

Some resources would potentially be affected in both the short- and long-term and thus require mitigation. As a result of the project, existing benthic invertebrates within the proposed dredging footprint would be lost but impacts would be temporary. To the extent that suitable substrate is available within the dredging footprint, recolonization is expected to occur relatively soon after completion of dredging activities. Sediment characterization demonstrates similar material at depth but generally lower contaminant levels. Any existing benthic communities within the area to be filled to elevations above mean high water would be permanently lost. It is anticipated that dredging would result in the temporary loss of up to 35 acres of benthic habitat, and that filling, excavation, and shading within the Southport Development Project footprint would result in the

permanent loss and/or alteration of approximately 8.88 acres of benthic habitat and the destruction of nonmobile benthos. The loss and alteration of benthic habitat would be mitigated in several ways, as set forth in the Mitigation Plan (Appendix K).

Dredging and wharf construction would result in a permanent loss of approximately 5,500 linear ft of a rocky intertidal area along the project shoreline. Construction of the wharf would remove habitat that is currently utilized as a probable foraging area by a number of species, including striped bass. Construction of the rock revetment and stabilization of the bank along the southern shoreline would likewise result in similar impacts to this habitat. However, the rock revetment would be constructed in such a way and with similar rubble materials that recolonization would occur and the area would eventually return to a productive foraging area for striped bass. In addition, the open-water area under the wharves would provide habitat for fish, including species that inhabit shaded, deeper-water areas (e.g., catfish) and species that utilize open-water areas higher in the water column as well as the pilings. In addition, a variety of fish habitats, primarily intertidal and subtidal, would be provided from the proposed mitigation in the area of Jack's Marina (JM).

The 1.08 acres of submerged aquatic vegetation (SAV) located in the area between the sheet pile bulkhead south of Pier 124 and the north shoreline of the Navy Yard would be permanently lost from the proposed Southport Project. There is no version for the preferred alternative that can reduce or eliminate the loss of the entire 1.08-acre SAV area within the project footprint. Therefore, compensation for the loss of this aquatic habitat type will be required and is being evaluated as one of the required mitigation components. A mitigation ratio of 3:1 (creation-to-loss) is initially proposed, with the establishment of SAV in the proposed mitigation area footprint (Jack's Marina) or expanding the footprint of existing SAV areas in the Delaware River.

Construction of the proposed project would result in the loss of 116 acres of potential terrestrial habitat. However, much of the area to be cleared, filled, and converted to gravel or paved surfaces has been classified as disturbed, and the loss of potential habitation would not significantly impact the quality of the environment. No substantial impacts are expected from construction or operation activities because of the relative absence of terrestrial species within

the project footprint, timing of construction, and the collection and relocation of endangered plant species.

Construction of the proposed Southport Development Project would result in the permanent loss or alteration of a combination of nontidal wetlands, tidal wetlands, tidal mudflats, and subtidal and deep-water areas (refer to Table 3-9, Figure 3-4, and Appendix F). Impacts to these regulated areas would be mitigated through a combination of creation, enhancement, restoration, and preservation at the Southport project site and at an approved mitigation location, and would result in no net impact to the quality of the environment.

The loss of greater than 100 acres of terrestrial and associated wetland and water habitats may impact and displace birds that utilize the site seasonally and year round, but any potential impact would not be significant because most of the project area already has been developed (former Navy housing) and provides marginal habitat (common reed dominated areas).

Federally listed RTE species potentially occurring in Philadelphia County include the threatened bog turtle, endangered Atlantic and shortnose sturgeon, endangered dwarf wedgemussel, and threatened small-whorled pogonia. The bog turtle, Atlantic and shortnose sturgeon, dwarf wedgemussel, and small-whorled pogonia are also listed as endangered in the State of Pennsylvania.

The proposed project is not expected to adversely impact the shortnose sturgeon and Atlantic sturgeon. Habitat conditions within the Delaware River surrounding the proposed facility are not optimal for spawning or supporting juvenile sturgeon populations due to the lack of deep-pool refuge preferred by the species.

The United States Fish and Wildlife Service (USFWS) does not list Philadelphia County as a location in which the dwarf wedgemussel is known to occur (USFWS, 2010a). The small-whorled pegonia habitat type does not exist within the project site so it is unlikely that this species exists within the Southport Development Project site. Since neither of these species is likely to occur in or near the project site, adverse impacts are not likely.

Field surveys conducted in 2009 and 2010 determined that none of the investigated wetlands within the project site provide suitable habitat for bog turtle (see Appendix C); therefore, this species would not be affected by the construction of the terminal.

The bald eagle nest located in a wooded area on the southern portions of the proposed site was last used for nesting during periods in the spring and summer of 2008, with confirmation that the pair fledged one eagle (Normandeau, 2010). Since 2008, only one unconfirmed sighting of an eagle on the nest has occurred. With the exception of this one unconfirmed sighting, neither eagles nor evidence of nest-building activities were observed at the nest site from late January to mid-March in 2010. The nest has not been occupied by nesting eagles since 2008 as described above. An application for removal of the inactive nest, as well as implementation of measures that would provide a "net benefit" to the bald eagle population, is currently pending with USFWS. A supplement to the application for take of an abandoned bald eagle nest has been developed and is being provided to the appropriate resource agencies. It should be noted that routine monitoring of the nest has been conducted since the application was submitted, and no nesting activities have been observed. If the nest site is lost, it would not adversely impact or change the increased breeding in the area's bald eagle population. According to Normandeau (2010), the Navy Yard is not an important site for breeding, feeding, or sheltering. The majority of the foraging, roosting, and perching observations have been made on the New Jersey side of the Delaware River.

The construction and operation of the Southport terminal is expected to have minimal impacts on recreation. Construction and operation of the terminal would have no impact to the surrounding parks and there would be no loss of frequently used recreational lands. Dredging of the Delaware River and placement of dredged material would have short-term impacts on recreation, including a temporary increase in turbidity, which has the potential to impact recreational fishing. Notification to fishermen would minimize the disturbance because recreational fishermen would likely avoid fishing in the vicinity of dredging. Dredging and operation of the terminal are not expected to have major impacts on boating. Temporary impacts may occur related to recreational boating and commercial activities at the Navy Yard due to the floating discharge pipeline; however, boaters have the ability to navigate around dredging operations and generally avoid

these areas. Ship traffic to and from the container terminal during operations should have minimal impacts to recreation.

A reconnaissance-level, Phase IA Cultural Resources Assessment (Appendix G) was conducted in January 2010 with the objective of investigating the potential for previously undocumented archaeological resources to exist within the project area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP). As a result of the documentary review and pedestrian reconnaissance, the proposed project area does not possess the potential to contain intact significant archaeological resources. The assessment revealed four architectural sites of potential significance: former military housing, Mustin Airfield, Greenwich Coal Pier (Pier 124), and Pier 122/Ore Conveyor and Support Building historic district. The former military housing (subsequently demolished in 2012 for public safety reasons under a separate permit) did not meet the 50-year criteria for listing on the NRHP and was not of exceptional importance. The abandoned Mustin Airfield was previously designated as ineligible so no further investigations are recommended. The Philadelphia Naval Shipyard Historic District, located west of the project area, is listed on NRHP. The Seaplane Hangar is a contributing resource to the district; however, the proposed action would not physically alter the structure or have an adverse effect on this resource. Piers 122 and 124 have been in the process of being dismantled and no longer have the historic fabric and architectural integrity to meet the criteria to be listed on the NRHP.

The proposed action would provide significant economic benefits to the local and regional economies. The Southport Development project is projected to generate nearly 18,073 direct, induced, and indirect jobs annually. It is estimated that 7,310 direct jobs would be generated, and these job holders would receive about $325.3 million of direct personal earnings, for an average salary of approximately $44,500. An additional $1,041.7 million of local spending and consumption activity is anticipated to be generated, which would support 9,452 induced jobs. It is anticipated that $871.0 million of business revenue to local service providers would be generated annually from a 1,340,000 TEU container throughput.

The project site itself is currently uninhabited. Present land use in the area is predominantly undeveloped or light industrial. Since there are no residential neighborhoods adjacent to the project site, there would be no adverse environmental justice issues concerning the construction or operation of the container terminal. However, the new terminal would provide numerous socioeconomic benefits, through jobs and local revenue that may have a positive effect on nearby minority and lower income populations.

During the estimated 2-year construction period there is expected to be a minor, temporary increase in local traffic. Even considering traffic volume during terminal operations, following construction activities, both local and regional traffic impacts are not significant, and any impacts to traffic could be mitigated through the optimization of traffic signal timings and the implementation of turning-lane restrictions.

Noise impacts to the natural and human environment are expected to be localized and short-term, occurring during the construction of the container terminal, including dredging and dredged material placement. Minimal noise impacts are also expected even during the operation of the container terminal. Present land use in the area is predominantly port related, light industrial, former military, or undeveloped. There are no environmentally sensitive areas such as schools, hospitals, and low-income areas near the proposed project site.

Construction and operation of the proposed terminal would not cause significant cumulative effects, which result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions.

The long-term productivity of this area is in use for port and industrial developments, and the anticipated benefits from these developments outweighs any potential impacts from the federal action, particularly in light of the mitigation measures proposed to offset potential impacts.

Recommendation

Through a systematic process within this study, viable options that meet the purpose and need of this proposed action were evaluated and a preferred alternative selected. The preferred alternative provides improvements to a 116-acre parcel of land along the Delaware River in the

City of Philadelphia that includes a new marine terminal with associated infrastructure, dredging approximately 1.3 mcy of material from the Delaware River adjacent to the project site, and placing the dredged material in the Fort Mifflin confined disposal facility (CDF) or other approved disposal facility. The project has the potential to provide significant positive socioeconomic impacts. After applying the proposed mitigation (Appendix K), it has been determined that the net environmental impacts resulting from the implementation of the proposed action are not significant and will not require the preparation of an Environmental Impact Statement (EIS). It is recommended that the final review of this EA result in a Finding of No Significant Impact (FONSI).

1. PURPOSE AND NEED

1.1 INTRODUCTION

The Commonwealth of Pennsylvania ("Commonwealth"), acting through the Department of General Services ("DGS") and the Philadelphia Regional Port Authority ("PRPA"), an independent agency of the Commonwealth, is proposing the development of a new marine terminal (Southport) in the City of Philadelphia, PA. The proposed Southport site (Figure 1-1) extends along the Delaware River, from the east end of the former Philadelphia Naval Shipyard to the existing sheet pile bulkhead just south of Pier 124. The Southport development will be approximately 116 acres, with capacity at full build-out for an annual container throughput of 1.34 million twenty-foot equivalent units (TEUs). Southport is projected to create thousands of new, family-sustaining jobs and inject substantial new business and tax revenue into the regional economy.

Due to projected growth in East Coast cargo volumes, increased shipping traffic due to expansion of the Panama Canal and impending capacity constraints at other East Coast ports, the proposed Southport terminal would enable the Port of Philadelphia to provide an efficient, competitive facility that can respond to increased market demand, particularly for the import/export of containerized cargoes. Projections done in 2008 indicated that the China-North America containerized cargo trade via the Panama Canal is expected to reach 14.9 million TEUs by 2027, compared to 3.1 million TEUs in 2006 (Ghonima, 2008).

The Panama Canal expansion will likely result in post-Panamax ships calling on the larger, East Coast container ports that are already congested. This in turn could easily displace some of the smaller Panamax vessels, causing shippers to redirect cargoes to less-congested facilities in Philadelphia. This phenomenon is called the "cascade effect", when large ships displace small ships in all trade routes due to the emergence and large scale deployment of large, post-Panamax ships. For the cascade effect to take place, the following conditions must be present (Lam, 2010):

- Increased container volume, hence justifying larger ships, or
- same volume, but reduced sailing frequencies, or
- both of above happening.

By 2011, post-Panamax vessels will contribute about 45% of all container slots. As these vessels become larger, with the ability to carry up to 10,000 TEUs, many upgraded East Coast hub ports will gain market share and become gateways for intermodal traffic. However, most other East Coast ports will also need upgrades for greater ship sizes due to the combined Panama Canal expansion and cascade effect (Lam, 2010). Although the existing Delaware River channel depth will not allow the passage of most post-Panamax container ships, the Port of Philadelphia, with the addition of new Panamax-capable facilities, will be able to take advantage of the Panama Canal expansion and resulting cascade effect by receiving Panamax ships displaced from hub ports, such as New York/New Jersey, Norfolk, and Charleston.

The new Southport terminal would especially be in a good position to alleviate projected short- and mid-term capacity constraints at other East Coast ports. Development of the proposed terminal is consistent with the region's economic initiatives to take advantage of increased demand for containerized cargo-handling capacity, resulting from the expanding Asian markets and future widening of the Panama Canal. The proposed Southport development would also foster trade and enhance commerce by providing an efficient, cost-competitive facility for the import and export of goods.

Southport's proximity to an extensive network of established key distribution centers for large retailers and distributors, as well as its access to excellent rail and highway transportation, would provide importers with a competitive option that features the necessary capacity plus significant savings in transportation costs, particularly compared to other Northeast and Mid-Atlantic ports (e.g., Port of New York and New Jersey, Port of Baltimore, and Port of Norfolk). With steady increases projected in global trade and East Coast container volumes, as well as impending capacity constraints at other East Coast ports, the Port of Philadelphia's existing terminal facilities and infrastructure need enhanced capacity in order to satisfy continuing increases in market demand. Inability to satisfy this demand will result in deteriorating efficiency levels in the logistics network, higher costs, barriers to trade, loss of business, and reduced competitiveness for the Port of Philadelphia, which functions as a strong driver of economic growth in the Philadelphia region.

1.1.1 Shipping Trends

Foreign and domestic waterborne trade is generally composed of three cargo types—general cargo, dry bulk, and liquid bulk. General cargo trade can be subdivided into two categories, containerized and break bulk. A significant trend in recent years is the movement away from break bulk ships to containerized cargo ships. General cargo, particularly containerized cargo, utilizes the most land and generates the greatest revenue for marine terminal facilities.

Growth in the U.S. Atlantic Coast shipping trade is strongly influenced by growth in European and particularly the Asian trades. Since 1989, imported cargo from Asia into the United States has grown from approximately 20 million tons to approximately 60 million tons (Martin Associates and St. Onge Company, 2006). Although global economic conditions have taken a significant downturn since 2006, recovery is underway in the containerized shipping markets. Recently, a shipping consultant estimated shipments from Asia to the United States for the month of June 2010 to be 1.23 million TEUs, a 32% increase over a year ago; (Barnard, 2010) and despite the concern of a continued sluggish economy, the global demand growth projection for 2010 was recently increased to 8.5% by Drewry Shipping Consultants (Leach, 2010). In May 2010, Hackett Associates forecasted that East Coast ports would import 17.1 percent more TEUs in 2010 than 2009, while west coast ports are projected to import 13.5 percent more than in 2009. The total volume forecast for the two coasts in 2010 is 15.9 million TEUs (Hackett Associates, 2010).

Although the West Coast U.S. ports have historically handled approximately 80% of containerized imports, two recent events caused significant adverse effects to the logistics system of major retail and manufacturing products importers: The impact of 9/11 on the distribution supply chain and the labor conflicts resulting in the 2002 West Coast port shutdown (Martin Associates and St. Onge Company, 2006). The temporary shutdown in September 2002 of the Port of Los Angeles, the largest container port in the United States, was especially significant in that it forced importers to look to other destinations for containerized cargo from Asia. As a result of these events, more Asian cargo has moved through East Coast ports, such as Savannah, Norfolk, and New York/New Jersey. This in turn has caused major importers to invest in the construction or expansion of large-scale distribution centers to serve as hubs to many of the East Coast ports. A major portion of this network of distribution centers includes facilities in the

Philadelphia "hinterland." Over 300 of these facilities, which have the least-cost trucking service from the Port of Philadelphia, are located throughout the outlying areas of Philadelphia. They include distribution centers in Westampton, Delran, Swedesboro, and Burlington, NJ; and Mechanicsburg, Chambersburg, York, Reading, Allentown, and King of Prussia, PA (Martin Associates and St. Onge Company, 2006). As such, the expected high rate of growth of the Asian markets will continue to spur the growth of the U.S. Atlantic Coast trade, requiring additional capacity. The Southport project is designed to address this need for additional capacity.

The proposed Southport site is centrally located to efficiently serve the port needs of one of the most densely populated consumer markets in the United States. The Port of Philadelphia and its neighboring ports from New Jersey to Maryland transported a combined 5.7 million TEUs of import and export merchandise in 2009 according to the American Association of Port Authorities. With an improvement underway in the Mid-Atlantic economy, and concurrent growth in retail sales and distribution supply, the region's international trade volume is expected to increase substantially in the next 15 years. This expected increase in trade volume will require additional terminal facilities to alleviate the congestion and capacity constraints that currently exist at many of the East Coast ports. The Port of Philadelphia is especially positioned to capitalize on these opportunities by having the available land to construct a new, state-of-the-art facility.

1.1.2 Competitive Position of the Port of Philadelphia

The underlying purpose of the proposed project is to create sustainable jobs and stimulate the local and regional economies by providing a new container terminal that will enhance Philadelphia's ability to respond to projected growth in container volumes on the East Coast, as well as impending capacity constraints at other East Coast ports. Southport would enhance the efficiency and cost-competitiveness of the logistics network, which would grow business and benefit the region.

The Commonwealth is dedicated to positioning the Port of Philadelphia to capitalize on the projected growth in East Coast container volumes, as well as expected capacity constraints at other East Coast port facilities. The Port Authority of New York and New Jersey (PANYNJ), the largest U.S. East Coast container port, is anticipated to begin experiencing capacity constraint problems in the near future. The PANYNJ, aside from hoping that its terminal operations can

obtain material land productivity increases at existing terminals, is pursuing a number of specific options to gain significant incremental capacity during the next several years. Even if the PANYNJ realizes its desired increase in productivity, as well as all of its incremental capacity gains, the transportation industry consensus is that within the next 10–15 years they will have no growth capacity. The Port of Philadelphia would be poised to take advantage of this constraint by attracting new carriers to Southport, thereby creating thousands of family-sustaining jobs and boosting the local and regional economies with millions of dollars in new business and tax revenues. To fully understand the potentially significant economic benefits of the Southport development, the Commonwealth commissioned a comprehensive analysis of the projected economic impact from the Southport project. The results of this study are included in Section 4.3.15 (Econsult, July 2010).

The Port of Philadelphia operates in an extremely competitive environment. To continue its important role in the local and regional economy, Philadelphia must expand existing facilities or build new terminals to remain competitive and take advantage of the following market conditions and opportunities:

- Increased containerized cargo from Asia to East Coast U.S. ports.
- Capacity constraints and congestion at other East Coast ports.
- Widening of the Panama Canal—New post-Panamax container ships visiting deeper, East Coast ports may displace Panamax ships to Philadelphia.

Key distribution points in the Philadelphia cost-effective hinterland.

1.1.3 Conceptual Design of Southport

The conceptual design plan for the Southport development envisions a two-berth marine terminal on approximately 116 acres of vacant land, most of which was previously used by the U.S. Navy. The proposed project includes construction of berthing areas, a container yard, new access roadway and existing roadway improvements, installation of utilities, construction of various buildings to support the operations of the terminal, berth and access channel dredging in the Delaware River from the new bulkhead line out to the limits of the federally maintained navigational channel, and the placement of dredged material in a permitted confined disposal facility (CDF). Specific components of the proposed project are listed below:

- Construction of 3,043 ft of marginal wharf, a utility trench, and pile-supported crane rails to provide two 1,064-ft berths for containerized cargo ships.
- Installation of six electric-powered, post-Panamax container cranes.
- Construction of a container yard that provides approximately 116 acres of developed surfaces (paved and permeable) for the loading, offloading, and storage of containers and trailer chassis.
- Construction/installation of the necessary infrastructure and utilities for a fully operational container yard that would accommodate a throughput capacity of approximately 1.34 million TEUs per year at full build-out.
- Construction of various buildings and structures to include an administration building, maintenance and repair building, yard operations/crane maintenance and roadability canopy, driver service building, and gate pedestals and guard booth.
- Relocation of approximately 1,000 ft of an existing stormwater conveyance channel.
- Extension of Columbus Boulevard to provide dedicated truck access to the terminal site.
- Dredging of the Delaware River to -40 ft mean lower low water (MLLW) from the new bulkhead line to the limits of the federally maintained navigation channel. If sufficient funding and dredged material placement capacity are available, dredging may include a 2-ft optional overdredge for final elevation of -42 ft MLLW. A total of approximately 1,008,000 cubic yards (cy) of material would be removed from the river bottom, and placed into the Fort Mifflin CDF, or other approved disposal facility. Subsequent dredging to -45 ft MLLW (plus an allowable 2-ft overdredge) could occur should the ongoing Delaware River main channel deepening be concluded and result in deeper-draft vessels calling at the Port of Philadelphia. Approximately an additional 298,000 cubic yards (cy) of material would be removed from the river bottom, and placed into the Fort Mifflin CDF, or other approved disposal facility. Initially, only 35 acres would be dredged due to the existing bathymetry, assuming a dredged depth of -42 ft MLLW.

1.2 PROPOSED ACTION AND FEDERAL AUTHORITY

The U.S. Army Corps of Engineers (USACE) regulates construction of facilities, dredging, and placement of fill in navigable waters of the United States under Section 10 of the River and Harbors Act of 1899 (33 U.S.C. 403). USACE also regulates placement of dredged or fill material into U.S. waters under Section 404 of the Federal Water Pollution Control Act Amendments for 1972 (P.L. 92–500; 33 U.S.C. 1344), as amended by the Clean Water Act (CWA) of 1977 (P.L. 95–217; 33 U.S.C. 1251 et seq.). The federal action involved in this project is USACE's issuance of a Joint Permit under Section 404 of the federal CWA and Section 10 of

the Rivers and Harbors Act to authorize the discharge of dredge and fill material and construction within navigable waters of the United States. The following components of the proposed project require a permit from USACE:

- Construction of the marginal wharf, bulkhead, and rock revetment in navigable waters of the United States.
- Filling of jurisdictional wetlands.
- Filling of navigable waters of the United States.
- Dredging in navigable waters of the United States.

Issuance of a permit for these activities is a federal action that requires compliance with the National Environmental Policy Act (NEPA) process. USACE is the federal agency responsible for the NEPA review process for the federal action associated with this project, pursuant to 42 United States Code (U.S.C.) 4371 et seq., 40 Code of Federal Regulations (CFR) 1500–1508, and USACE NEPA implementation procedures for the regulatory program found in 33 CFR Part 325 Appendix B.

USACE's regulatory program is contained in 33 CFR Parts 230 and 320–332. Selection and use of disposal sites for dredged and/or fill material under permits issued pursuant to Section 404 of the CWA is guided by regulations in 40 CFR Part 230.

1.3 RELEVANT ISSUES

Consistent with applicable NEPA regulations and guidelines, this EA evaluates a range of environmental impacts attributable to USACE's issuance of a joint Section 404/Section 10 permit relating to this project, including the following:

- Surface Water Quality
- Air Quality
- Benthos
- Fisheries
- Submerged Aquatic Vegetation (SAV)
- Wetlands
- Federally Threatened and Endangered Species
- Species of Special Concern
- Recreation
- Cultural Resources

- Socioeconomics
- Transportation/Traffic

1.4 PERMITS REQUIRED

DGS and PRPA are the proponents for the proposed project and are the co-applicants for the Joint Permit under Section 10 of the Rivers and Harbors Act and Section 404 of the CWA (which calls for a CWA Section 401 Certification), and the Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit. The CWA Section 401 certification is administered by the Pennsylvania Department of Environmental Protection (PADEP). Any future dredging event (e.g., deepening to -45 MLLW, as described in Subsection 2.4) would require a separate CWA Section 401 Water Quality Certificate (WQC). In addition, the work authorized by the Joint Permit issued by USACE must demonstrate consistency with the Pennsylvania and the New Jersey Coastal Zone Management Programs. DGS and PRPA would be responsible for compliance with the aforementioned permits and the implementation of any mitigative actions required by those permits.

1.5 METHODOLOGY

If a proposed action cannot be exempted or categorically excluded from further examination under NEPA, additional analysis is required through an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). In accordance with 33 CFR 230.7, a permit from USACE is a regulatory action "normally requiring an EA, but not an EIS." Therefore, this EA has been prepared to provide sufficient information to the USACE, Philadelphia District (CENAP) Commander regarding potential environmental effects of the proposed action for issuance of a Finding of No Significant Impact (FONSI) or determination of whether preparation of an EIS is necessary (40 CFR 1508.9).

CEQ recently published draft guidelines making clear that it is the "net" impact of a federal action (i.e., "gross" impact minus mitigation measures) that should be used to determine whether a federal action presents a significant impact warranting an EIS rather than an EA/FONSI. The CEQ Memorandum *Draft Guidance for NEPA Mitigation and Monitoring*, dated 18 February 2010, provides:

> "(2) Mitigation Alternatives in Environmental Assessments

> When an agency develops and makes a commitment to implement mitigation measures to avoid, minimize, rectify, reduce, or compensate for significant environmental impacts (40 C.F.R. § 1508.20), then NEPA compliance can be accomplished with an Environmental Assessment (EA) coupled with a Finding of No Significant Impact (FONSI). Using mitigation to reduce potentially significant impacts to support a FONSI enables an agency to conclude the NEPA process, satisfy NEPA requirements, and proceed to implementation without preparing an EIS. In such cases, the basis for not preparing the EIS is the commitment to perform those mitigation measures identified as necessary to reduce the environmental impacts of the proposed action to a point or level where they are determined to no longer be significant. That commitment should be presented in the FONSI and any other decision document. CEQ recognizes the appropriateness, value, and efficacy of providing for mitigation to reduce the significance of environmental impacts; consequently, when that mitigation is available and the commitment to perform it is made, there is an adequate basis for a mitigated FONSI."

This EA has compiled information from a variety of sources, including DGS and PRPA planning documents, conceptual design studies, previously issued permits, and agency consultations, as well as previous NEPA documents prepared for the development of other projects in the area. The preparation of this EA has relied on an interdisciplinary team using a systematic approach to analyze the affected area, to estimate the probable environmental effects, and to prepare the document. The process used during the preparation of this EA included literature searches, and coordination with federal, state, and local resource agencies having expertise in certain areas, as well as on-site field investigations.

The findings of these efforts, as well as the conclusions and recommendations derived from the analysis of these findings, and proposed mitigation strategies to offset all anticipated impacts are presented in the following sections of this document.

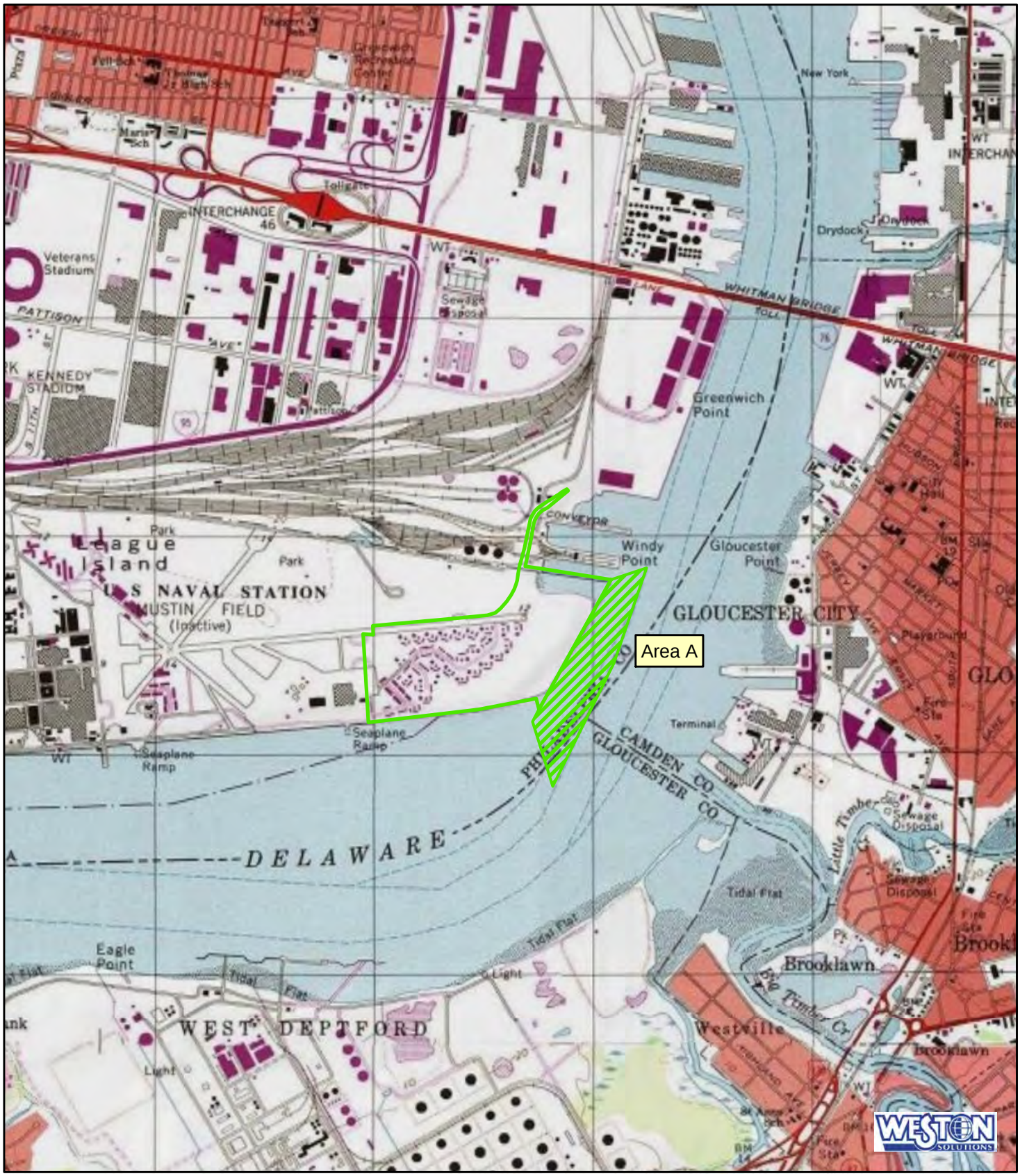
The following appendices associated with this document provide supporting information:

- Appendix A: Sediment Characterization Report
- Appendix B: Coastal Zone
- Appendix C: Macrobenthic and Finfish Surveys
- Appendix D: Threatened and Endangered Species Studies

- Appendix E: Submerged Aquatic Vegetation Survey
- Appendix F: Wetland Surveys
- Appendix G: Pennsylvania Natural Diversity Inventory
- Appendix H: Cultural Resources
- Appendix I: Traffic
- Appendix J: Air Emissions
- Appendix K: Mitigation

SECTION 1

FIGURES



Legend

Southport Project Site Boundary

Proposed Dredging Template

N
W E
S

0 1,000 2,000
Feet

SOURCE: USGS 7.5 Minute Series (Topographic) Quadrangle: Philadelphia PA, 1986, Camden NJ, 1985

Figure 1-1
Overview of the Proposed Southport Development Project

Southport Development Project
Philadelphia, PA

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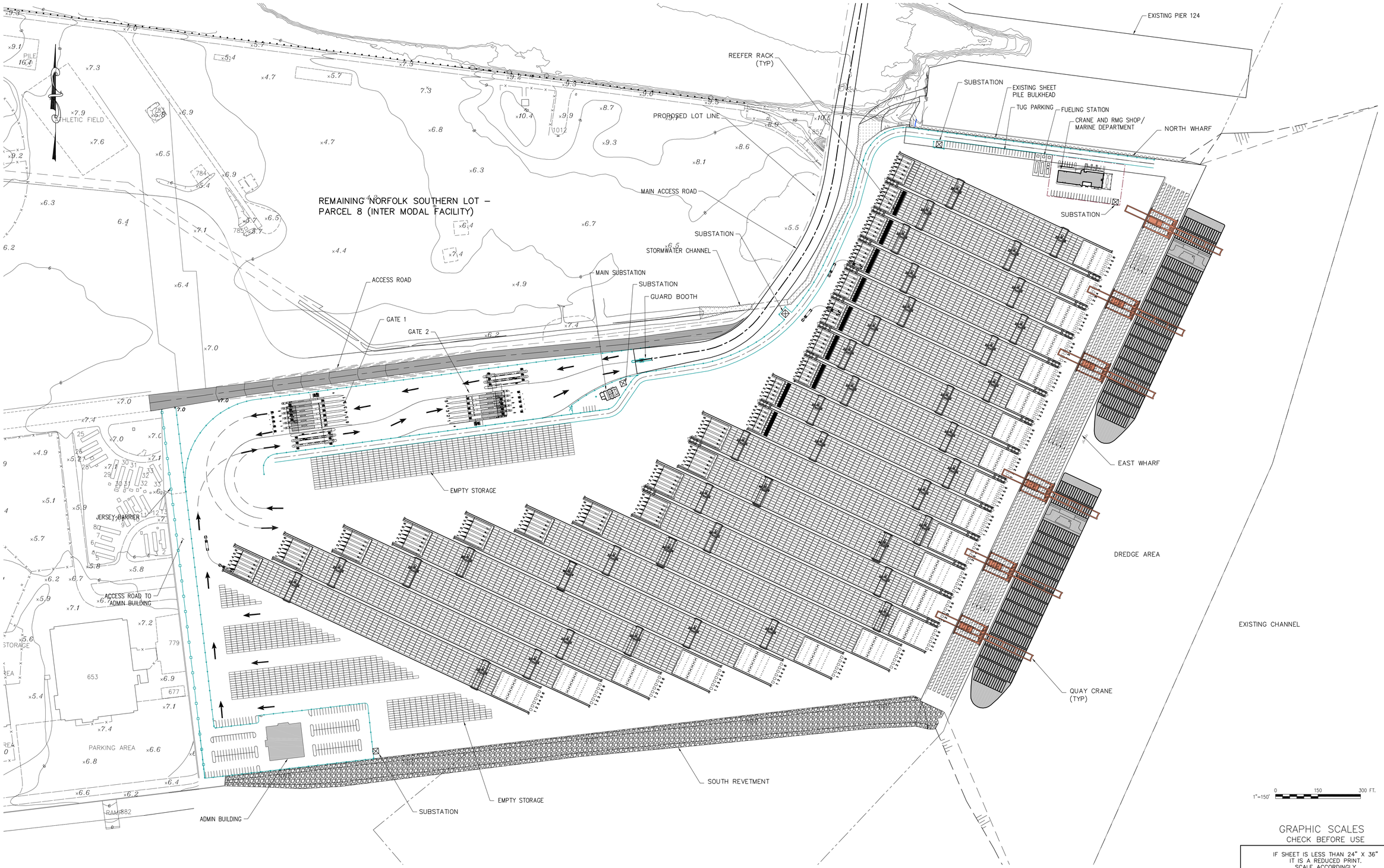

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COMMONWEALTH OF PENNSYLVANIA
PHILADELPHIA REGIONAL PORT AUTHORITY
PHILADELPHIA, PA

SOUTHPORT PROJECT

Figure 1-2
Site Concept Plan
Preferred Alternative

SCALE 1"=150'

DATE JULY 15, 2010

REVISION

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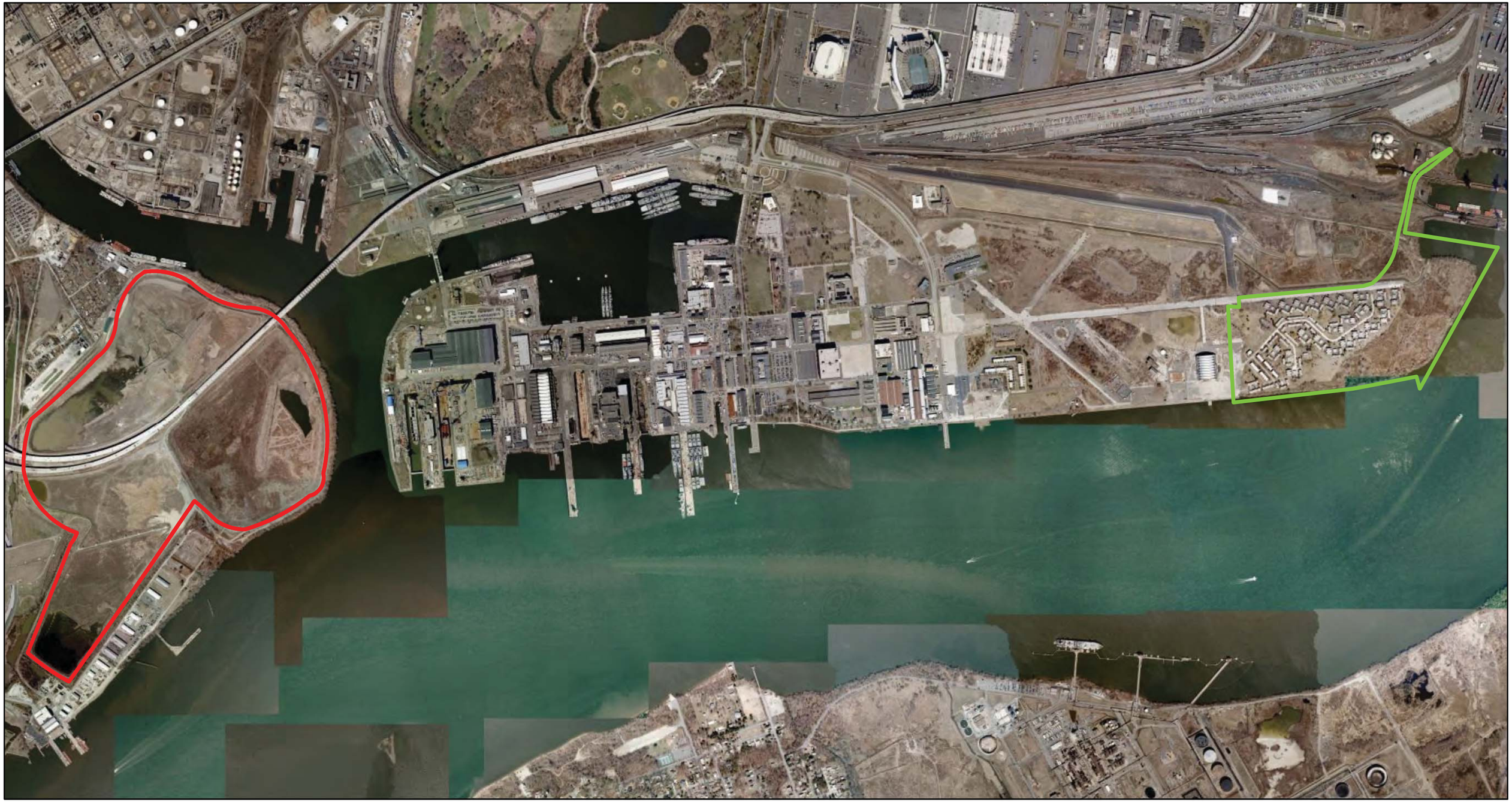

Legend

- Southport Boundary
- Fort Mifflin CDF

Image Source: ESRI, Bing Maps, USGS 2009

N W E S

0 625 1,250 2,500 3,750 5,000 Feet

Figure 1-3
Fort Mifflin CDF and Southport Terminal
Southport Development Project
Philadelphia, Pennsylvania

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2. ALTERNATIVES

2.1 INTRODUCTION

A project alternatives analysis must be undertaken during the preparation of an EA to evaluate all practicable alternatives to satisfy NEPA requirements and to complete part of the permit application processes associated with Section 404 of the CWA. The analysis is based on the overall purpose of the project and evaluates the possibility for alternatives to avoid and/or minimize environmental impacts.

Over the years, the PRPA has conducted a series of comprehensive studies to evaluate potential areas for expansion of the Port of Philadelphia, in order to facilitate the Port's ability to respond to economic opportunities in the international shipping sector. These studies have guided the Commonwealth's planning process through the identification of specific properties for port expansion and modernization. Ultimately, this planning process led to the selection of the Southport site as the most appropriate location for a new terminal. After selection of the Southport location, a comprehensive planning and formulation process was conducted to optimize the site while minimizing the environmental impacts associated with the project.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the Joint Permit would not be issued and the Commonwealth would not develop a terminal at the proposed location. The proposed site would not be developed for the Southport facility and would not be the subject of additional improvements associated with the Southport project, including the clearing and grading of land, paving, building construction, bulkhead/wharf construction, utility improvements, and associated infrastructure. The filling of approximately 13 acres of open water and dredging and placement of up to 1.3 million cubic yards (mcy) of material from the Delaware River would not occur.

2.3 ALTERNATIVE SITES

From 2003 until present, extensive analysis was conducted by the Commonwealth to examine the suitability of lands along the Delaware River for future port development, which included consulting major carriers and terminal operators to determine critical factors for port development. A number of constraints and desired site characteristics were applied during the

site selection process that eventually culminated in the proposed location. The major constraints were the air draft (distance from the surface of the water to the highest point of the ship) limitations of the Walt Whitman Bridge and the location needed to be within the Commonwealth of Pennsylvania.

The current maximum allowable air draft for ships transiting the Panama Canal is 190 ft. The vertical clearance under the Walt Whitman Bridge at MHW is 150 ft at the center of the span and 139 ft above the federal channel. Many Panamax container vessels have air drafts greater than 139 ft and some have air drafts greater than 150 ft. For example, on March 8, 2009, the Panamax *NYK Nebula* (4,886 TEUs and keel-to-mast-height (KTMH) of 197 ft) attempted to call the New York Container Terminal (Howland Hook) on the Arthur Kill and could not enter Newark Bay because it was riding too high to pass beneath the Bayonne Bridge, which has a vertical clearance of 151 ft at MHW. (USACE, 2009) Since many Panamax container ships would not be able to pass beneath the Walt Whitman Bridge while navigating the federal channel, it was determined that the potential site for the Southport terminal had to be downriver of the bridge.

In addition, all potential sites outside of the Commonwealth of Pennsylvania were not considered due to the requirement that Pennsylvania capital funds may only be used in Pennsylvania.

Applying the constraints resulted in a study area (for site selection) along the Delaware River from the Delaware State line to the Walt Whitman Bridge. The following desired characteristics were considered during evaluation of the potential sites:

1. a buildable footprint that is sufficient to produce an annual throughput of at least 1,000,000 TEUs, which is the target throughput necessary to maximize efficiencies for the expected market conditions, along with waterside frontage capable of berthing two Panamax container ships,
2. land that the PRPA owns or could feasibly acquire,
3. close to the federal navigation channel in the Delaware River or adjacent to a Delaware River tributary (i.e., Schuylkill River) with sufficient deepwater maneuvering areas to safely berth and navigate Panamax container ships,
4. upstream of the Delaware River effective mixing zone to avoid direct impacts to the NMFS-designated fish species and their associated Essential Fish Habitat,

5. close to major highway transportation corridors including the ability to easily expand to intermodal capabilities,
6. would not interfere with Philadelphia International Airport operations (e.g., require height restriction of cranes) and
7. compatible with adjacent land use that includes the avoidance of sensitive receptors.

Undeveloped land along the Delaware River in the aforementioned study area is rare. Of the undeveloped parcels that do exist, none of the sites, with the exception of the proposed location, provide enough landside acreage to construct a containership terminal. The remaining developed areas are a mix of water-dependent industrial uses and various commercial activities that are owned by private entities.

The following sites were considered during planning process, which are summarized in Table 2-1:

Site A – Conoco Philips Site – This 65-acre site is along the Delaware adjacent to the Conoco Philips refinery facility in Marcus Hook, Pa. The site would require the filling of approximately 35 acres of critical intertidal/subtidal habitat, including mudflats. Although the river frontage, with development, might be sufficient to berth one Panamax containership, the available land would not be sufficient to accommodate the desired container throughput of 1,000,000 TEUs per year. This site was removed from further consideration.

Site B – PECO/Superfund Site – Located adjacent to the western approach of the Commodore Barry Bridge, this 25-acre site composed of a Superfund site, an ongoing LNG operation, and a parking lot for PPL Park (soccer stadium) in Chester, Pennsylvania. Approximately 15 acres of the site had contaminated soil that was previously remediated to construct the parking lot. The site area is insufficient for a container terminal and the close proximity to the bridge would prevent the safe maneuvering and berthing of a containership. This site was removed from further consideration.

Site C – Penn Terminals Site – The undeveloped portion of this site is adjacent to the Penn Terminals private container terminal in Eddystone, PA. The site could provide a 70-acre, one-berth terminal but the land is insufficient for the required annual throughput. Approximately 23 acres of river bottom would be filled. Developing this site could interfere with or displace the

existing terminal operations conducted by a private entity; as such it is unlikely that property acquisition would be successful. This site was removed from further consideration.

Site D – Southport Site – The Southport site is located at the eastern end of the former Philadelphia Naval Shipyard. It is owned by PRPA and has sufficient area to provide berths for two Panamax containerships and the storage and operating space to produce an annual throughput of approximately 1.3 million TEUs per year. Development would require the filling of approximately 12 acres of the Delaware River. This alternative, unlike the other potential sites, provides enough land to berth two ships and produce the required annual throughput that would create more than 7,000 sustainable, direct jobs.

Table 2-1 provides a comparison of the characteristics and potential environmental impacts of the sites considered for the proposed project.

After evaluating all existing sites along this length of the Delaware River shoreline, it was determined that the proposed Southport project site is the only location that is suitable for the development of a modern, state-of-the-art marine terminal, due to its size and location on the river. Of the four sites considered, the Southport site requires the least amount of fill in the river, the least amount of dredging, is not within the effective mixing zone (the EFH) for the designated fish species as defined by the NMFS, and is owned by PRPA. Therefore, the proposed Southport site is the least environmentally damaging practicable alternative.

The proposed site provides the following attributes:

- Two berth capability with sufficient land to support an annual container throughput in excess of 1,000,000 TEUs.
- Land is already owned by PRPA
- Easy deepwater access (with dredging) to the existing federal navigation channel (-40 ft MLLW).
- The in-water construction and dredging is outside of the mixing zone/designated EFH.
- Highway connectivity (Interstate I-95/Interstate I-76).
- National rail connectivity (adjacent to two intermodal rail yards accessed by three Class I rail operators).

- Proposed operations would not interfere with Philadelphia International Airport.
- Consistent with adjacent land use, including the Packer Avenue Marine Terminal and existing land development requirements.

2.4 ALTERNATIVES CONSIDERED

2.4.1 Southport Site Alternatives

In 2003, PRPA prepared the Southport Master Plan (Urban Engineers, TECicon, 2003) to evaluate several site configurations and operational options. During the preparation of the Master Plan, PRPA considered three site development options, Options A, B, and C, and two operational options, Option 1 (general cargo facility) and Option 2 (dedicated container terminal). Consequently, six alternatives were evaluated for the project site, with each of the three site configurations evaluated for both general cargo and container operations.

Property boundary constraints, tidal and upland wetlands, open-water fill, dredging, shoreline limits, road access, and access to the nearby interstate highways were all factors considered in developing the conceptual plan for the site. Since container terminals are most efficient when the container yard is the same width as the berthing areas and as deep as possible, it was important to maximize the distance inland away from the river and toward the proposed Norfolk Southern Intermodal Yard property.

The following site configurations were evaluated in the Southport Master Plan and are further summarized in Table 2-2:

- Option A (Figure 2-1): Option A would create the new marine terminal by filling in both the slip between Piers 122 and 124 and the slip between Pier 124 and Parcel 9A. This would create a separate new terminal south of the existing Pier 122.
- Option B (Figure 2-2): Option B would create a smaller new terminal area by filling in only the slip located between the south side of Pier 124 and Parcel 9A. Under this option, the PAMT would also be expanded by filling in the existing slip between the Navy barge berth and Pier 122 and expanding PAMT southward.
- Option C (Figure 2-3): Option C would create one large terminal complex by filling in all the slips between the existing PAMT and Parcel 9A.

The following operational options were evaluated in the Southport Master Plan:

- Option 1: This operational concept anticipated the new marine terminal to be used as a general cargo facility, which would require the development of warehouse and transit storage buildings, while providing space for the handling of containers, dry bulk, and break-bulk cargoes.

- Option 2: This operational concept anticipated the terminal to become a dedicated container terminal.

Although the six terminal options depicted in the Southport Master Plan allowed flexibility in the site configuration and intended operations, PRPA ultimately decided to proceed with further evaluation of a dedicated container terminal that maximizes the footprint within PRPA property boundaries (Figure 1-1). This decision was based on projected market conditions and the site's proximity to nationwide rail and highway systems.

Subsequent to the Southport Master Plan, PRPA continued to explore additional property acquisitions to ensure the proposed Southport site would be the most efficient and environmentally sound facility, resulting in lower environmental impacts and additional jobs and benefits to the local and regional economies. A planned acquisition of a portion of Parcel 9 on the eastern end of the former Philadelphia Naval Shipyard, that was owned by Philadelphia Authority for Industrial Development (PAID) and managed by the Philadelphia Industrial Development Corporation, led to a follow-on development concept known as Option D-2 (Figure 2-4). This parcel contained the former Navy housing and would provide 63.28 acres for terminal development.

Once it was determined that the Southport site would be best utilized as a marine terminal, particularly containerized cargo, the Commonwealth continued to develop several site alternatives that met the purpose and need of the project. As described in Section 1, the proposed project will provide a terminal capable of providing a throughput of at least 1,000,000 TEUs per year at full build-out. This throughput goal was the basis for planning that has continued since 2003.

2.4.2 Landside Access

In November 2004, a report (Shaw Environmental & Infrastructure, Inc., 2004) was prepared that evaluated potential alternatives and design parameters for landside access to the proposed Southport site. Shaw Environmental & Infrastructure, Inc. (Shaw) interviewed stakeholders of this and adjacent projects and reviewed existing data that identified objectives and plans of

potential rail, roadway, and port users that could influence the design of landside access. Based on the alternatives evaluation, it was determined that access to the proposed Southport terminal would be best achieved by extending Columbus Boulevard. Extending Columbus Boulevard would be consistent with the Southport Master Plan and the Philadelphia Navy Yard Master Plan and is the only permissible access requirement pursuant to the PAID contract of sale.

2.4.3 "Refined" Terminal Planning

In 2008, planning of the proposed terminal continued. A variety of project footprints and ship berthing arrangements were considered to maximize throughput efficiency and job creation. Although the previously identified Option D-2 was used as a basis for further refinement, the planning effort undertaken in 2008 explored six potential site design alternatives requiring various degrees of filling in the Delaware River or additional property acquisitions, evaluating each for potential productivity and screening for environmental concerns. The primary differences between the six options are ship berthing alignments and construction, container yard footprint, and the amount of in-water fill and dredging. The options that were considered have the same types of environmental concerns, but vary in the total area disturbed. The following options were considered before a preferred alternative was selected during the 2008 "Refined Terminal Planning" process (DMJM Harris/AECOM, 2008).

Alternative A

Alternative A (Figure 2-5) is a two-berth facility that would require approximately 114 acres. It was projected that this alternative would produce a throughput of approximately 620,000 TEUs per year and create approximately 3,300 direct jobs. Approximately 24 acres of subtidal/intertidal habitat would be filled and 125 acres of the river bottom would require dredging.

Alternative B

Alternative B (Figure 2-6) is a three-berth facility that would require approximately 123 acres of land. It was projected that this alternative would produce a throughput of approximately 930,000 TEUs per year and create approximately 4,950 direct jobs. Approximately 25 acres of subtidal/intertidal habitat would be filled and 175 acres of the river bottom would require dredging.

Alternative C

Alternative C (Figure 2-7) is a four-berth facility that would require approximately 138 acres of land. It was projected that this alternative would produce a throughput of approximately 1,240,000 TEUs per year and create approximately 6,600 direct jobs. Approximately 26 acres of subtidal/intertidal habitat would be filled and 250 acres of the river bottom would require dredging.

Alternative C2

Alternative C2 (Figure 2-8) is a three-berth facility (with expansion) that would require approximately 152 acres of land. It was projected that this alternative would produce a throughput of nearly 1,000,000 TEUs per year and create approximately 4,950 direct jobs. Approximately 30 acres of subtidal/intertidal habitat would be filled and 125 acres of the river bottom would require dredging.

Alternative D

Alternative D (Figure 2-9) is a three-berth facility (with expansion) that would require approximately 146 acres of land. It was projected that this alternative would produce a throughput of nearly 1,000,000 TEUs per year and create approximately 4,950 direct jobs. Approximately 26 acres of subtidal/intertidal habitat would be filled and 225 acres of the river bottom would require dredging.

Alternative E

Alternative E (Figure 2-10) is a three-berth facility (with expansion) that would require approximately 287 acres of land. It was projected that this alternative would produce a throughput of nearly 1,000,000 TEUs per year and create approximately 4,950 direct jobs. Approximately 176 acres of subtidal/intertidal habitat would be filled and 75 acres of the river bottom would require dredging.

The process to develop a preferred alternative during the “Refined” Terminal Planning process in 2008 involved evaluating the alternative’s ability to meet the project’s throughput goal, cost of construction, and potential environmental impacts. Table 2-2 is a summary of the potential environmental impacts resulting from the construction and operation of each of the six alternatives. After a comprehensive tradeoff analysis was conducted by weighing project goals

against costs and environmental impacts, Alternative C2 (Figure 2-8) was selected as the preferred alternative during the 2008 planning process. Minimizing dredging, open-water fill, and impacts to intertidal/subtidal habitat, while maximizing the berthing and throughput capabilities, were factors considered during the screening of the various alternatives. Although some of the alternatives require less in-water fill than Alternative C2, implementation of Alternative C2 would avoid the significant striped bass habitat (U.S. Fish and Wildlife Service, 2004) that exists along the southern shoreline of the project site. Therefore, it was determined that Alternative C2 would have the lowest degree of potential environmental impacts while still meeting the purpose and need of the proposed action as described in Section 1 of this document.

2.4.3.1 Refinement of Alternative C2

In 2009, the Commonwealth contracted the services of Weston Solutions, Inc., to further refine Alternative C2 and prepare the environmental documentation and applications required to obtain permits for the construction of the proposed terminal. Early informal consultations with federal, state, and local regulators and resource agencies led the efforts to further reduce the potential environmental impacts associated with constructing the preferred alternative as then presented. The most notable concern was the amount of in-water fill that would adversely impact submerged aquatic vegetation (SAV) and intertidal/subtidal habitat along the northern end of the proposed project footprint. Since this type of habitat is less common along the developed shores of the Delaware River, regulatory and resource agencies expressed that all efforts needed to be taken in the planning process to avoid and then minimize impacts to the areas. As such, the then-current preferred alternative (now called Option A) (Figure 2-11) was reevaluated using different modes of terminal operation, container alignment, and berthing configurations to maximize throughput and reduce the amount of in-water fill. A new preferred alternative (Option B, Figure 1-2) was developed that required significantly less in-water fill by reducing the number of berths to two, changing the stacked container alignment to a diagonal arrangement, and using rail-mounted gantry (RMG) cranes instead of rubber-tired gantry (RTG) cranes during yard operations. The planning process conducted since 2003, which has resulted in the selection of Option B, the final preferred alternative, demonstrates that all efforts have been undertaken to avoid and/or minimize the proposed project's environmental impacts to the maximum extent practicable, while maintaining the constructability and operability of the proposed new terminal.

2.4.3.2 Dredging and Dredged Material Placement Alternatives

The proposed action would initially require the dredging of approximately 1,008,000 cy of material from the Delaware River to a depth of -40 ft MLLW. An additional 2-ft optional overdredge (final elevation -42 MLLW) may be included in the project if warranted by the development and if placement capacity and funding are available. The dredging area (Figure 2-12) is approximately 35 acres and extends from the federal navigation channel to the wharf face of the terminal. The dredged area would provide sufficient space for maneuvering and berthing Panamax container ships. It is proposed that the dredging would be accomplished by a mechanical dredge and a hydraulic dredge. A mechanical dredge would remove material to allow construction of the pile-supported wharf and revetment along the eastern shoreline berthing areas, with placement of the dredged material at the Fort Mifflin or another approved Confined Disposal Facility (CDF) (Figure 1-3). Based on the result of the alternative analysis presented below and in consultation with USACE, the remaining dredging would likely be accomplished by a hydraulic cutterhead dredge with hydraulic placement of the dredged material via floating and submerged pipeline to the Fort Mifflin CDF. Should the ongoing Delaware River Main Channel Deepening Project result in deeper-draft vessels calling at the Port of Philadelphia, the operator of the facility could also choose to deepen the berthing areas to -47 ft MLLW (45 ft+2-ft optional overdredge). This additional 298,000 cy of material, which brings the total volume that could be dredged to approximately 1,306,000 cy, could also be placed at the Fort Mifflin CDF or another approved disposal facility. A detailed physical and chemical analysis of the sediment to be dredged was conducted and the sampling and testing procedures, along with the testing data and evaluation of the results, are included in Appendix A.

All reasonable dredged material placement alternatives were considered during the project planning process. This process has included consultation with USACE, Philadelphia District (CENAP) and PADEP to formulate the project alternatives, including dredged material placement. As stated previously, the area suitable for expansion of port properties is limited. Resources for establishing new dredged material disposal facilities are limited. The following options were considered before selecting the preferred alternative for dredged material placement:

Open-Water Disposal—Open-water disposal has been historically used for the disposal of dredged material at many U.S. ports. The Port of Philadelphia, however, like a majority of ports, has no permitted open-water disposal facility nearby because of limited areas to dispose of material without impacting navigation. In addition, open-water disposal is often considered less desirable from an environmental standpoint due to water quality issues and impacts to the benthos. There are no offshore disposal sites within an economically feasible transport distance to the Southport site, with the closest disposal sites near the mouth of the Chesapeake Bay. Because of these significantly limiting factors, open-water disposal of dredged material was not considered further.

Whites Basin Disposal Facility—The Whites Basin Facility in Logan Township, New Jersey, has been historically the primary dredged material disposal facility for non-federal dredging projects on the Delaware River. Consequently, Whites Basin was considered for disposal of material from the dredging at Southport. Whites Basin accepts material into a subaqueous disposal basin on the riverbank. Clamshell dredges fill scows at the dredge site, which are then towed to Whites Basin and bottom dumped into the basin. When the basin is filled, the material is then dredged and pumped into a nearby upland CDF.

Whites Basin is currently available for dredged material disposal but recent legal disputes have called into question the long term availability of this site. Because of the uncertainties that the site would be available for this project for dredged material placement, Whites Basin was originally removed from further consideration during the Draft EA. However, use of this site to supplement the preferred alternative could be re-considered if the preferred site becomes unavailable and Whites Basin remains a permitted disposal facility.

Fort Mifflin CDF—The Fort Mifflin CDF (Figure 1-3) is part of both the existing authorized Delaware River Philadelphia to the Sea and the Schuylkill River projects. USACE Fort Mifflin is located in Southeast Pennsylvania in Philadelphia County. The site is at the confluence of the Schuylkill and Delaware Rivers on the former Hog Island. The facility and all of its operations are entirely within federally owned property. It is one of nine similar CDFs in the Delaware River Philadelphia to the Sea project and the only federally owned CDF in Pennsylvania. The Fort Mifflin CDF is almost exclusively used for disposal of material from the Schuylkill River Federal Channel Navigation Project. As CDFs fill to capacity, new lands must often be acquired

to use for subsequent material storage. Alternately, the berms of the existing CDF are raised to create more capacity, as has been done on several occasions at Fort Mifflin and can be done again if necessary. The Fort Mifflin CDF currently has adequate capacity for disposal of material from Southport.

As per USACE Policy Guidance Letter (PGL) 47, 7. b. (5) and d., "Non Federal interests may use a disposal facility under the jurisdiction of or managed by the Corps if it is determined that the capacity to be used by the non-federal interest will not reduce the availability of the disposal facility for federal navigation project purposes."

CENAP agrees that disposal would not reduce the availability of the Fort Mifflin CDF or other approved disposal facility for material from federal projects and has agreed to allow the Fort Mifflin CDF to be used for the Southport Development project. USACE would utilize WRDA 96 Section 217, which states the Secretary of the Army "may permit the use of any dredged material disposal facility under the jurisdiction of, or managed by, the Secretary by a non-Federal interest." CENAP has agreed it can execute a Real Estate License Agreement (RELA) for the disposal of the material into Fort Mifflin, as it has done for disposal of material from other non-federal entities. CENAP executed several RELAs for similar activities as recently as 2010.

Southport Project Site Fill—Construction of temporary dredged material placement cells at the Southport project site was considered. These containment cells would be constructed to provide enough area for the separation of sand and mud and for solids removal by gravity settling before returning the clean discharge water to the river. The mud (silts and clays) could be pumped over to the Fort Mifflin CDF. The remaining sand would be used for needed fill during the construction of the container terminal. Although some of the dredged material may be suitable for site fill without amendments, it was determined that the water quality issues associated with dewatering this material on-site would require a lengthy approval process and costly construction/operations. Therefore, using the project's dredged material for on-site fill was removed from further consideration.

Other Beneficial Uses—Dredged material can be used for a variety of beneficial uses, including wetlands restoration, shoreline protection, agricultural amendments, landfill cover, and manufactured products such as bricks and lightweight aggregate. Although some of the sediment to be dredged for the Southport container terminal project may be suitable for such applications,

consultation with federal and state agencies has not identified any potential beneficial use projects in the area. As such, this alternative was eliminated from further consideration.

2.5 PREFERRED ALTERNATIVE

The preferred alternative of the Southport Development Project is Option B (Figure 1-2). The alternative would provide approximately 116 acres of land for the construction and necessary improvements required to develop and operate a state-of-the-art marine terminal capable of handling two Panamax-class container ships simultaneously. The construction of 3,043 ft of pile-supported marginal wharf would require the filling of approximately 8.88 acres of the Delaware River and impacts to approximately 5,500 linear ft of existing shoreline. The shoreline along the southern end of the project site would be protected with a revetment and stone riprap similar to the existing shoreline but with better structural properties. The project would include over 43 acres of permeable gravel surfaces to provide the necessary areas for container storage and yard operations. An additional 73 acres would be paved to provide an operating area for horizontal transport of containers to and from the wharf, as well as to and from trucks. The impervious surfaces would necessitate an extensive stormwater collection and management system, including the construction of catch basins and a stormwater treatment and drainage system. Approximately 1,000 ft of an existing stormwater conveyance channel would be relocated with a new outfall near its existing location. An extension of Columbus Boulevard along with associated improvements would provide dedicated vehicle access to the terminal. The clearing, grading, paving, building construction, and associated infrastructure necessary for this alternative would permanently impact 3.75 acres of freshwater wetlands and 8.88 acres of intertidal wetlands/open water. Initially, an area of approximately 35 acres of deep water would be dredged to -40 ft MLLW (plus an optional 2-ft overdredge) to provide two ship berths and the resulting 1,008,000 mcy of dredged material would be placed at the Fort Mifflin CDF or other approved disposal facility. Subsequent dredging to deepen the berths to -45 ft MLLW (plus an optional 2-ft overdredge) could result in removing an additional 298,000 cy. Once fully operational, the terminal would draw approximately 260 ship visits per week and provide a container throughput capacity of approximately 1,340,000 TEUs per year.

2.5.1 Dredged Material Placement

After careful consideration of all reasonable dredged material placement options, the only viable and reliable alternative for up to 1,306,000 cy of dredged material resulting from dredging associated with Southport development is hydraulic placement of the dredged material at the Fort Mifflin CDF or other approved disposal facility. Hydraulic dredging is more economical than clamshell dredging and is generally considered more environmentally friendly due to less opportunity for sediment dispersion in the water column. The decant water resulting from the hydraulic placement of the Southport dredged material into the CDF would be discharged through existing weir and piping infrastructure and would comply with the existing NPDES permit held by USACE for operation of the Fort Mifflin CDF.

Initially, the dredging would be conducted by a mechanical dredge to allow construction of the pile-supported wharf and revetment at the shoreline berthing areas. Figures 2-13, 2-14, and 2-15 show cross sections of the east shore wharf structure, the north shore wharf structure, and the south revetment, respectively. This material would be dredged in conjunction with construction of the wharf. Additional dredging by a hydraulic cutterhead dredge would be conducted to -42 ft MLLW (40 ft +2-ft optional overdredge) to create berthing areas and an access channel from the federal navigation channel. This would occur following the construction of the wharf and revetment, immediately prior to beginning operations.

In the future, the operator of the facility could choose to deepen the berthing areas to -47 ft (45 ft +2-ft optional overdredge), should the ongoing Delaware River Main Channel Deepening Project be completed and should deeper-draft vessels begin calling at the Port of Philadelphia. The design of the wharf structures has been prepared to accommodate berths dredged to -47 ft and permits are being sought for dredging to -47 ft (45 ft +2 ft allowable overdredge). Additional sediment characterization and a CWA Section 401 Water Quality Certificate (WQC) may be required prior to commencing the last phase of dredging. This dredging, deepening the berths to -47 ft MLLW (45 ft +2-ft optional overdredge), is expected to result in removing an additional 298,000 cy of sediment and could occur prior to the opening of the terminal or several years after operations begin at the terminal.

The sediment characterization to support the dredging for Southport included collecting a high frequency of samples down to -42 ft MLLW to support the WQC requirements for dredging and

disposal (Appendix A). Seven additional samples were collected from the material between -42 ft and -47 ft MLLW to gain an understanding of the sediment characteristics at those depths and to adequately assess the impacts resulting from the potential deeper dredging. A WQC and other applicable permits for disposal of this additional material would be obtained prior to dredging and disposal operations.

SECTION 2

TABLES

Summary Table 2-1
Comparison of Site Alternatives

	Site A - Conoco Philips	Site B - Superfund/PECO	Site C - Penn Terminals	Site D - Southport
Project Footprint	± 65 acres	± 25 acres	± 70 acres	116 acres
No. of Berths	1	1	1	2
Land Owner	Private	Private	Private	Commonwealth of Pennsylvania
Sufficient throughput capabilities (≥ 1,000,000 TEU/yr)?	No (less than 100 acres)	No (less than 100 acres)	No (less than 100 acres)	Yes
Distance to Federal navigation channel	± 1,200 ft	± 1,500 ft	± 1,200 ft	± 750 ft
Downriver from Walt Whitman	Yes	Yes	Yes	Yes
Interference with Philadelphia Intl Airport operations?	No	No	No	No
Compatible with adjacent land use?	Yes	No	Yes	Yes
Easy access to major highway	No	Yes	Yes	Yes
Future intermodal capability?	Possible	Possible	Possible	Yes
Impacts				
Direct impacts to Delaware River effective mixing zone?	Yes	Yes	Yes	No
Benthic Habitat	Permanent loss of approximately **35 acres** of river bottom through filling. Temporary impacts to approximately **66 acres (within dredging template)**. Conversion of shallow water habitat to deep water.	Permanent loss of approximately **3 acres** of river bottom through filling. Temporary impacts to approximately **86 acres (within dredging template)**. Conversion of shallow water habitat to deep water.	Permanent loss of approximately **23 acres** of river bottom through filling. Temporary impacts to approximately **107 acres (within dredging template)**.	Permanent loss of approximately **8.88 acres** of river bottom through filling. Temporary impacts to approximately **48 acres (35 acres within dredging template assuming dreding to 40+2')**.

Summary Table 2-2
Southport Philadelphia Conceptual Study Terminal Layout Alternatives
(DMJM HARRIS/AECOM, 2008)

	Preferred ALT	ALT "A"	ALT "B"	ALT "C"	ALT "C2"	ALT "D"	ALT "E"
Project Footprint (RTG)	116.0 acres	114.0 acres	123.0 acres	138.4 acres	151.6 acres	145.8 acres	286.6 acres
Crane Operations	RMG	RTG	RMG	Limited RMG	RTG/RMG	RTG/RMG	RTG/RMG
No. of Berths	2	2	3	4	2 (+ expansion)	2 (+ expansion)	2 (+ expansion)
Annual Throughput	1,340,000 TEU	620,000 TEU	930,000 TEU	1,240,000 TEU (with land acquisition)	620,000+ TEU	620,000+ TEU	620,000+ TEU
Project Cost	$$$	$$	$$$$	$$$$$	$$$	$$$$	$$$$$
Impacts							
Benthic Habitat	Permanent loss of approximately **8.88 acres** of river bottom through filling. Temporary impacts to approximately **48 acres (35 acres within the dredging template assuming 40+2' depth)**. Conversion of shallow water habitat to deep water.	Permanent loss of approximately **24 acres** of river bottom through filling. Temporary impacts to approximately **125 acres (within dredging template)**. Conversion of shallow water habitat to deep water.	Permanent loss of approximately **25 acres** of river bottom through filling. Temporary impacts to approximately **175 acres (within dredging template)**. **Extensive dredging** along southern shoreline of site. Permanent loss of shoaled/habitat area. Conversion of shallow water habitat to deep water.	Permanent loss of **25.9 acres** of river bottom through filling. Temporary impacts to approximately **250 acres (within dredging template)**. **Extensive dredging** along southern shoreline of site. Permanent loss of shoaled/habitat area. Conversion of shallow water habitat to deep water .	Permanent loss of **30.1 acres** of river bottom through filling. Temporary impacts to approximately **125 acres (within dredging template)**. Conversion of shallow water habitat to deep water.	Permanent loss of **25.9 acres** of river bottom through filling. Temporary impacts to approximately **225 acres (within dredging template)**. **Extensive dredging** along southern shoreline of site. Permanent loss of shoaled/habitat area. Conversion of shallow water habitat to deep water.	Permanent loss of **176.4 acres** of river bottom through filling. Temporary impacts to approximately **75 acres (within dredging template)**. Permanent loss of shoaled/habitat area through filling. Conversion of shallow water habitat to deep water.
Wetlands	**Filling** of approximately **3.75 acres**	**Filling** of approximately **3.75 acres**	**Filling** of approximately **3.75 acres**	**Filling** of approximately **3.75 acres**	**Filling** of approximately **3.75 acres**	**Filling** of approximately **3.75 acres**	**Filling** of approximately **3.75 acres**
Terrestrial Resources	**Clearing of 116 acres** of historically disturbed terrestrial habitat to construct terminal.	**Clearing of 93 acres** of historically disturbed terrestrial habitat to construct terminal.	**Clearing of 102 acres** of historically disturbed terrestrial habitat to construct terminal.	**Clearing of 117 acres** of historically disturbed terrestrial habitat to construct terminal.	**Clearing of 124 acres** of historically disturbed terrestrial habitat to construct terminal.	**Clearing of 124 acres** of historically disturbed terrestrial habitat to construct terminal.	**Clearing of 124 acres** of historically disturbed terrestrial habitat to construct terminal.
Water Quality	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.	Direct, minor effects (incresed turbidity) on water quality during dredging and in-water construction.
Recreation	Minor, short-term impacts to recreational boat traffic near the proposed dredging location.	Minor, short-term impacts to recreational boat traffic near the proposed dredging location.	Minor, short-term impacts to recreational boat traffic near the proposed dredging location. Conversion of shallow water habitat (southern shoreline) to deep water may impact recreational fishery.	Minor, short-term impacts to recreational boat traffic near the proposed dredging location. Conversion of shallow water habitat (southern shoreline) to deep water may impact recreational fishery.	Minor, short-term impacts to recreational boat traffic near the proposed dredging location.	Minor, short-term impacts to recreational boat traffic near the proposed dredging location. Conversion of shallow water habitat (southern shoreline) to deep water may impact recreational fishery.	Minor, short-term impacts to recreational boat traffic near the proposed dredging location. Permanent loss of shallow water habitat may reduce recreational fishery along shoreline
Cultural Resources	No adverse impacts to resouces deemed eligible for listing on the NRHP.	No adverse impacts to resouces deemed eligible for listing on the NRHP.	No adverse impacts to resouces deemed eligible for listing on the NRHP.	No adverse impacts to resouces deemed eligible for listing on the NRHP.	No adverse impacts to resouces deemed eligible for listing on the NRHP.	No adverse impacts to resouces deemed eligible for listing on the NRHP.	No adverse impacts to resouces deemed eligible for listing on the NRHP.
Socioeconomics	Approximately **7,310 direct jobs**	Approximately **3,300 direct jobs**	Approximately **4,950 direct jobs**	Approximately **6,600 direct jobs**	Approximately **4,950 direct jobs** (depending on throughput)	Approximately **4,950 direct jobs** (depending on throughput)	Approximately **4,950 direct jobs** (depending on throughput)

Summary Table 2-2
Southport Philadelphia Conceptual Study Terminal Layout Alternatives
(DMJM HARRIS/AECOM, 2008)

	Preferred ALT	ALT "A"	ALT "B"	ALT "C"	ALT "C2"	ALT "D"	ALT "E"
Project Footprint (RTG)	116.0 acres	114.0 acres	123.0 acres	138.4 acres	151.6 acres	145.8 acres	286.6 acres
Crane Operations	RMG	RTG	RMG	Limited RMG	RTG/RMG	RTG/RMG	RTG/RMG
No. of Berths	2	2	3	4	2 (+ expansion)	2 (+ expansion)	2 (+ expansion)
Annual Throughput	1,340,000 TEU	620,000 TEU	930,000 TEU	1,240,000 TEU (with land acquisition)	620,000+ TEU	620,000+ TEU	620,000+ TEU
Project Cost	$$$	$$	$$$$	$$$$$	$$$	$$$$	$$$$$
Impacts							
Transportation	Increased local traffic due to an **additional 3,300 trucks/day.**	Increased local traffic due to an **additional 1,700 trucks/day.**	Increased local traffic due to an **additional 2,550 trucks/day.**	Increased local traffic due to an **additional 3,400 trucks/day.**	Increased local traffic due to an additional **2,550+ trucks/day (depending on throughput).**	Increased local traffic due to an additional **2,550+ trucks/day (depending on throughput).**	Increased local traffic due to an additional **2,550+ trucks/day (depending on throughput).**
Geology/Soils/Sediments	Fill required for fast land creation (12.3 acres); **35 acres of sediment removed.**	Fill required for fast land creation (24 acres); **125 acres of sediment removed.**	Fill required for fast land creation (25 acres); **175 acres of sediment removed.**	Fill required for fast land creation (25.9 acres); **250 acres of sediment removed.**	Fill required for fast land creation (30.1 acres); **125 acres of sediment removed.**	Fill required for fast land creation (25.9 acres); **225 acres of sediment removed.**	Fill required for fast land creation (176.4 acres); **75 acres of sediment removed.**
Endangered Species	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.	Possible impacts to shortnose and atlantic sturgeon; can be reduced or eliminated with tubidity controls and imposing work restrictions for dredging during critical periods. Direct impacts to state-listed plant species.
Hazardous, Toxic, and Radioactive Waste (HTRW)	No impacts	No impacts	No impacts	No impacts	No impacts	No impacts	No impacts
Air Quality	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 1,700 trucks/day.	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 3,300 trucks/day.	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 2,550 trucks/day.	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 3,400 trucks/day.	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 2,550+ trucks/day.	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 2,550+ trucks/day.	Localized, short term impacts due to construction. Increased air emissions (long-term) due to container operations and additional 2,550+ trucks/day.
Noise	Localized, short term impacts due to construction.	Localized, short term impacts due to construction.	Localized, short term impacts due to construction.	Localized, short term impacts due to construction.	Localized, short term impacts due to construction.	Localized, short term impacts due to construction.	Localized, short term impacts due to construction.
Short-Term Uses vs. Long-Term Productivity	Minor, short-term impacts, long-term benefits of direct job creation	Minor, short-term impacts, long-term benefits of direct job creation	Minor, short-term impacts, long-term benefits of direct job creation	Minor, short-term impacts, long-term benefits of direct job creation	Minor, short-term impacts, long-term benefits of direct job creation	Minor, short-term impacts, long-term benefits of direct job creation	Minor, short-term impacts, long-term benefits of direct job creation
Irreversible or Irretrievable Commitments of Resources	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.	Construction will change land use and result in the permanent loss of terrestrial, wetlands, benthic and aquatic habitats.
Cumulative Effects and Mitigation	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats.	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats.	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats.	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats.	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats. Future expansion for an additional berth will result in additional impacts.	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats. Future expansion for an additional berth will result in additional impacts.	Required mitigation would create non-tidal wetlands and upland, intertidal, subtidal, deepwater habitats. Future expansion for an additional berth will result in additional impacts.

SECTION 2

FIGURES

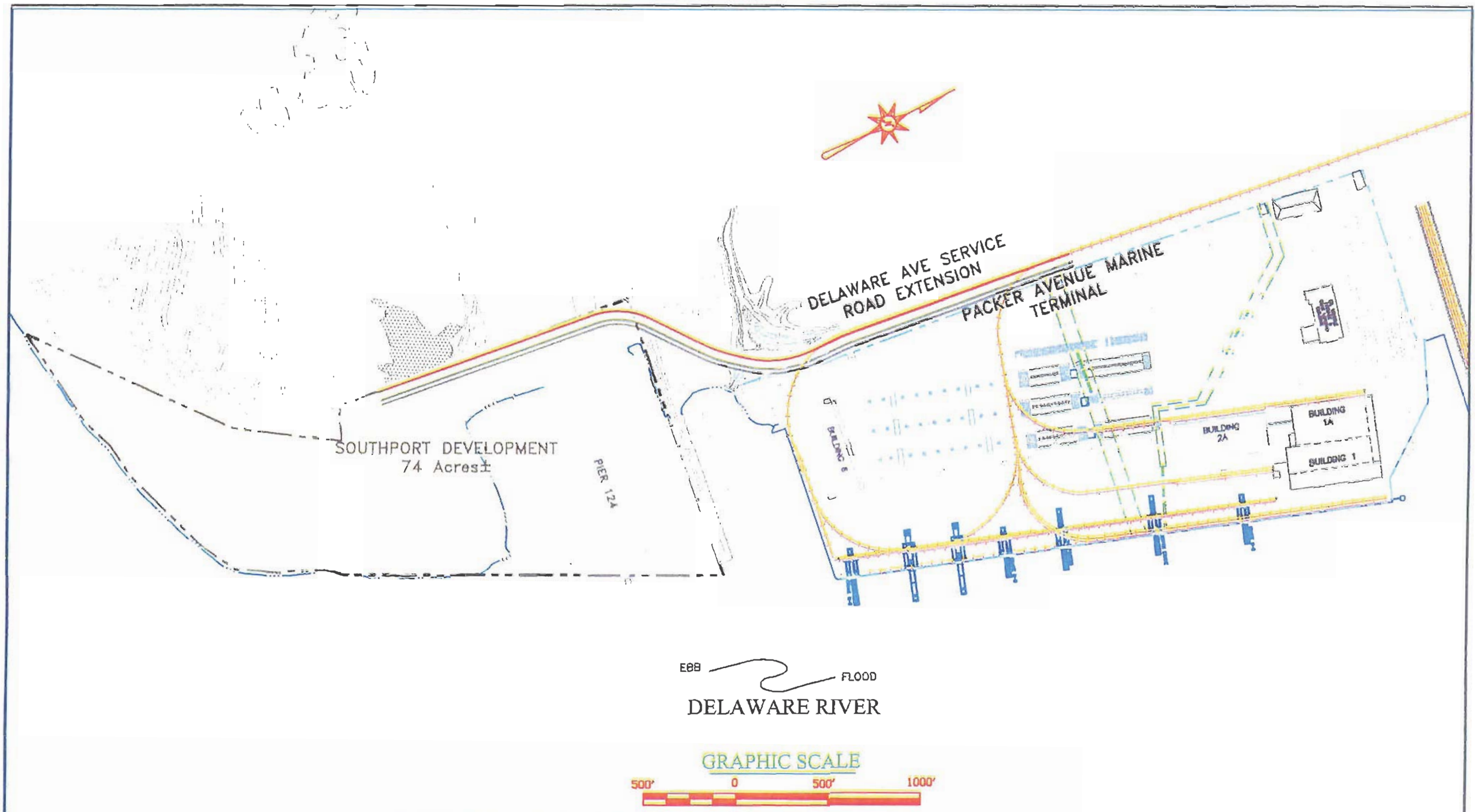

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FIGURE 2-1 OPTION A

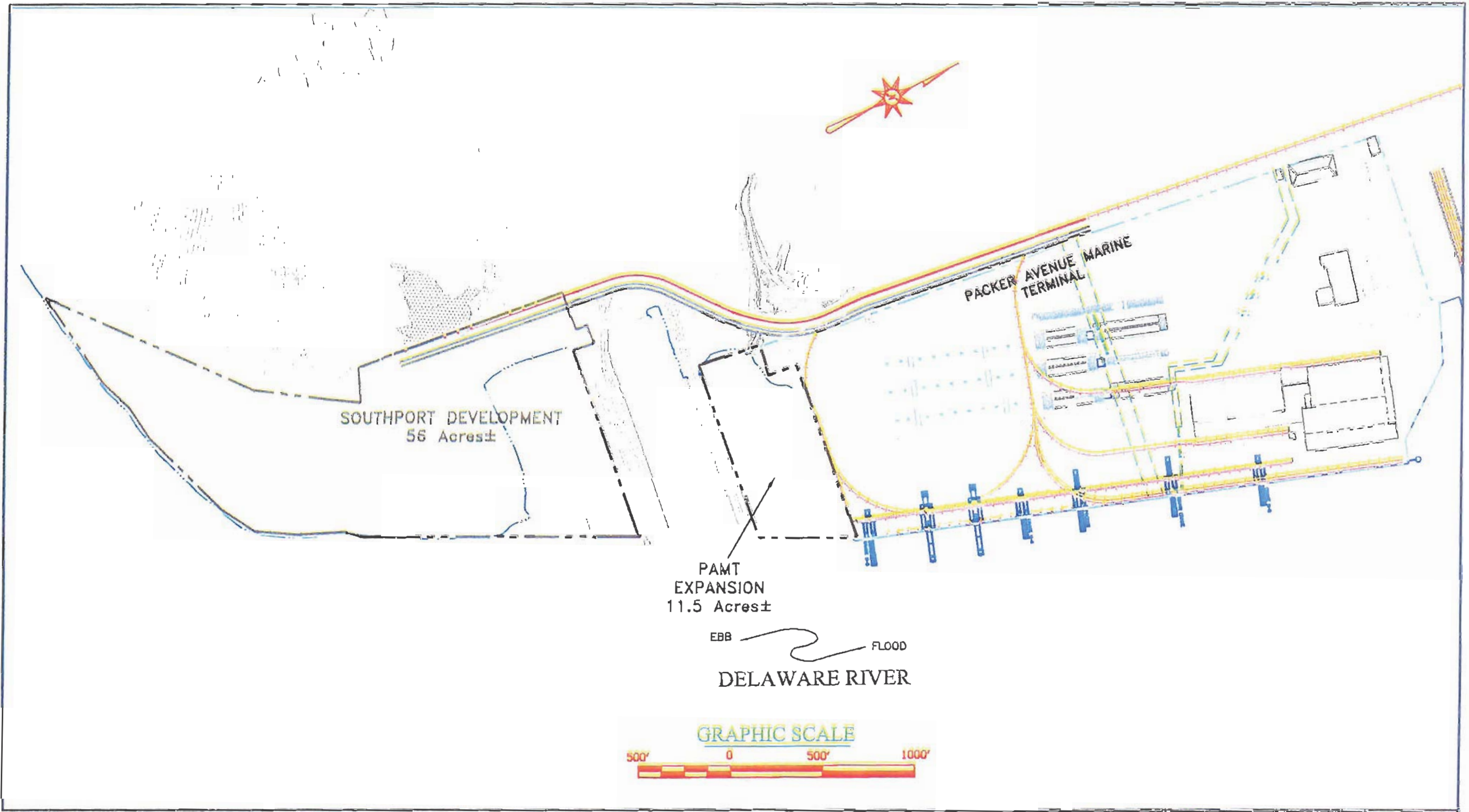
SOUTHPORT DEVELOPMENT

FILE LOCATION & NAME
PROJECTS\5565 PORT OF PHILADELPHIA\002 PIER 122-124\Concepts\ 5585 002 Option A-1.dwg

SCALE: 1" = 600'
DATE: 8-26-2003
DRAWN BY: CJL
DESIGNED BY: JWH

PIER 122 / 124 TERMINAL

PHILADELPHIA REGIONAL PORT AUTHORITY



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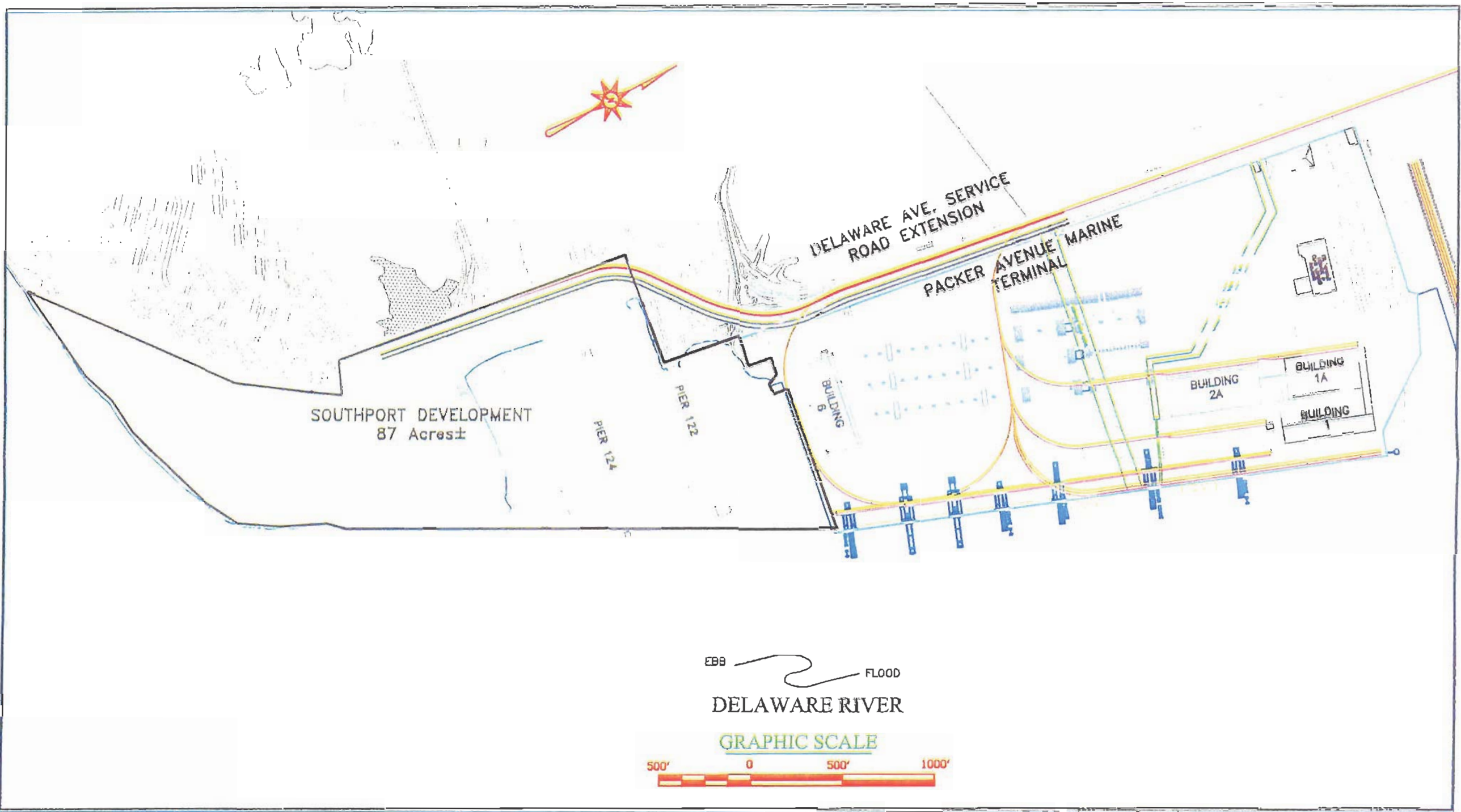
PHILADELPHIA, PA. 19106-3685

FIGURE 2-2 OPTION B
SOUTHPORT DEVELOPMENT

FILE LOCATION & NAME
PROJECTS\5565 PORT OF PHILADELPHIA\002
PIER 122-124\Concepts\
5565 002 Option B-1.dwg

SCALE: 1" = 60'
DATE: 8-26-03
DRAWN BY: C.E.
DESIGNED BY: JWH

PIER 122 / 124 TERMINAL
PHILADELPHIA REGIONAL PORT AUTHORITY



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530 WALNUT STREET, 14TH FLOOR
PHILADELPHIA, PA. 19106-3685

FIGURE 2-3 OPTION C
SOUTHPORT DEVELOPMENT

FILE LOCATION & NAME
PROJECTS\5566 PORT OF PHILADELPHIA\002 PIER 122-124\Deliverable\ 5565 002 Option C and C1.dwg

SCALE: 1" = 800'
DATE: 8-28-2003
DRAWN BY: CJL
DESIGNED BY: JWH

PIER 122 / 124 TERMINAL
PHILADELPHIA REGIONAL PORT AUTHORITY

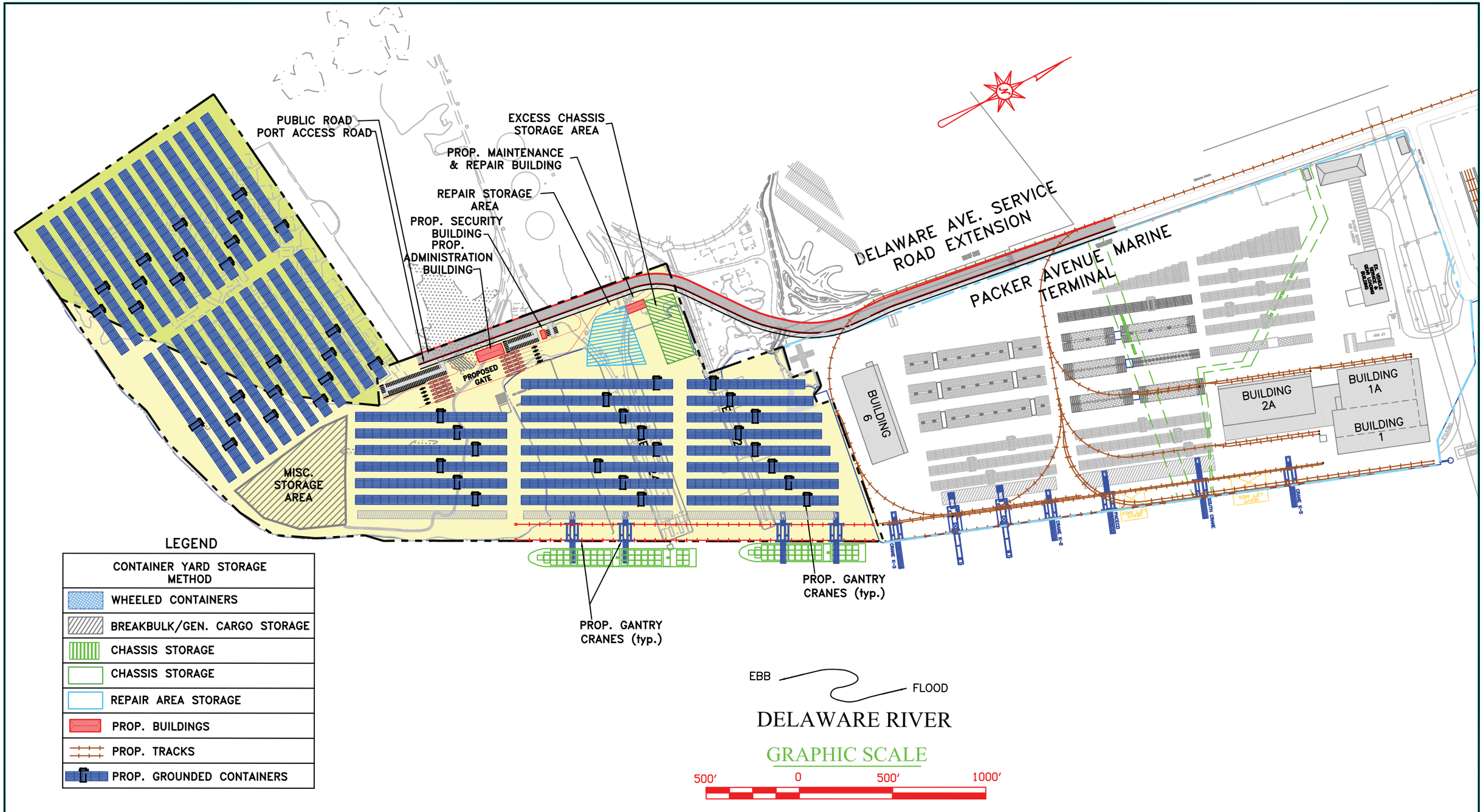


FIGURE 2-4 OPTION D-2

SOUTHPORT DEVELOPMENT

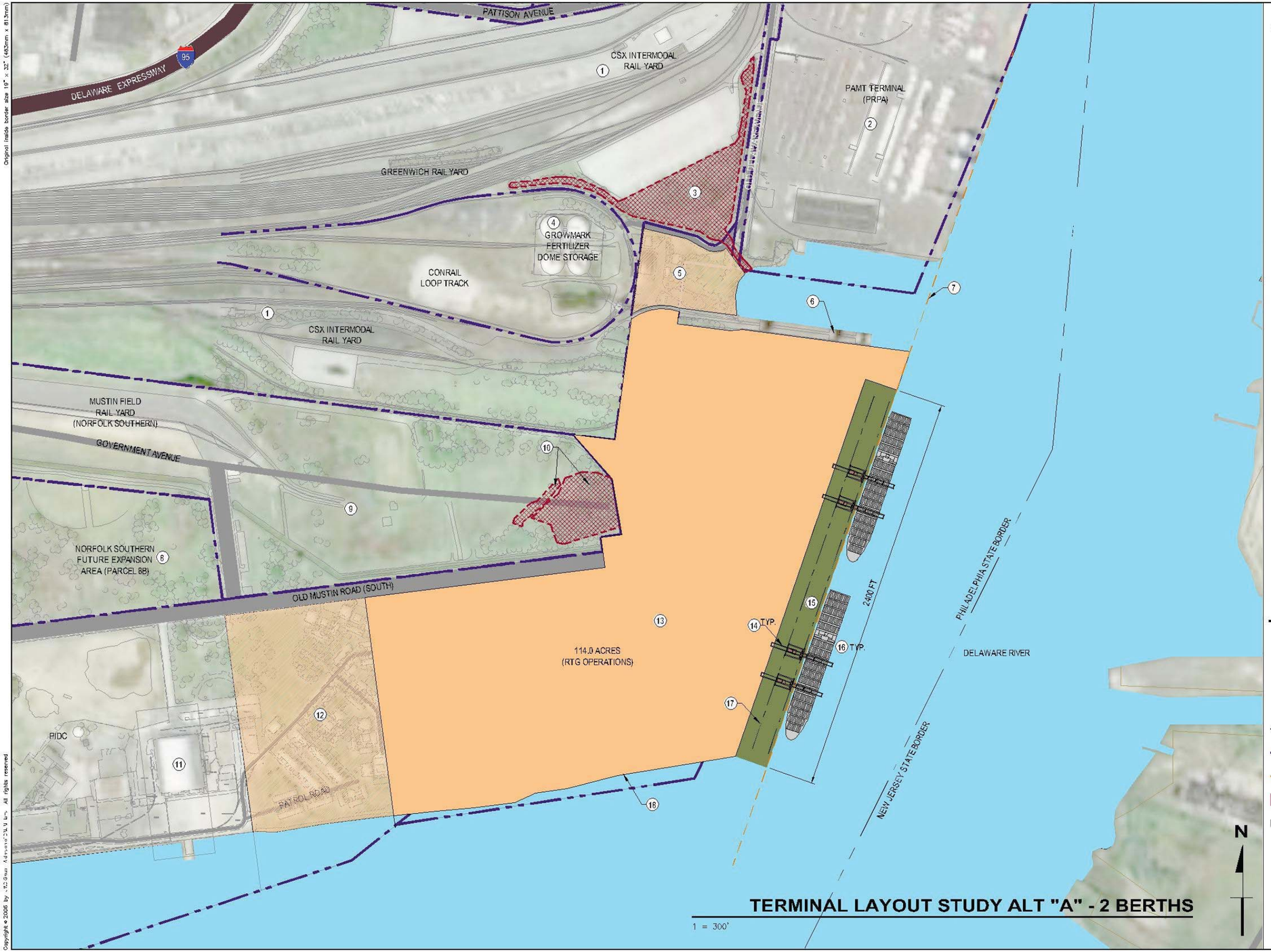
CONTAINER DEVELOPMENT

SCALE: 1" = 600'

DATE: 3-22-04

SOUTHPORT DEVELOPMENT

PHILADELPHIA REGIONAL PORT AUTHORITY



TERMINAL LAYOUT STUDY ALT "A" - 2 BERTHS

KEYNOTES

1. CSX INTERMODAL RAIL YARD
2. PAMT - PACKER AVENUE MARINE TERMINAL (PRPA) (APPROX. 112 ACRES)
3. WETLAND MITIGATION SITE (6.4 ACRES)
4. GROWMARK FERTILIZER DOME STORAGE (3.3 ACRES)
5. POTENTIAL PIER 122 BACK LAND EXPANSION AREA (PRPA) (5.6 ACRES)
6. PIER 122 - GROWMARK FERTILIZER EXPORT PIER (2 LOADERS W/ CONVEYOR SYSTEM)
7. EXTENSION OF EXISTING PAMT WHARF FACE
8. NORFOLK SOUTHERN FUTURE EXPANSION AREA (24.1 ACRES)
9. NORFOLK SOUTHERN INTERMODAL RAIL YARD
10. WETLAND (4.3 ACRES)
11. SEAPLANE HANGAR (HISTORIC BUILDING) (7.7 ACRES)
12. POTENTIAL PIDC EXPANSION AREA (25.8 ACRES)
13. PROPOSED CONTAINER TERMINAL (114 ACRES)
14. 100 FT. GAGE GANTRY CRANE (TYP.)
15. PROPOSED 2-BERTH WHARF (2,400 LIN. FT.) W/ 1 LANE WHARF SERVICE ROAD (18 FT. TO CENTERLINE OF RAIL)
16. 5,500 TEU CONTAINER SHIP (935 FT x 129 FT TYP.)
17. WHARF CRANE RAIL (TYP.)
18. EXISTING SHORE LINE

BERTH CAPACITY STUDY

NO. OF BERTHS	ANNUAL TEU	RTG (ACRES)	RMG (ACRES)
1 BERTH	310,000	57	41
2 BERTHS	620,000	114	82
3 BERTHS	930,000	171	123
4 BERTHS	1,240,000	228	164

LEGEND

- POTENTIAL CONTAINER TERMINAL (114 ACRES)
- POTENTIAL EXPANSION AREA (31.4 ACRES)
- PROPOSED WHARF (11 ACRES)
- WETLAND AREA (10.7 ACRES)
- STATE LINE BOUNDARY
- PROPERTY LINE BOUNDARY
- EXISTING PAMT WHARF ALIGNMENT
- HIGHWAY
- LOCAL STREETS

0' 300' 600' 900'
SCALE: 1" = 300' FULL SIZE
SCALE: 1" = 600' HALF SIZE

PRELIMINARY

Original Inside border size 19" x 32" (483mm x 813mm)

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Revision	By	Approved	Date

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Drawn By: SHL
Approved By: RLE
Date: 3/12/08
Meeting: Mtg 1

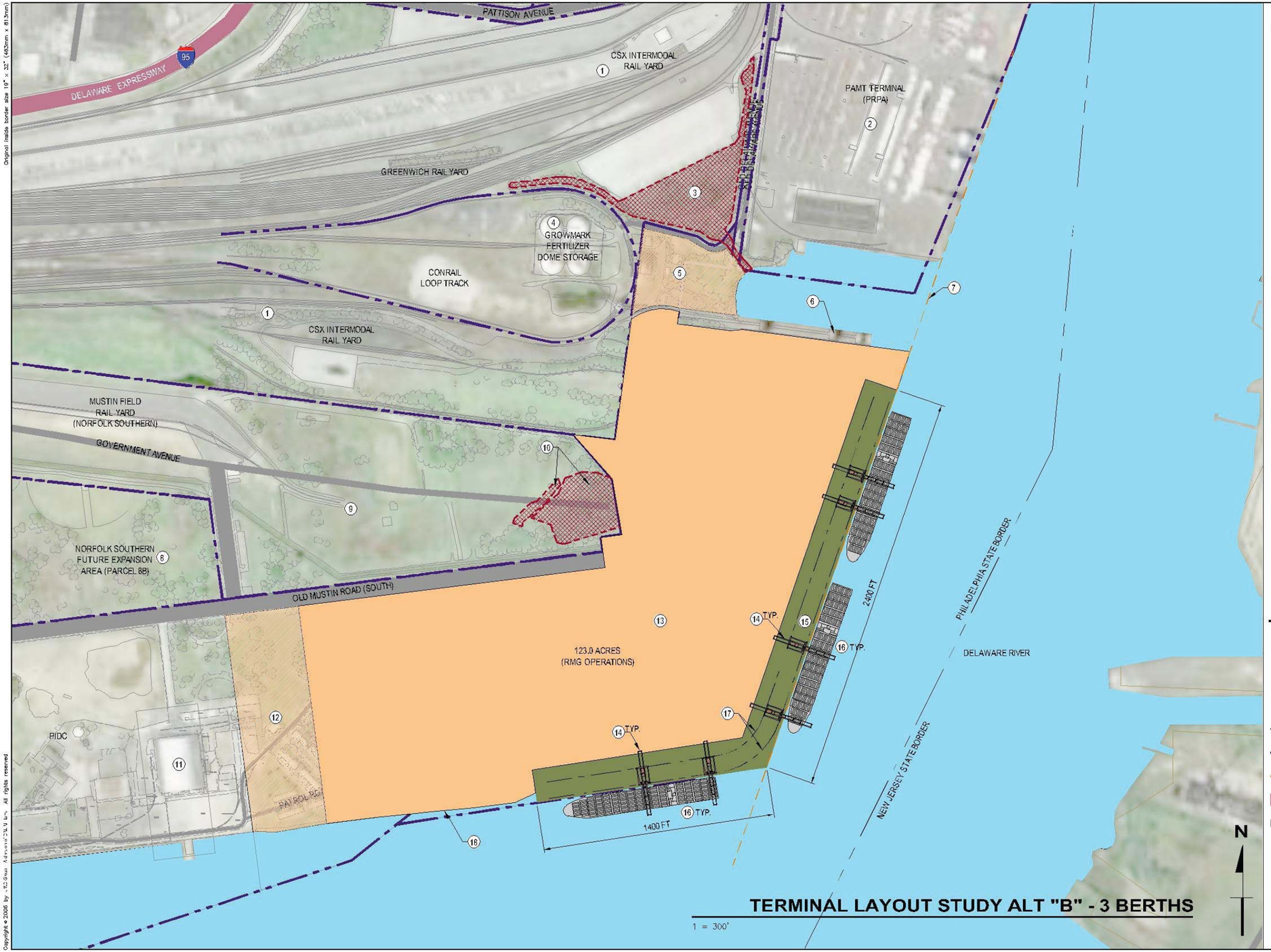
Commonwealth of Pennsylvania

SOUTHPORT PHILADELPHIA CONCEPTUAL STUDY

Sheet Title: **FIGURE 2-5** TERMINAL LAYOUT STUDY ALT "A" – 2 BERTHS

Project Number: 6000XXXX

Sheet Number: 9 of 14



TERMINAL LAYOUT STUDY ALT "B" - 3 BERTHS

1 = 300'

KEYNOTES

1. CSX INTERMODAL RAIL YARD
2. PAMT - PACKER AVENUE MARINE TERMINAL (PRPA) (APPROX. 112 ACRES)
3. WETLAND MITIGATION SITE (6.4 ACRES)
4. GROWMARK FERTILIZER DOME STORAGE (3.3 ACRES)
5. POTENTIAL PIER 122 BACK LAND EXPANSION AREA (PRPA) (5.6 ACRES)
6. PIER 122 - GROWMARK FERTILIZER EXPORT PIER (2 LOADERS W/ CONVEYOR SYSTEM)
7. EXTENSION OF EXISTING PAMT WHARF FACE
8. NORFOLK SOUTHERN FUTURE EXPANSION AREA (24.1 ACRES)
9. NORFOLK SOUTHERN INTERMODAL RAIL YARD
10. WETLAND (4.3 ACRES)
11. SEAPLANE HANGAR (HISTORIC BUILDING) (7.7 ACRES)
12. POTENTIAL PIDC EXPANSION AREA (13.5 ACRES)
13. PROPOSED CONTAINER TERMINAL (123 ACRES)
14. 100 FT. GAGE GANTRY CRANE (TYP.)
15. PROPOSED 3-BERTH WHARF (2,400 LIN. FT. + 1,400 LIN. FT.) W/ 1 LANE WHARF SERVICE ROAD (18 FT. TO CENTERLINE OF RAIL)
16. 5,500 TEU CONTAINER SHIP (935 FT x 129 FT TYP.)
17. WHARF CRANE RAIL (TYP.)
18. EXISTING SHORE LINE

BERTH CAPACITY STUDY

NO. OF BERTHS	ANNUAL TEU	RTG (ACRES)	RMG (ACRES)
1 BERTH	310,000	57	41
2 BERTHS	620,000	114	82
3 BERTHS	930,000	171	123
4 BERTHS	1,240,000	228	164

LEGEND

- POTENTIAL CONTAINER TERMINAL (123 ACRES)
- POTENTIAL EXPANSION AREA (19.1 ACRES)
- PROPOSED WHARF (16.9 ACRES)
- WETLAND AREA (10.7 ACRES)
- STATE LINE BOUNDARY
- PROPERTY LINE BOUNDARY
- EXISTING PAMT WHARF ALIGNMENT
- HIGHWAY
- LOCAL STREETS

0' 300' 600' 900'
SCALE: 1" = 300' FULL SIZE
SCALE: 1" = 600' HALF SIZE

PRELIMINARY

Original Inside border size 19" x 32" (483mm x 813mm)

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Revision	By	Approved	Date

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Drawn By: SHL
Approved By: RLE
Date: 3/12/08
Meeting: Mtg 1

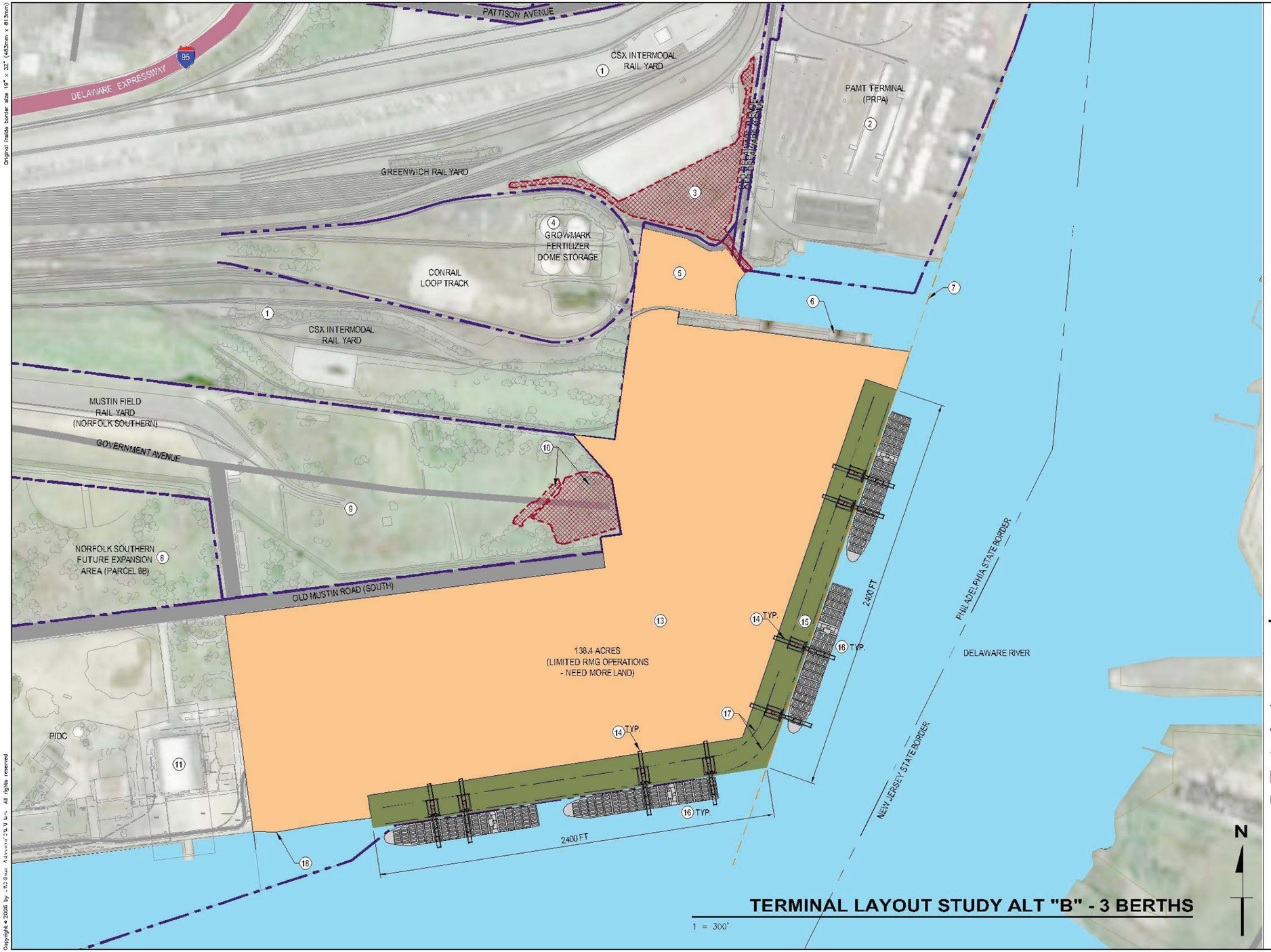
Commonwealth of Pennsylvania

SOUTHPORT PHILADELPHIA CONCEPTUAL STUDY

Sheet Title: **FIGURE 2-6** TERMINAL LAYOUT STUDY ALT "B" – 3 BERTHS

Project Number: 6000XXXX

Sheet Number: 10 of 14



TERMINAL LAYOUT STUDY ALT "B" - 3 BERTHS

1 = 300'

KEYNOTES

1. CSX INTERMODAL RAIL YARD
2. PAMT - PACKER AVENUE MARINE TERMINAL (PRPA) (APPROX. 112 ACRES)
3. WETLAND MITIGATION SITE (6.4 ACRES)
4. GROWMARK FERTILIZER DOME STORAGE (3.3 ACRES)
5. POTENTIAL PIER 122 BACK LAND EXPANSION AREA (PRPA) (5.6 ACRES)
6. PIER 122 - GROWMARK FERTILIZER EXPORT PIER (2 LOADERS W/ CONVEYOR SYSTEM)
7. EXTENSION OF EXISTING PAMT WHARF FACE
8. NORFOLK SOUTHERN FUTURE EXPANSION AREA (24.1 ACRES)
9. NORFOLK SOUTHERN INTERMODAL RAIL YARD
10. WETLAND (4.3 ACRES)
11. SEAPLANE HANGAR(HISTORIC BUILDING) (7.7 ACRES)
12. NOT USED
13. PROPOSED CONTAINER TERMINAL (132.6 ACRES)
14. 100 FT. GAGE GANTRY CRANE (TYP.)
15. PROPOSED 4-BERTH WHARF (2,400 LIN. FT. + 2,400 LIN. FT.) W/ 1 LANE WHARF SERVICE ROAD (18 FT. TO CENTERLINE OF RAIL)
16. 5,500 TEU CONTAINER SHIP (935 FT x 129 FT TYP.)
17. WHARF CRANE RAIL (TYP.)
18. EXISTING SHORE LINE

BERTH CAPACITY STUDY

NO. OF BERTHS	ANNUAL TEU	RTG (ACRES)	RMG (ACRES)
1 BERTH	310,000	57	41
2 BERTHS	620,000	114	82
3 BERTHS	930,000	171	123
4 BERTHS	1,240,000	228	164

LEGEND

- POTENTIAL CONTAINER TERMINAL (138.4 ACRES)
- PROPOSED WHARF (21.5 ACRES)
- WETLAND AREA (10.7 ACRES)
- STATE LINE BOUNDARY
- PROPERTY LINE BOUNDARY
- EXISTING PAMT WHARF ALIGNMENT
- HIGHWAY
- LOCAL STREETS

0' 300' 600' 900'
SCALE: 1" = 300' FULL SIZE
SCALE: 1" = 600' HALF SIZE

PRELIMINARY

Revision	By	Approved	Date

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Drawn By: SHL
Approved By: RLE
Date: 3/12/08
Meeting: Mtg 1

Commonwealth of Pennsylvania

SOUTHPORT PHILADELPHIA CONCEPTUAL STUDY

Sheet Title: **FIGURE 2-7**
TERMINAL LAYOUT STUDY ALT "C" – 4 BERTHS

Project Number: 6000XXXX

Sheet Number: 11 of 14

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Original Inside border size 19" x 32" (483mm x 813mm)

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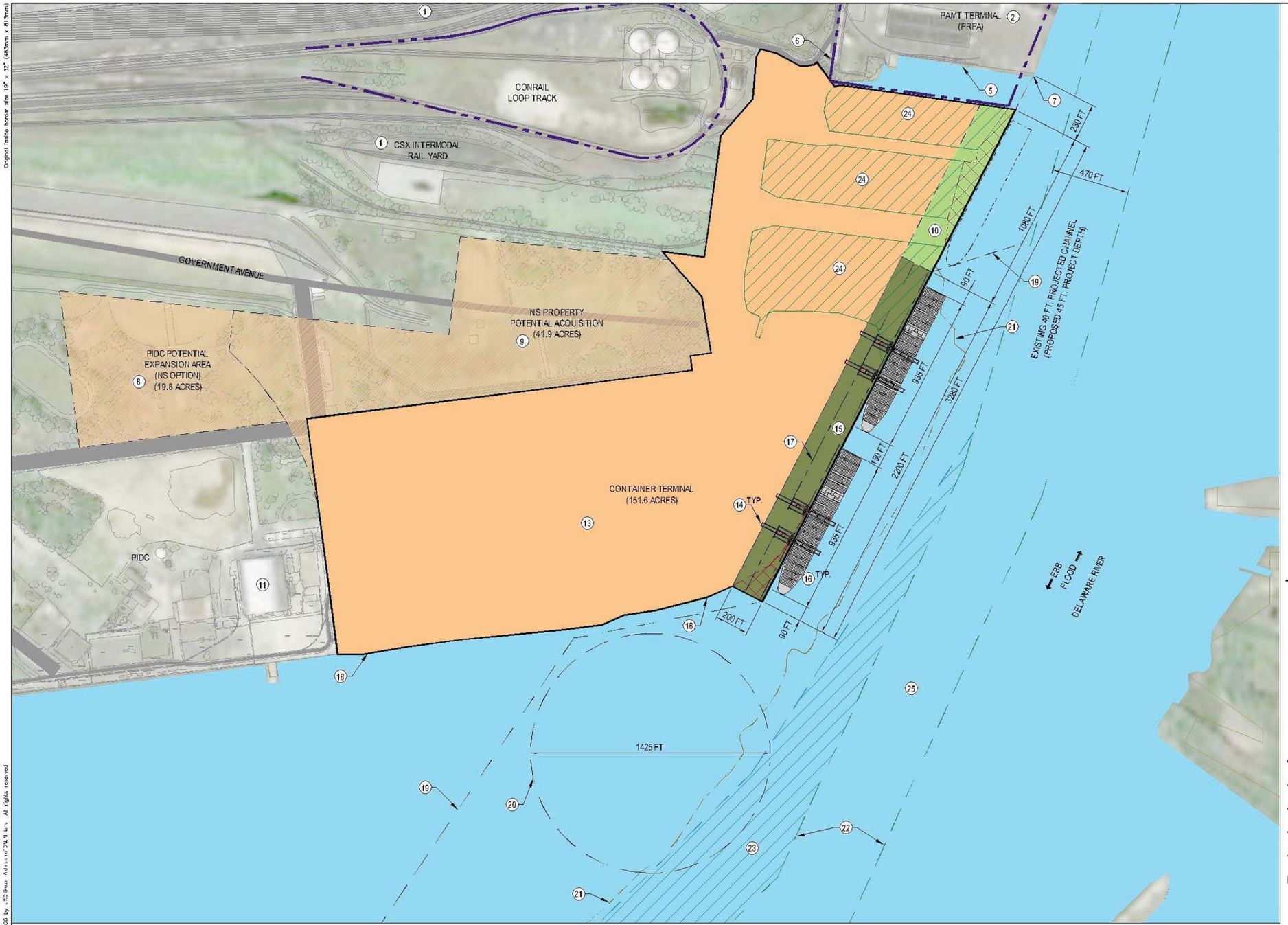

KEYNOTES

1. CSX INTERMODAL RAIL YARD
2. PAMT - PACKER AVENUE MARINE TERMINAL (PRPA) (APPROX. 112 ACRES)
3. NOT USED
4. NOT USED
5. EXISTING PAMT BERTH 6 - BARGE / RORO WHARF
6. EXISTING PAMT LEASE LINE
7. PIVOT POINT AT EXISTING PAMT WHARF
8. PIDC POTENTIAL EXPANSION AREA (NS OPTION) (19.8 ACRES)
9. NS PROPERTY POTENTIAL ACQUISITION (41.9 ACRES)
10. POTENTIAL FUTURE 3RD BERTH OR LAY BERTH (1,080 LIN. FT.)
11. SEAPLANE HANGAR(HISTORIC BUILDING) (7.7 ACRES)
12. NOT USED
13. PROPOSED CONTAINER TERMINAL (151.6 ACRES)
14. 100 FT. GAGE GANTRY CRANE (TYP.)
15. PROPOSED 2-BERTH WHARF (2,200 LIN. FT.) W/ 1 LANE WHARF SERVICE ROAD (18 FT. TO CENTERLINE OF WATERSIDE CRANE RAIL)
16. 5,500 TEU CONTAINER SHIP (935 FT x 129 FT. TYP.)
17. WHARF CRANE RAIL (TYP.)
18. EXISTING SHORE LINE
19. POTENTIAL LIMITS OF BERTHING BASIN
20. PROPOSED TURNING BASIN (1,425 FT. DIA.)
21. APPROX. BOUNDARY OF HORSESHOE SHOAL (SHALLOW WATER HABITAT)
22. EDGE OF CHANNEL - EXISTING 40 FT. PROJECT DEPTH (PROPOSED 45 FT. PROJECT DEPTH)
23. PROPOSED CHANNEL WIDENING
24. SLIP FILL AREA
25. HORSESHOE REACH

LEGEND

- PRPA AVAILABLE LAND AREA (151.6 ACRES)
- PIDC LAND AREA (61.7 ACRES)
- PROPOSED CONTAINER WHARF (10.1 ACRES)
- POTENTIAL FUTURE WHARF (4.8 ACRES)
- SLIP FILL AREA (27.7 ACRES)
- RIVER OPEN WATER FILL AREA (2.4 ACRES)
- CHANNEL WIDENING (42.8 ACRES)
- PROPERTY LINE BOUNDARY
- CHANNEL LIMIT
- POTENTIAL LIMITS OF BERTHING / TURNING BASIN
- SOUTHPORT MASTER PLAN WHARF ALIGNMENT (NOV. 2003)
- HORSESHOE SHOAL BOUNDARY
- LOCAL STREETS

N

0' 300' 600' 900'

SCALE: 1" = 300' FULL SIZE
SCALE: 1" = 600' HALF SIZE

TERMINAL LAYOUT STUDY ALT "C2" (2 BERTHS)

1 = 300'

PRELIMINARY

Original inside border size 19" x 32" (483mm x 813mm)

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Approved By	LJD
Date	X/XX/08
Meeting	Mtg 2

Commonwealth of Pennsylvania

SOUTHPORT PHILADELPHIA CONCEPTUAL STUDY

Sheet Title **FIGURE 2-8**
TERMINAL LAYOUT STUDY – ALT "C2"

Project Number 6000XXXX

Sheet Number 15 of 27

KEYNOTES

1. CSX INTERMODAL RAIL YARD
2. PAMT - PACKER AVENUE MARINE TERMINAL (PRPA) (APPROX. 112 ACRES)
3. GROWMARK OVERHEAD CONVEYOR SYSTEM
4. GROWMARK FERTILIZER DOME STORAGE (3.3 ACRES)
5. EXISTING PAMT BERTH 6 - BARGE / RORO WHARF
6. EXISTING PAMT LEASE LINE
7. PIVOT POINT AT EXISTING PAMT WHARF
8. PIDC POTENTIAL EXPANSION AREA (NS OPTION) (19.8 ACRES)
9. NS PROPERTY POTENTIAL ACQUISITION (41.9 ACRES)
10. POTENTIAL FUTURE 3RD BERTH OR LAY BERTH (1,300 LIN. FT.)
11. SEAPLANE HANGAR(HISTORIC BUILDING) (7.7 ACRES)
12. PIER 122
13. PROPOSED CONTAINER TERMINAL (145.8 ACRES)
14. 100 FT. GAGE GANTRY CRANE (TYP.)
15. PROPOSED 2-BERTH WHARF (2,400 LIN. FT.) W/ 1 LANE WHARF SERVICE ROAD (18 FT. TO CENTERLINE OF WATERSIDE CRANE RAIL)
16. 5,500 TEU CONTAINER SHIP (935 FT x 129 FT. TYP.)
17. WHARF CRANE RAIL (TYP.)
18. EXISTING SHORE LINE
19. POTENTIAL LIMITS OF BERTHING BASIN
20. PROPOSED TURNING BASIN (1,425 FT. DIA.)
21. APPROX. BOUNDARY OF HORSESHOE SHOAL (SHALLOW WATER HABITAT)
22. EDGE OF CHANNEL - EXISTING 40 FT. PROJECT DEPTH (PROPOSED 45 FT. PROJECT DEPTH)
23. PROPOSED CHANNEL WIDENING
24. SLIP FILL AREA
25. HORSESHOE REACH
26. CLEARANCE REQUIRED FROM CRANE BOOM TO TURNING BASIN (EQUAL TO 1 SHIP BEAM PLUS LENGTH OF 1 TUG BOAT)

LEGEND

- PRPA AVAILABLE LAND AREA (145.8 ACRES)
- PIDC LAND AREA (61.7 ACRES)
- PROPOSED CONTAINER WHARF (11 ACRES)
- POTENTIAL FUTURE WHARF (5.5 ACRES)
- SLIP FILL AREA (21.5 ACRES)
- RIVER OPEN WATER FILL AREA (4.4 ACRES)
- CHANNEL WIDENING (42.8 ACRES)
- PROPERTY LINE BOUNDARY
- CHANNEL LIMIT
- POTENTIAL LIMITS OF BERTHING / TURNING BASIN
- SOUTHPORT MASTER PLAN WHARF ALIGNMENT (NOV. 2003)
- HORSESHOE SHOAL BOUNDARY
- LOCAL STREETS

N

0' 300' 600' 900'

SCALE: 1" = 300' FULL SIZE
SCALE: 1" = 600' HALF SIZE

TERMINAL LAYOUT STUDY ALT "D" (2 BERTHS)

1 = 300'

PRELIMINARY

Original inside border size 19" x 32" (483mm x 813mm)
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Revision	By	Approved	Date

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Drawn By	SHL
Approved By	LJD
Date	X/XX/08
Meeting	Mtg 2

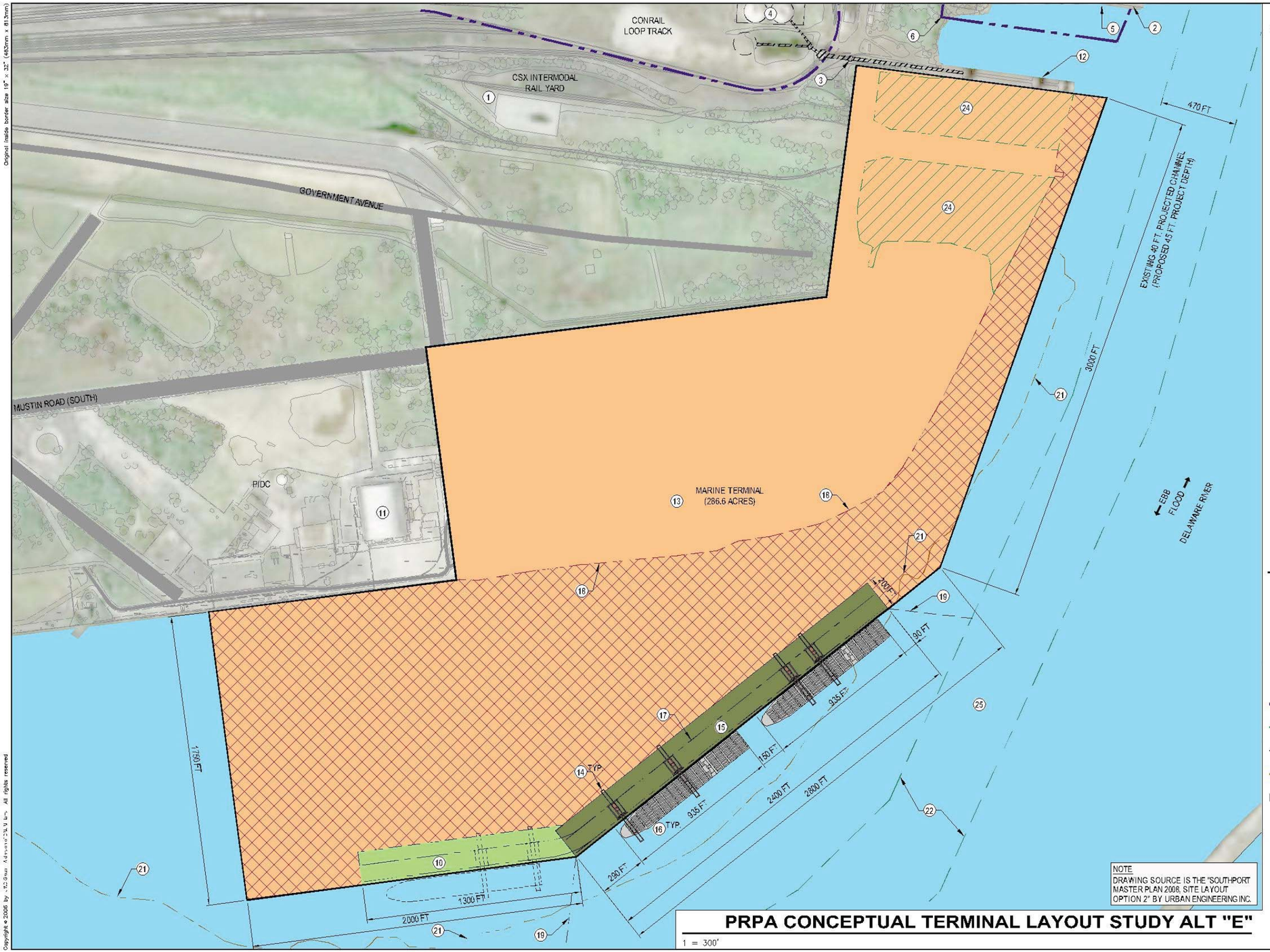
Commonwealth of Pennsylvania

SOUTHPORT PHILADELPHIA CONCEPTUAL STUDY

Sheet Title **FIGURE 2-9**
TERMINAL LAYOUT STUDY – ALT "D"

Project Number 60000XXXX

Sheet Number 16 of 27



KEYNOTES

1. CSX INTERMODAL RAIL YARD
2. PAMT - PACKER AVENUE MARINE TERMINAL (PRPA) (APPROX. 112 ACRES)
3. GROWMARK OVERHEAD CONVEYOR SYSTEM
4. GROWMARK FERTILIZER DOME STORAGE (3.3 ACRES)
5. EXISTING PAMT BERTH 6 - BARGE / RORO WHARF
6. EXISTING PAMT LEASE LINE
7. NOT USED
8. NOT USED
9. NOT USED
10. POTENTIAL FUTURE 3RD BERTH OR LAY BERTH (1,300 LIN. FT.)
11. SEAPLANE HANGAR (HISTORIC BUILDING) (7.7 ACRES)
12. PIER 122
13. PROPOSED CONTAINER TERMINAL (286.6 ACRES)
14. 100 FT. GAGE GANTRY CRANE (TYP.)
15. PROPOSED 2-BERTH WHARF (2,400 LIN. FT.) W/ 1 LANE WHARF SERVICE ROAD (18 FT. TO CENTERLINE OF WATERSIDE CRANE RAIL)
16. 5,500 TEU CONTAINER SHIP (935 FT x 129 FT. TYP.)
17. WHARF CRANE RAIL (TYP.)
18. EXISTING SHORE LINE
19. POTENTIAL LIMITS OF BERTHING BASIN
20. NOT USED
21. APPROX. BOUNDARY OF HORSESHOE SHOAL (SHALLOW WATER HABITAT)
22. EDGE OF CHANNEL - EXISTING 40 FT. PROJECT DEPTH (PROPOSED 45 FT. PROJECT DEPTH)
23. NOT USED
24. SLIP FILL AREA
25. HORSESHOE REACH

LEGEND

- PRPA AVAILABLE LAND AREA (286.6 ACRES)
- PROPOSED CONTAINER WHARF (11 ACRES)
- POTENTIAL FUTURE WHARF (5.7 ACRES)
- SLIP FILL AREA (21.5 ACRES)
- RIVER OPEN WATER FILL AREA (154.9 ACRES)
- PROPERTY LINE BOUNDARY
- CHANNEL LIMIT
- POTENTIAL LIMITS OF BERTHING / TURNING BASIN
- HORSESHOE SHOAL BOUNDARY
- LOCAL STREETS

N

0' 300' 600' 900'

SCALE: 1" = 300' FULL SIZE
SCALE: 1" = 600' HALF SIZE

NOTE
DRAWING SOURCE IS THE "SOUTHPORT MASTER PLAN 2008, SITE LAYOUT OPTION 2" BY URBAN ENGINEERING INC.

PRPA CONCEPTUAL TERMINAL LAYOUT STUDY ALT "E"

1 = 300'

PRELIMINARY

Original Inside border size 19" x 32" (483mm x 813mm)

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Revision	By	Approved	Date

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Approved By	LJD
Date	X/XX/08
Meeting	Mtg 2

Commonwealth of Pennsylvania

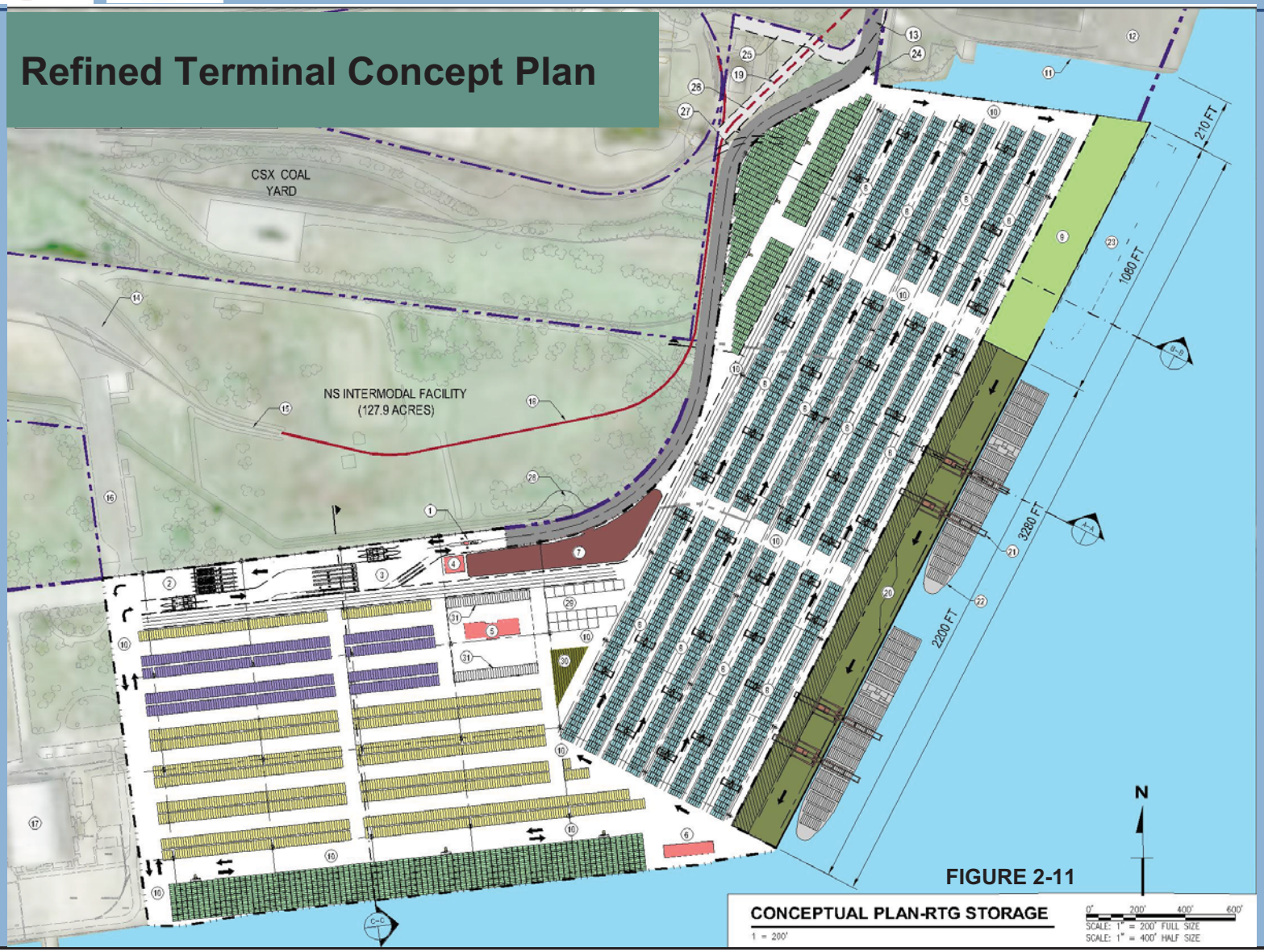
SOUTHPORT PHILADELPHIA CONCEPTUAL STUDY

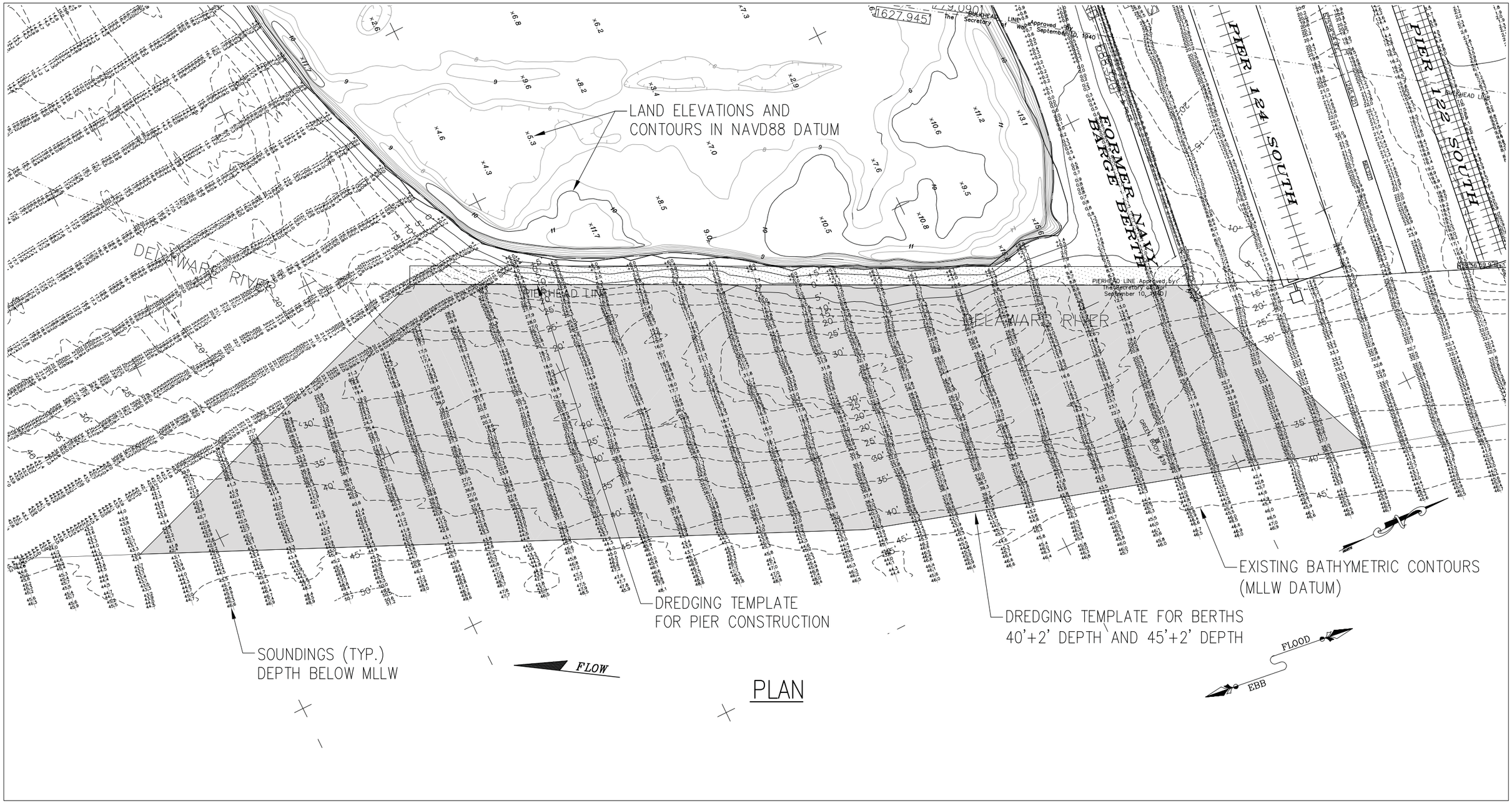
Sheet Title FIGURE 2-10
PRPA CONCEPTUAL TERMINAL LAYOUT STUDY – ALT "E"

Project Number 60000XXXX

Sheet Number 17 of 27

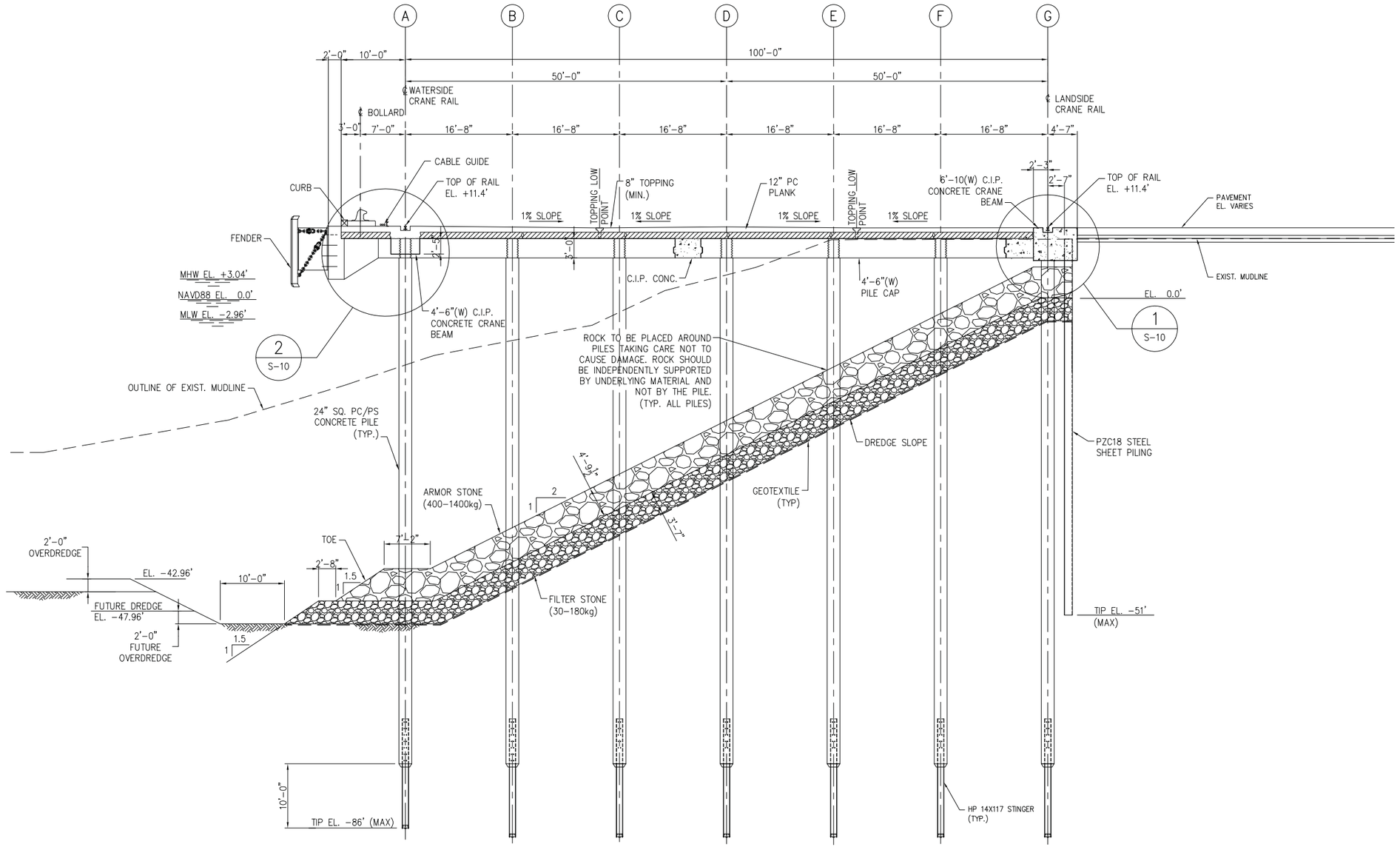
Refined Terminal Concept Plan





0 125 250 500 750 1,000 Feet

Figure 2-12
Proposed Dredging Template
Southport Development Project
Philadelphia, Pennsylvania



A SECTION
SCALE 1/8"=1'-0"
S-1,S-2,S-3,S-4

1/8"=1'-0" 0 5 10 15 FT.

GRAPHIC SCALES
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PHILADELPHIA, PA

SOUTHPORT PROJECT
FIGURE 2-13
TYPICAL EAST WHARF CROSS SECTION

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REVISION

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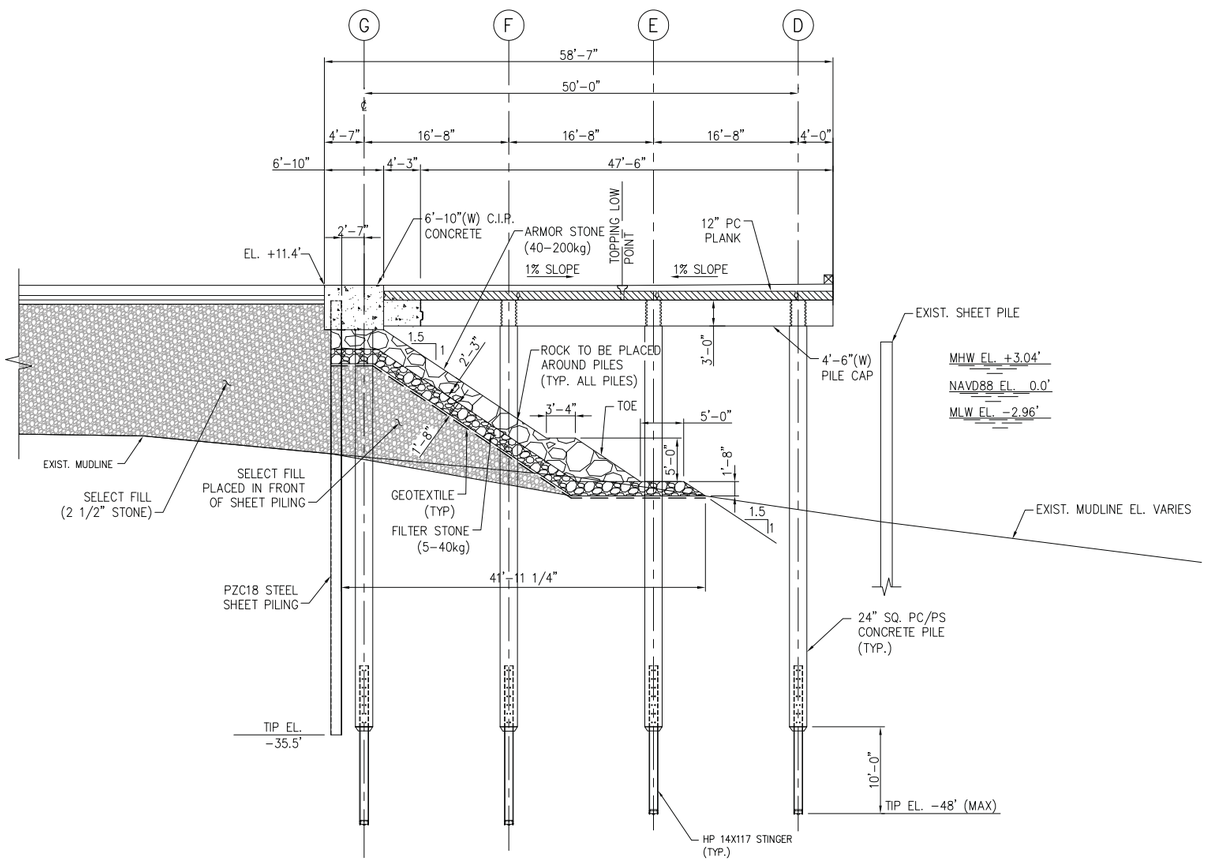
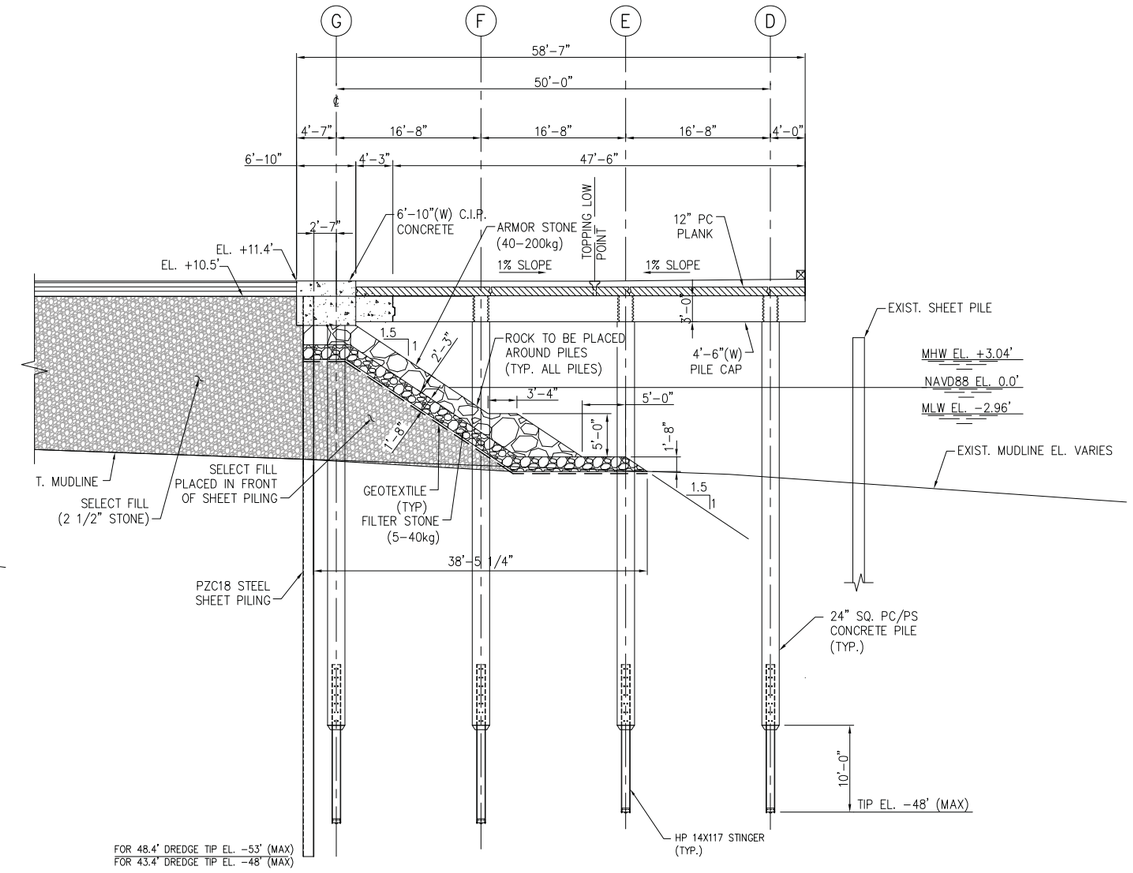
S-9



C SECTION
S-1,S-6



D SECTION
S-1,S-6

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TYPICAL CROSS SECTION
AT NORTH SIDE

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SOUTHPORT PROJECT
FIGURE 2-14
TYPICAL NORTH WHARF CROSS SECTIONS

SCALE 1/8"=1'-0"
DATE APRIL 2, 2010
REVISION

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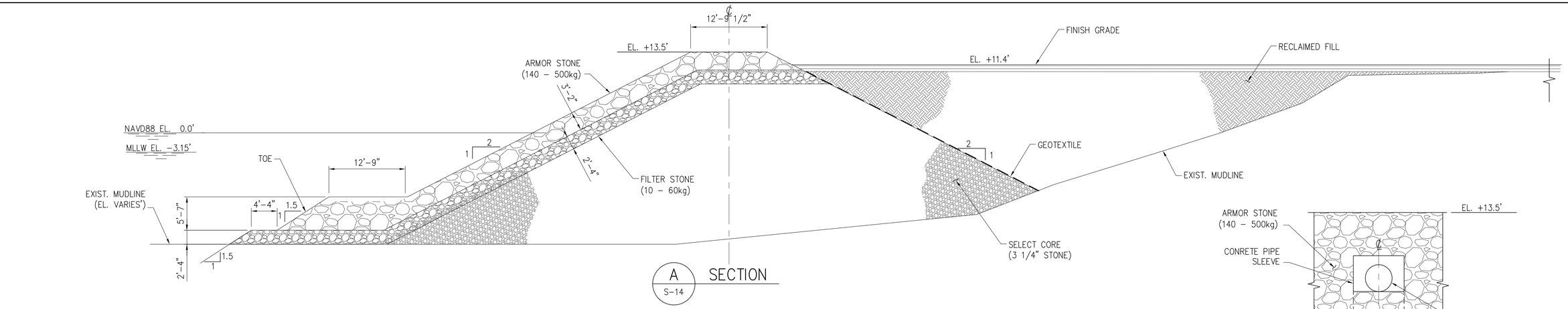
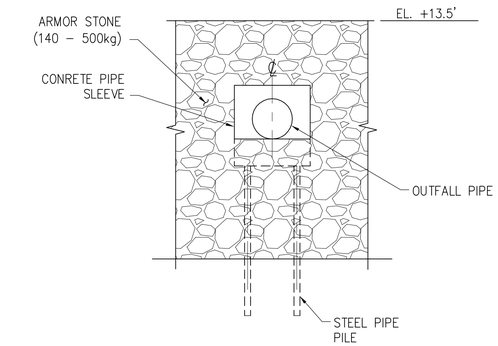
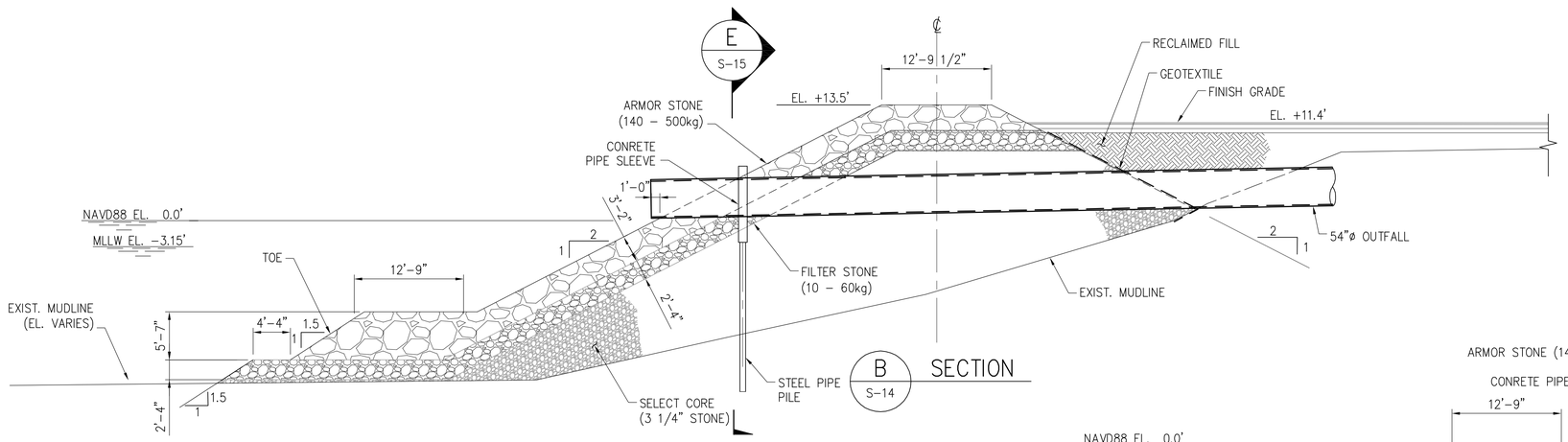


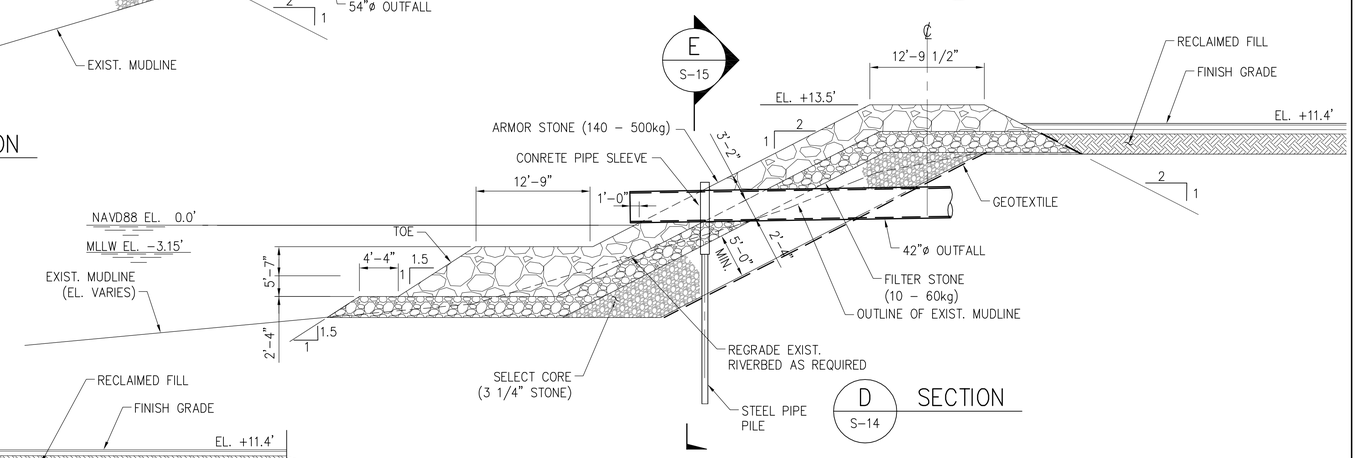
A S-14 SECTION



E S-15 SECTION



B S-14 SECTION



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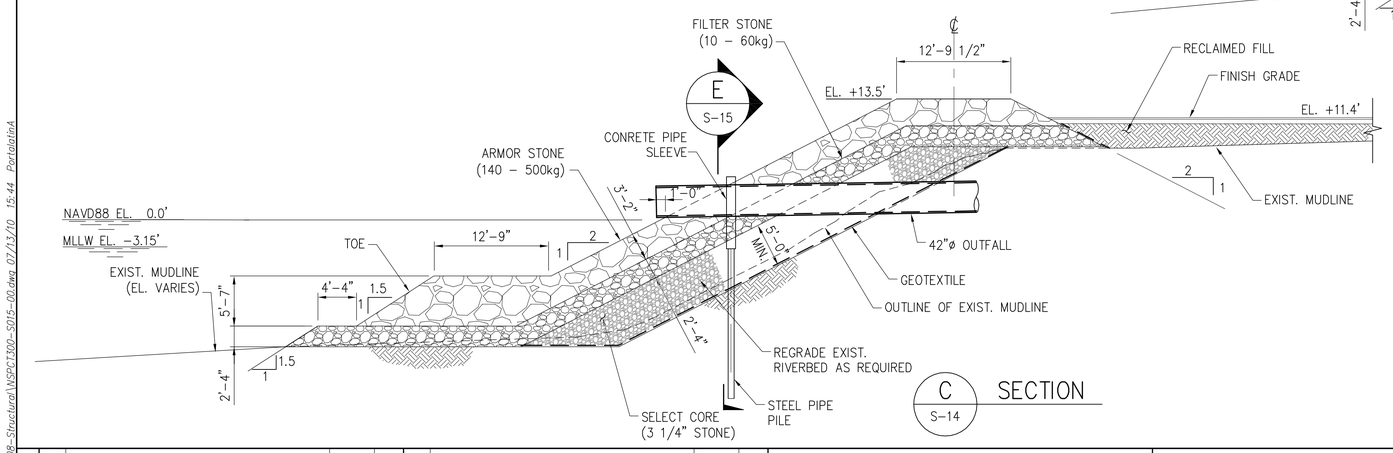

C S-14 SECTION

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PHILADELPHIA, PA

SOUTHPORT PROJECT
Figure 2-15
SOUTH REVETMENT SECTIONS

SCALE 1/8"=1'-0"
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3. AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This section describes the current conditions of the environmental resources, either man-made or natural, that could be affected by the implementation of the proposed federal action and identified alternatives. The plan for the Southport Development Project consists of the construction of a two-berth marine terminal on approximately 116 acres of vacant land, along the eastern end of the former Philadelphia Naval Shipyard. The proposed project includes construction of ship berthing areas, a container yard, new access roadway and existing roadway improvements, installation of utilities, various buildings to support the operations of the terminal, dredging of a two-slip berthing area and access channel from the new bulkhead line-out to the limits of the federally maintained Delaware River navigational channel, and the placement of dredged material in the Fort Mifflin (Figure 1-3) CDF.

3.2 GENERAL DESCRIPTION

The proposed Southport Development Project site (Figure 1-1) extends along the Delaware River, starting in the east end of the former Philadelphia Naval Shipyard and extending to the existing sheet pile bulkhead just south of Pier 124. The terminal would be approximately 116 acres in size and have capacity for 1.3 million TEUs annually.

The land proposed for the terminal site consists of an abandoned residential area, formerly used by the U.S. Navy for family housing, and primarily undeveloped areas that include some isolated wetlands and undeveloped, but historically disturbed and filled, shorelines.

3.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.3.1 Physical Conditions

3.3.1.1 General Regional Meteorology

Philadelphia experiences, on average, 93 clear days and 160 cloudy days per year, with the remaining 112 days of the year being partly cloudy.

Temperature

The average annual mean temperature for Philadelphia is 54.3 degrees Fahrenheit (°F). The average temperature during the summer months is 74.6°F, with record extremes of 44°F and 104°F. The average temperature during the winter months is 33°F, with record extremes of -4°F and 74°F. Philadelphia averages 23 days per year with temperatures above 90°F. Subfreezing temperatures occur an average of 93 days per year.

Wind

The predominant wind direction in the vicinity of the project site is from the southwest from roughly May through October and from the northwest from November through April. The annual average wind direction is from the northwest. The average annual wind velocity is 9.5 miles per hour (mph). Table 3-1 shows the monthly average wind speeds for Philadelphia, based on 62 years of data.

Precipitation

Mean precipitation is 42 inches per year. May and July are the wettest months and February and October are the driest. The average precipitation during summer months is 3.9 inches. The average precipitation during winter months is 3.1 inches. The average annual relative humidity is 67.5%.

Severe Weather

Severe weather in the Philadelphia area includes thunderstorms, heavy rain, hail, snowstorms, strong winds, coastal flooding events, and, to a lesser degree, tornadoes. Severe storms with rain (thunderstorms and heavy rain) occur an average of 5 days per year, with 49% occurring during June, July, and August. Of these rain events, 18% included some hail during the period of record. On average, three snowstorms and “wintry mix” events occur each year, 59% of them in January and February.

Strong wind events, which include events with steady winds and gusts from 55 to 80 miles per hour, occur primarily in the colder months; 79% of these events occurred in November, December, January, February, and March. The only strong wind events that have occurred in June, July, and August were tornadoes.

Coastal flooding occurs when storm events augment the monthly high-tide cycles. Of the coastal flooding events on record since 1980, 65% have occurred from October through January. This time period coincides with the season for nor'easter storms (October through March). These storms travel along the coastline and "push" tidal waters so that measured water levels are higher than normal and flooding of low areas occurs. Historically, the highest water levels on the Delaware River at the site result primarily from the propagation of this coastal "storm surge" and not from extreme precipitation events. This is primarily because the river is tidal in this location and its width and depth provide virtually unimpeded conveyance of terrestrial runoff to the lower Delaware Bay and Atlantic Ocean.

3.3.1.2 Bathymetry

Delaware River bathymetry (water depth) at the proposed project site ranges from 0 ft to -45 ft mean lower low water (MLLW), as determined from a September 2009 hydrographic survey at the berthing areas (Hydrographic Surveys, Inc., 2009). The depth increases perpendicularly to the shoreline, extending toward the Federal navigation channel. In some areas, this depth increase is steady and gradual. In the middle of the proposed dredging area, however, depths exceed 30 ft, which indicates these areas are naturally deep and do not have high sedimentation rates (Figure 2-12).

3.3.1.3 Tides and Currents

Tides on the Delaware River at the project site are diurnal with the spring and neap tides increasing or decreasing by only 0.5 ft from mean tide. The spring tidal range (mean higher high water [MHHW] to MLLW) on the Delaware River at Philadelphia Municipal Pier 11, located approximately 4 miles north of the site, is 6.6 ft (NOAA, 2010a). The mean lower low water is -3.15 ft NAVD88 and the mean higher high water is 3.46 ft NAVD88.

3.3.1.4 River Hydraulics and Sediment Transport

Tidally driven currents generally govern hydraulic and sediment transport conditions within the Delaware River Estuary and, therefore, the project site. The magnitude and distribution of currents across the river cross section determines the extent of net sediment transport that shapes the channel bed. Bathymetry indicates the existing depths within the proposed dredging template are significantly deeper, on average, than shoaling areas located just downstream of the project

site. This indicates the proposed dredging template contains naturally deep, high-velocity areas and is a good location to serve as a deep-draft berth because it would minimize the magnitude and frequency of maintenance dredging.

Many of the banks of the Delaware River have been stabilized with bulkheads and revetments that have been in place for centuries. A Federal navigation channel was constructed to accommodate various uses, including the transport of goods and services in support of the regional port industry. The Delaware River Federal navigation channel acts as the dominant hydraulic conveyance in the section of the river along the project site and is the predominant influence on river hydraulics and sediment transport in this area. In other words, the majority of flow is focused within the Federal navigation channel and sediment transport patterns must be evaluated in terms of the conveyance of flow through this channel. The Federal navigation channel is fixed and its position is maintained by regular maintenance dredging, which leads to relatively stable morphology at the project site and in adjacent areas of the river.

At the proposed berthing areas and dredging template, the Delaware River is approximately 2,500 ft wide and relatively deep across the entire width. The Federal navigation channel is parallel to the shore and is closer to the western side of the river. At the southern end of the proposed dredging template, the western shoreline of the river bends approximately 45 degrees to the west, but the Federal navigation channel remains approximately straight through this area. Downriver from the project site, the river width rapidly increases to approximately 4,100 ft and the Federal navigation channel continues straight, diverging from the shoreline, and then bends approximately 45 degrees to the west. This bend is known as the Horseshoe Bend.

To the northwest of Horseshoe Bend is a shallow area that experiences high rates of sediment deposition; this area is called Horseshoe Shoal. Slower average velocities due to increased channel width and the bend in the Federal navigation channel causes sediment carried within the main flow of the river to be deposited in this area. Horseshoe Shoal has been historically and consistently shallow since the banks of the Delaware River have been stabilized and the Federal navigation channel constructed and maintained. Although no high-level numerical or physical modeling has been conducted, it can be concluded from empirical information, such as historical navigation charts, that sediment transport through this area is relatively stable with minor

fluctuations in depths (1 ft to 4 ft) occurring periodically and randomly with seasonal sediment loads and currents.

Refer to Figure 3-1 for a map of the Delaware River, project site, and the surrounding areas. This map provides bathymetric measurements within the channel, outlines the Federal navigation channel, and notes the locations of Horseshoe Bend and Shoal.

Maximum currents at the site range from 3 to 5 mph. Significant eddies and turbulence exist immediately downstream of the project site due to the abrupt widening of the entire river cross section and a bend in the Federal navigation channel. River currents are generally the same magnitude in both directions, but can be 20% higher after heavy rainfall or snowmelt when in phase with ebb tidal currents.

3.3.2 Geology, Soils, and Sediment

The proposed Southport Development Project site is located in the Atlantic Coastal Plain physiographic province, which is characterized by gently undulating, low-lying topography and consists of Quaternary to Cretaceous-age sediments overlying the seaward-dipping crystalline rocks of the Piedmont physiographic province. The site occupies the eastern corner of the former Philadelphia Naval Shipyard (Navy Yard) on primarily man-made land along the Delaware River. The Philadelphia Naval Shipyard was established in 1874 on the former League Island, which historically was a tidal marsh formed by the accumulation of sediments deposited from the adjacent Delaware and Schuylkill rivers. The Navy Yard was subsequently increased in size over time by adding sediment and other fill materials to the western and eastern sides and to the top to increase the elevation above tidal influence. The proposed project site is located on this fill material. Current elevation at the site ranges from approximately -6 ft to +12 ft NAVD.

3.3.2.1 Geology

The geology of the site consists of fill material overlying the Recent (present to 10,000 years before present), Pleistocene (10,000 to 1.6 million years before present), and Cretaceous (66 to 144 million years before present) sediments of the Potomac-Raritan-Magothy (PRM) system. The fill consists of river sediments, gravel, ash, concrete, brick, and sandblast grit (WESTON, 2005). Thickness of the fill ranges from approximately 10 ft on the original League Island area to

approximately 20 ft along the eastern edge of the present-day island. This fill interfingers with tidal marsh at open-water interfaces.

The Recent sediments are generally less than 10 ft thick at the site and overlie the Cretaceous sediments. Recent sediments consist of organic-rich dark gray mud, silt, and fine sand (EA Engineering, Science, and Technology, 1998a).

The Recent and Cretaceous sediments are separated by the Pleistocene Trenton gravel, which is a cross-bedded, pale reddish-brown, gravelly sand unit with interbedded sand and clay-silt layers. This unit is 10 to 30 ft thick beneath the site.

The Cretaceous PRM system is a sequence of fluvial and estuarine sediments deposited on the metamorphic basement rocks of the Piedmont. This system represents three cycles of sedimentation, with each sequence beginning as coarse deposits that grade upward to silt and clay. The units, from youngest to oldest (top to bottom), include the upper clay unit, upper sand unit, middle clay unit, middle sand unit, lower clay unit, and lower sand unit (Sloto, 1988).

The upper clay unit comprises a discontinuous light gray sandy clay; a dark gray carbonaceous clay; and a massive red, white, and yellow clay with no regular sequence or combination. The upper clay is discontinuous at the site and overlies the upper sand unit, which was deposited by streams that eroded portions of the underlying middle clay unit. The upper sand consists of medium- to coarse-grained sand with minor fine- to very fine-grained sand. Gravel beds are common, especially at the base of the unit. The maximum thickness of the upper sand is approximately 25 ft beneath the southwestern part of the Navy Yard. This unit is discontinuous, and has been eroded from most of the rest of the Navy Yard (EA Engineering, Science, and Technology, 1998a).

The middle clay unit is the most extensive clay unit of the PRM system and extends across south Philadelphia. At the Navy Yard, the thickness ranges from 10 ft to 70 ft. The surface of this unit is characterized by several elongated depressions oriented parallel to underlying bedrock channels that may have resulted from the occupation of historical stream channels exhibiting erosion that occurred at the same time as deposition of the upper sand. The middle clay is a tough red and white clay with uniformly massive texture and relatively little sand. Locally,

lignite may be found at the base of the unit. The middle clay acts as a confining unit to the middle sand (Greenman et al., 1961).

The middle sand unit consists of a sequence of pale yellowish-brown to orange, very fine- to coarse-grained sand beds with a few beds of light gray clay. The maximum thickness of this unit is approximately 40 ft, but it is generally less than 20 ft thick (Greenman et al., 1961).

The lower clay unit is a tough red clay with beds of soft, well-stratified gray clay and thin lenses of fine-grained sand. Thickness of this unit ranges from 10 ft to 60 ft beneath the Navy Yard, and was likely deposited unconformably on either the lower sand unit or on saprolite. The lower sand unit is the basal unit of the PRM system and is a clean yellowish coarse sand and fine gravel that grades upward into medium- to fine-grained sand with a few beds of white clay. The thickness of the lower sand is highly variable, but is generally approximately 60 ft (Greenman et al., 1961).

The bedrock beneath the Cretaceous sediments is Paleozoic (450 to 570 million years before present) and consists of three lithofacies: hornblende gneiss; granite gneiss; and alternating micaceous schist and quartzite. The surface of the bedrock was channeled by the ancestral Schuylkill and Delaware rivers. The channels contain thick accumulations of highly permeable, coarse-grained sediments of the PRM system. There are two south- to southeast-trending channels carved into the bedrock beneath the Navy Yard: the League Island Trough and the Greenwich Point Trough (Paulachok et al., 1984; Greenman et al., 1961).

3.3.2.2 Soil

The Web Soil Survey (USDA, 2010) shows Urban Land for the entire Southport area. Urban Land, in general, is soil material that has been disturbed, filled over, or otherwise destroyed prior to construction (Fluor Daniel, 2004). The disturbed material is fill that consists of river sediments, gravel, ash, concrete, brick, and sandblast grit (WESTON, 2005). The Urban Land was described by Gannett Fleming (2007) as very gravelly medium- to coarse-grained sand with clay, silt loam, and sandy loam. Most of this land was marsh or open water, but filling operations by the Navy extended the original League Island eastward to its present configuration. This fill material is deeper in the northeastern and eastern portions of the site where tidal marsh and muck soils originally existed and in areas that were previously marshlands, back channels, or part of the river. At depth, the predominant soil type (muck) ranges from 40 ft to 50 ft below ground

surface (bgs). A hard pan layer beneath the muck constitutes the upper confining layer of the PRM. This was confirmed during the 2009 soil boring effort (WESTON, 2009).

Observed Soils – The observed soils in both wetland and upland areas illustrate the history of filling and grading at the site. The site has been used for disposal of dredged material, construction debris, and blasting grit (WESTON, 2009 and WESTON, 2010b). Subsequent to this filling, the Navy developed a portion of the area for family housing and its associated infrastructure.

3.3.2.3 Sediment Characterization

The overlying sediments of the Delaware River are generally fine grained and highly mobile in the tidal currents. Seismic and borehole data east of the proposed facility indicate the presence of a thin, continuous layer of silt over sand within the Delaware River. Smaller, less continuous layers of silt occur above and within the channel-bottom sands south of the proposed facility, although sand predominates (Duran, 1986). Surface sediments overlie Cretaceous sediments.

During a geotechnical drilling event for the Philadelphia Regional Port Authority (PRPA) in November 2008, WESTON collected five sediment samples, as well as one duplicate, and one field blank to be tested for analytical parameters, as detailed in "Geotechnical Investigation Report – Southport Site" (WESTON, 2009). The analytical parameters included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total organic carbon (TOC), total petroleum hydrocarbons (TPH), and the priority pollutant list of metals.

The sediment samples were collected along the shoreline and at the entrances to the berthing areas along Piers 122 and 124. A comparison of these results indicates that all detected organic and inorganic compounds were below the Pennsylvania Department of Environmental Protection (PADEP) Residential and Nonresidential Direct Contact Medium Specific Concentration (MSC) criteria, where available, with two exceptions. The detected concentrations of arsenic and total chromium exceeded the Residential Direct Contact MSC criteria in four of the sediment samples. Concentrations of arsenic were consistent with levels found in most river sediments and are widely accepted as regional background levels. The total chromium levels exceeded the regulatory limit for hexavalent chromium, but did not exceed the limits for trivalent chromium.

As is typical with other Delaware River dredged materials, most chromium is in the trivalent state due to the reducing environment of the river.

A more comprehensive sediment characterization effort was conducted in March and April 2010. The Sediment Characterization Report (SCR) detailing the findings of this effort is provided as Appendix A and focuses on geotechnical and chemical properties of the sediments in the context of PADEP dredging and disposal regulations. The results of the SCR are summarized below.

Southport Sediment Characterization

The sediments to be dredged at the Southport site have been analyzed for physical and chemical characteristics. The results of these analyses are presented in a SCR provided in Appendix A and are summarized below. Note that low levels of contaminants were found in surficial sediment samples and not in the deep samples, indicating that the sediments containing concentrations of parameters that exceeded criteria were deposited recently at the site and similar to maintenance dredge material in this reach of the Delaware River.

Physical Characterization of Sediments

In general, Southport sediments were predominantly composed of clay, sand, and silt with some concentrations of gravel, as summarized in Table 4 of Appendix A. The grain size analysis indicated that the average clay fraction was 51%, the average sand fraction was 36%, the average silt fraction was 12%, and the average gravel concentration was ~1.0%.

Sediments at the Southport site contained TOC concentrations ranging from 0.59% to 5.06%, as summarized in Table 4 of Appendix A. Note that only the individual cores and split spoon samples were analyzed for TOC.

Chemical Characterization of Bulk Sediments

Results from the bulk sediment analysis, which consisted of the entire soil matrix, were compared to Pennsylvania Clean Fill Criteria, PADEP Act 2 Residential and Nonresidential MSCs, and Resource Conservation and Recovery Act (RCRA) criteria as appropriate. For the 69 samples analyzed, the results are provided in Tables 5a, 5b, 6, 7a, and 8 in Appendix A. A summary of the parameters that exceeded criteria are provided below.

Volatile Organic Compounds: One of the detected VOCs, methylene chloride, exceeded the PA Clean Fill Criteria (0.076 milligrams per kilogram [mg/kg]) in three of the samples, at concentrations of 0.085 mg/kg, 0.088 mg/kg, and 0.094 mg/kg, as summarized in Table 5a of Appendix A.

Semivolatile Organic Compounds: The following SVOCs exceeded available criteria, as summarized in Table 5b of Appendix A: benzo(a)pyrene exceeded the PADEP Residential MSC and Clean Fill Criteria (2.5 mg/kg) at a concentration of 4.0 mg/kg, in one sample; 2-nitroaniline exceeded the PADEP Clean Fill Criteria (0.033 mg/kg) at a concentration of 0.086 mg/kg in one sample; 3-nitroaniline exceeded the PADEP Clean Fill Criteria (0.038 mg/kg) at a concentration of 0.041 mg/kg in one sample; bis(2-chloroethyl)ether exceeded the PADEP Clean Fill Criteria (0.0039 mg/kg) at a concentration of 0.027 mg/kg in one sample; N-Nitrosodi-n-propylamine exceeded the PADEP Clean Fill Criteria (0.0013 mg/kg) in three samples at concentrations of 0.017 mg/kg, 0.1 mg/kg, and 0.39 mg/kg; 2,4-Dinitrotoluene exceeded the PADEP Clean Fill Criteria (0.05 mg/kg) at a concentration of 0.53 mg/kg in one sample; and 4-Nitroaniline exceeded the PADEP Clean Fill Criteria (0.031 mg/kg) in three samples at concentrations of 0.035 mg/kg, 0.036 mg/kg, and 0.37 mg/kg.

Pesticides: None of the detected pesticides were present in concentrations that exceeded the available PADEP Residential and Nonresidential MSC or PADEP Clean Fill Criteria.

Polychlorinated Biphenyls (PCBs): None of the detected PCB aroclors were present in concentrations that exceeded the available PADEP Residential and Nonresidential MSC and PADEP Clean Fill Criteria.

PCBs (Congeners): Six PCB congener bulk sediment samples were prepared from six of the 12 sample locations. PCB congeners are unique forms of the 206 PCB compound. The PCB congener results from the sampling event were summed in order to calculate the total PCB results since there are no PADEP regulatory criteria for PCB congeners (see Table 7a of Appendix A). The total PCB concentration in the six samples collected during this event ranged from 0.3 micrograms per kilogram (µg/kg) to 439.78 µg/kg. Note that in the past, the PADEP has accepted 200 µg/kg as a criterion for PCB congeners. This was based on Delaware River Basin Commission (DRBC) sampling for PCB congeners conducted in the Delaware River. Note

that the sample result for P-SS-5, which was collected from the SS-5 location detailed in Figure 2 of Appendix A, was higher than this level.

Total Petroleum Hydrocarbons: TPH were detected in 26 sediment samples collected at the Southport site. Table 5b in Appendix A summarizes these results and indicates the limit of quantitation. Note that no PA criteria have been developed to evaluate TPH at this time.

Inorganic Chemicals (Metals, Cyanide, and Sulfide): One of the detected metals, arsenic, exceeded the PADEP Residential MSC and the Clean Fill Criteria (12 mg/kg) in 17 of the 69 samples at concentrations ranging from 13 mg/kg to 48.1 mg/kg. The detected concentrations of arsenic are similar to maintenance dredge material in the Delaware River.

Note that no PADEP MSCs or Clean Fill Criteria have been developed for calcium, total chromium, magnesium, potassium, or sodium, so detected concentrations of these substances could not be compared to screening criteria. Calcium concentrations ranged from 500 mg/kg to 10,800 mg/kg. Total chromium concentrations ranged from 8.73 mg/kg to 181 mg/kg. Magnesium concentrations ranged from 1,180 mg/kg to 7,880 mg/kg. Potassium concentrations ranged from 477 mg/kg to 3,600 mg/kg. Sodium concentrations ranged from 44.7 mg/kg to 378 mg/kg.

Toxicity Characteristic Leaching Procedure (TCLP): Note that SVOCs, herbicides, and pesticides were not detected in the TCLP samples collected at the Southport site, as summarized in Table 6 of Appendix A; however, one VOC and seven inorganic analytes were detected at concentrations below RCRA criteria.

Radiological Results: Radiological data for gross alpha, gross beta, and total radium are provided in Table 8 in Appendix A. Based on a regulatory analysis previously conducted for sediment samples collected in the Delaware River, the only applicable regulatory limit governing soils is the criterion in 40 CFR192, which stipulates that soils may have a combined radium-226 and radium-228 activity equal to or less than 15 pCi/g above background levels. All total radium levels are less than the 15 pCi/g level. Using the criterion in 40CFR192, Delaware River sediment soils at the Southport site area are not considered to be contaminated.

Chemical Characterization of Elutriate Samples

Elutriate tests are performed on sediments to be dredged to evaluate potential water column impacts from the water discharge at the disposal site (USEPA and USACE, 1998). In this procedure an aqueous extract (i.e., an elutriate) is prepared from the material to be discharged by setting up large cylinders, mixing the sediment sample with site water, and allowing the sediment to settle out to the bottom of the cylinder. The remaining liquid at the top of this cylinder is then decanted and used to run the elutriate analyses. Total elutriates refers to the decanted liquid before filtering and dissolved refers to this liquid after filtering occurs.

The results from these total elutriate and dissolved elutriate samples were compared to PADEP acute and chronic Water Quality Criteria (WQC) and DRBC acute and chronic Stream Quality Objectives (SQOs) for the protection of aquatic life. All results are provided in Tables 7b, 9, and 10 in Appendix A. A summary of the parameters that exceeded criteria are provided below.

Semivolatile Organic Compounds: A comparison of detected SVOC concentrations with PADEP WQC follows:

SVOCs in Total Elutriates – Twenty-six SVOCs were detected in at least one total elutriate sample generated from sediments collected at the Southport site, with the following SVOC detections exceeding PADEP WQC: acenaphthene exceeded the PADEP chronic WQC (17 µg/L) in five samples; benzo(a)anthracene exceeded the PADEP acute and chronic WQC (0.5 µg/L and 0.1 µg/L, respectively) in 19 samples; fluoranthene exceeded the PADEP chronic WQC (40 µg/L) in one sample; and phenanthrene exceeded the acute PADEP WQC (5 µg/L) in nine samples and the PADEP chronic WQC (1 µg/L) in 18 samples. These results are summarized in Table 9 of Appendix A. In addition, three samples were reanalyzed using the selected ion monitoring (SIM) method to achieve a lower method of detection limit (MDL) for benzo(a)anthracene since American Analytical Laboratories' (AAL) standard MDL is higher than the PADEP WQC. Note that not all samples were reanalyzed—only a representative number of samples were, and no SVOCs were detected in the reanalyzed samples.

SVOCs in Dissolved Elutriates – Twenty-five SVOCs were detected in some or all of the dissolved elutriate sample, with the following SVOC detections exceeding PADEP WQC: acenaphthene exceeded PADEP chronic WQC (17 µg/L) in one sample; benzo(a) anthracene

exceeded the PADEP acute and chronic WQC (0.5 µg/L and 0.1 µg/L, respectively) in nine samples; and phenanthrene exceeded the PADEP acute WQC (5 µg/L) in five samples and the PADEP chronic WQC (1 µg/L) in 10 samples. As with the total elutriate samples, three samples E-2, E-16 (72 hour), and E-17, were reanalyzed using the SIM method. Note that only one sample, E-16 (72 hour), had a detection for benzo(a)anthracene. This detection, 0.65 µg/L, exceeded the PADEP acute WQC of 0.5 µg/L.

Pesticides: Total and dissolved elutriate samples were analyzed for Target Compound List (TCL) pesticides. Eight pesticides were detected in some or all of the total elutriate samples, with the following pesticide detections exceeding applicable criteria: 4,4-DDD exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in five samples. Dieldrin exceeded the DRBC chronic SQO (0.0019 µg/L) in three samples and the PADEP chronic WQC (0.056 µg/L) in one sample. 4,4-DDE exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in 15 samples, the DRBC acute SQO (0.55 µg/L) in four samples, and the PADEP acute WQC (1.1 µg/L) in three samples. Endrin exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.0023 µg/L and 0.036 µg/L, respectively) in seven samples, and the DRBC acute SQO and the PADEP acute WQC (0.09 µg/L and 0.086 µg/L, respectively) in six samples. Heptachlor epoxide exceeded the PADEP chronic WQC (0.0038 µg/L) in two samples.

Nine pesticides were detected in some or all of the dissolved elutriate samples. 4,4-DDD exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in two samples. 4,4-DDE exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in 12 samples and the DRBC acute SQO and the PADEP acute WQC (0.55 µg/L and 1.1 µg/L, respectively) in one sample. Endrin exceeded the DRBC chronic SQO (0.0023 µg/L) in eight samples, the PADEP chronic WQC (0.036 µg/L) in two samples, and the DRBC acute SQO and the PADEP acute WQC (0.09 µg/L and 0.086 µg/L, respectively) in one sample. Heptachlor epoxide exceeded the PADEP chronic WQC (0.0038 µg/L) in six samples. 4,4-DDT exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in one sample. Dieldrin exceeded the DRBC chronic SQO (0.0019 µg/L) in one sample. Note that no criteria have been developed to evaluate endosulfan sulfate, hexachlorobenzene, and delta-BHC at this time.

PCBs: One PCB Aroclor (Aroclor 1260) was detected in four of the total elutriate samples; all four samples exceeded the PADEP chronic WQC and the DRBC chronic SQO. One PCB

Aroclor (Aroclor 1260) was detected in four of the dissolved elutriate samples; all four samples exceeded the PADEP chronic WQC and the DRBC chronic SQO, with one sample exceeding the PADEP acute WQC and the DRBC acute SQO as indicated in Tables 9 and 10 of Appendix A, respectively.

In addition, one total and one dissolved elutriate sample, E-13 (see Table 7b of Appendix A) underwent PCB congener analysis per direction from PADEP and the DRBC. As with the PCB congener sample, all PCB congeners were summed to obtain a concentration of total PCBs in the sample. The total PCB detections for the total and dissolved E-13 elutriate samples were 5.6 µg/L and 0.243 µg/L, respectively.

Inorganics (Metals and Cyanide): Total and dissolved elutriates were analyzed for metals and cyanide. Note that many metals have no defined DRBC SQOs or Pennsylvania WQC, including calcium, chromium, iron, manganese, magnesium, potassium, sodium, and tin. The following metals have no defined DRBC SQOs, but do have Pennsylvania WQC: antimony, barium, and vanadium.

Metals/Cyanide in Total Elutriates – Twenty-three metals, plus cyanide, were detected in total elutriate samples. Thirteen of these inorganic analytes (aluminum, arsenic, barium, cadmium, chromium trivalent, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc) were detected in concentrations that exceeded acute and/or chronic DRBC SQOs or PADEP WQC, as detailed in Table 9 of Appendix A.

Metals/Cyanide in Dissolved Elutriates – Eighteen metals plus cyanide were detected in some or all dissolved elutriate samples. Six of these inorganic analytes (aluminum, chromium trivalent, copper, lead, zinc, and cyanide) were detected in concentrations that exceeded the acute and/or chronic DRBC SQOs or the PADEP WQC, as detailed in Table 10 of Appendix A.

In general, the concentrations of the detected metals decreased after the suspended particulate matter was removed (i.e., total elutriate concentrations were generally higher than dissolved elutriate concentrations). The difference in metal concentrations between dissolved and total elutriate samples indicates that the metals are largely associated with the suspended particulate material and not in the water matrix, indicating that the contaminants in the sediments will not leach into ground or surface water when decanted and stored in the upland CDF.

TOC: TOC concentrations in the total elutriate samples ranged from 5 mg/L to 59.9 mg/L, as summarized in Table 9 of Appendix A. TOC concentrations in the dissolved elutriate samples ranged from 3.7 mg/L to 37.6 mg/L, as summarized in Table 10 of Appendix A.

TSS: Total suspended solids (TSS) concentrations in the total elutriate samples ranged from 320 mg/L to 19,500 mg/L, as indicated in Table 9 of Appendix A. TSS concentrations in the dissolved elutriate samples ranged from 3 mg/L to 52 mg/L, as indicated in Table 10 of Appendix A.

3.3.3 Groundwater

Groundwater is present beneath the site under both unconfined and confined conditions. Throughout this area, the vertical component of flow has been generally determined to have a downward gradient. In general, both the regional and local horizontal groundwater flow is south to southeastward toward the Delaware River. Prior to development of the groundwater resources in the Navy Yard (prior to 1900), the vertical flow had a minor downward component, but increased extraction of groundwater at the Navy Yard (in the 1920s through the 1960s) increased this downward vertical gradient. Starting in the 1970s, increased residential and commercial development in New Jersey combined with a cessation in groundwater extraction caused the vertical gradient of the Navy Base to return to its pre-1920s levels.

The stratigraphy and hydrostratigraphy present under the Navy Base consists of a series of unconsolidated and consolidated aquifer units. The naturally occurring unconsolidated sediments underlying the Navy Base extend to a depth of over 250 ft bgs. These sediments lie in a structural trough known as the League Island Trough. This trough was formed on the surface of the crystalline bedrock by the erosional effect of the ancestral Schuylkill River in Pre-Cretaceous time and is responsible for the substantial thickness of sediments present in this area. The crystalline bedrock unit is a highly metamorphosed rock type identified as the Wissahickon Schist. A detailed summary of these stratigraphic units is provided below.

Three major overburden stratigraphic units are encountered beneath the Navy Base:

- Quaternary Age low-permeability alluvial silts and clays (Q_{al}).
- Pleistocene Age permeable sands and gravels (Q_p).

- Cretaceous Age low-permeability silts and clays interbedded with permeable sands and gravels of the Potomac-Raritan-Magothy F_m (K_{prm}).

Metamorphic rocks of the Wissahickon F_m underlie the unconsolidated sediments identified above.

Naturally deposited Q_{al} is generally present throughout the area. It is covered by a variable thickness layer of manmade fill. The Q_{al} is characterized as low-permeability (average hydraulic conductivity = 3.4 x 10-7 cm/sec), organic-rich, fine sandy clays and silts. These sediments were deposited during flooding of the Delaware and Schuylkill rivers and marsh development. The thickness of the Q_{al} ranges from 5 ft to over 25 ft.

Immediately beneath the Q_{al} is the Pleistocene Age permeable sand and gravel unit designated as the Q_p. This unit is also informally known as the Trenton Gravel. Typically, the Q_p is an iron-cemented, poorly sorted silty sand and gravel. This unit is relatively permeable (average hydraulic conductivity = 3.5 E-01 cm/sec) and represents the first true aquifer under the site. These sediments were deposited as channel deposits from the Delaware and Schuylkill rivers. The approximate thickness of the Q_p in the area ranges from 10 ft to over 50 ft.

Underlying the Q_p, the Cretaceous Age (Berriasian) K_{prm} stratigraphic sequence consists of alternating layers of silts and clays exhibiting low permeability, and saturated sands and gravel that are much more permeable. Cretaceous sediments come close to the surface but do not crop out in Pennsylvania's Coastal Plain Physiographic Province (Berg et al., 1980) but are exposed at the surface in New Jersey, Delaware, and Maryland (Parker et al., 1964). These sediments unconformably overlie crystalline rocks and residual clay and are regionally known as the Potomac-Raritan-Magothy aquifer system. The Cretaceous sediments are fluviodeltaic in origin (Owens, 1967) and are considered to be chiefly nonmarine in Pennsylvania.

The K_{prm} sediments consist of highly permeable beds of sand and gravel separated by less permeable beds of clay and silt. In Pennsylvania, the Potomac-Raritan-Magothy aquifer system has been divided into three informal sand and clay units: Lower Sand and Clay, Middle Sand and Clay, and Upper Sand and Clay. In Pennsylvania, these sediments reach a maximum thickness of 150 ft in the vicinity of the Navy Base where they were deposited in an ancient river channel structure (League Island Trough) incised in the bedrock. This channel network is repeated across Philadelphia and is thought to have been developed by the ancestral Schuylkill River.

The uppermost K_{prm} layer, a clayey silt (Upper Clay), is believed to be discontinuous and overlies a layer of sand and gravel (Upper Sand). This unit is hydraulically connected with the Q_p. The next underlying layer is a low-permeability silt and clay (Middle Clay) that is comparatively thicker than the other fine-grained layers included in the K_{prm} strata. This clay layer overlies a coarsening downward sequence of sand and gravel (Middle Sand). This later sequence is underlain by a third clay and silt layer and a third sand and gravel layer (Lower Clay and Sand).

These two sand and gravel units (K_{prm} Middle and Lower Sands) represent an aquifer unit that is an important part of the larger regional aquifer system, the New Jersey Coastal Plain Sole Source Aquifer (SSA). The proposed Southport Development Project site falls within the recharge (source) zone of this aquifer, which is recognized by USEPA as the "sole or principal source of drinking water" for much of central and southern New Jersey. No groundwater withdrawal occurs from these units in the local area with the nearest water supply well approximately 2 miles east of the Navy Base.

By USEPA definition, the entire unconsolidated aquifer (Qal, Qp, and Kprm units) are considered to be part of the SSA. USEPA has determined that the aquifer, if contaminated, would create a significant hazard to public health. The SSA is thought to be susceptible to contamination through its recharge and streamflow source zones among other potential influences. The thicker Middle Clay layer represents an effective hydraulic barrier between the Q_p sands and gravels and the underlying sands and gravels of the K_{prm} aquifer unit. Under the Navy Base, the Middle Clay is projected to range in thickness from between 20 ft to 60 ft. Laboratory permeability tests conducted on samples from the K_{prm} Middle Clay layer collected on a nearby site yielded a hydraulic conductivity of 1.0 x 10 8 cm/sec.

Below the lower sand unit lies crystalline rocks of the Wissahickon Formation composed chiefly of schist, probably from lower Paleozoic age (Greenman, 1961). Locally confined conditions are present on the top of this unit due to a 4- to 6-ft saprolitic layer (Paulachok, 1991). Bedrock is present at depths as much as 250 ft bgs. The hydrostratigraphy of this area is described below.

The unconsolidated stratigraphic units discussed above develop into three hydrostratigraphic units. The uppermost unconfined aquifer is a shallow water-bearing zone composed of the recent fill and low-permeability alluvial silts and clays (Q_{al} Unit). The intermediate water- bearing zone

below is a water-bearing zone composed of the Trenton Gravel sands and gravels (Q_p Unit). Below that is a deep confined water-bearing zone consisting of a discontinuous clay layer and sands and the uppermost section of the K_{prm}. The deep water-bearing unit consists of the remaining interbedded K_{prm} sand and clay layers (K_{prm} Unit).

The clay layers of the K_{prm} units separate the unconsolidated middle and lower sand units of the K_{prm}, resulting in confined groundwater conditions at the site. The hydraulic conductivities of the middle and lower sands are thought to be similar (135 ft/day for the lower sand unit) based on their physical properties and depositional environment (Paulachok, 1991). These confined aquifers are not used at the Navy Yard because quality of these aquifers has been degraded by the effects of heavy industrial use of the groundwater during the mid-20th century operation of the Navy Base and there are currently regulatory restrictions on water use.

Below the lower sand unit lies crystalline rocks of the Wissahickon Formation composed chiefly of schist, probably of lower Paleozoic age (Greenman, 1961), under locally confined conditions due to a 4- to 6-ft saprolitic layer present on the top of this unit (Paulachok, 1991). This lower bedrock aquifer is not a significant potable water source in the vicinity of the proposed Southport facility because its yield is only obtained from secondary fractures and a higher specific capacity is generally obtained from the overlaying lower sand units of the K_{prm}.

Recharge to the Q_{al} aquifer is primarily from infiltration of atmospheric precipitation and localized recharge from nearby surface water bodies including the Schuylkill and Delaware rivers. A secondary source of groundwater recharge in the area includes leakage of sewers and water-distribution systems as a result of urbanization of the area (Paulachok, 1991). Recharge to the Q_p aquifer is primarily from localized recharge from nearby surface water bodies, including the Schuylkill and Delaware rivers, and to a lesser extent from infiltration of atmospheric precipitation. As with the Q_{al} unit, secondary source of groundwater recharge in the area includes leakage of sewers and water-distribution systems as a result of urbanization of the area (Paulachok, 1991). Four metals have been listed as contaminants of potential concern (COPCs): arsenic, lead, manganese, and mercury. Recharge to the K_{prm} aquifer is primarily from localized recharge from nearby surface water bodies including the Schuylkill and Delaware rivers and to a lesser amount from infiltration of atmospheric precipitation at locations updip (to the west and

northwest) of the Navy Base in the area where the sands of the K_{prm} unit are close to or exposed at the surface.

Hydrographs prepared for both this site (Paulachok, 1991) and other nearby sites (Enterprise Avenue Landfill Study, 1994a–d) were used to estimate vertical gradients present at the proposed Southport site. Vertical gradients have been estimated between each of the three major hydrostratigraphic units at the site (Q_{al}, Q_p, and the K_{prm}). Vertical gradients between the Q_{al} and the Q_p are downward. Vertical gradients between the Q_p and the K_{prm} vary, with some downward and some upward. It is important to recognize that vertical gradients represent only differences in pressure head or potential between water-bearing zones. The pressure of a gradient does not mean that any significant flow is occurring. At the interface between the Q_{al} and the Q_p, there is a significant differential in hydraulic conductivity (5 orders of magnitude) between these units. With the limited head observed in the Q_{al}, the communication between the Q_{al} and the underlying Q_p unit is thought to be minimal. Any compounds of concern present in the Q_{al} unit would therefore migrate at an extremely slow rate into the Q_p unit. In the case of the Q_p–K_{prm} gradient, substantial thicknesses of plastic clays exist between zones; therefore, it is highly likely that no significant groundwater movement is occurring between zones. Extensive stratigraphic and hydrostratigraphic data collected both on-site and at nearby locations indicating the presence of different flow regimes in deep and shallow-intermediate water-bearing zones strongly supports the presence of a competent confining layer between these units.

The hydraulic conductivities of the middle and lower sands are high and are thought to be similar based on their physical properties and depositional environment (Paulachok, 1991). These confined aquifers are not used at the Navy Yard because the quality of these aquifers has been degraded by the effects of heavy industrial use. In addition, there are regulatory restrictions on water use.

Based on human health and ecological risk assessments completed for the Navy Yard, there are no COPCs for any potential discharge area (Reserve Basin, Delaware River, Schuylkill River, and wetlands) except wetlands (Greenman, 1961). The results of the study indicated that arsenic and mercury may be COPCs for the wetland areas, although this designation is considered highly conservative because the palustrine wetlands are not inundated for sufficiently continuous

periods. They are inundated only during periods of high rainfall and the runoff dilutes the effect of the metals.

The deep, confined aquifers (lower, middle, and upper sand units of the PRM) are not used at the Navy Yard. The quality of these aquifers has been degraded and there are regulatory restrictions on water use. Thus, increased usage of this aquifer in Philadelphia is unlikely. Any transfer documents from the base realignment will include restrictions on future groundwater use to preclude potable use (Greenman, 1961).

3.3.4 Surface Water Quality

The proposed project is located in the Lower Delaware River drainage basin (Hydrologic Unit Code 02040202), which encompasses more than 6,650 square miles and includes parts of Pennsylvania and New Jersey. The Delaware River is considered a valuable resource, providing exceptional scenery, recreational opportunities, fisheries and wildlife, historic sites, and cultural resources.

Many of the water-quality issues in the Lower Delaware River Basin are related to the high human population density in the area and to activities associated with urban, industrial, and agricultural land use. Most concerns are related to human health (the quality of domestic water supply, the safety of water contact recreation, and the safety of eating game fish) and the health of ecological communities. Advances in the treatment of municipal and industrial waste and changes in manufacturing and processing techniques over the past 25 years have led to improved water quality in many parts of the Delaware River Basin, as indicated by the return of shad runs to the Delaware River (Fisher, 1999).

Currently, the river water quality in the vicinity of the proposed Southport Development Project site is considered good, though the Delaware River is subject to fish advisories because of excessive toxins (National Park Service, 2010). Nearby surface water quality monitoring stations include one station located upstream of the site (station 892071) at the Benjamin Franklin Bridge (river mile 100.2) and downstream of the site (station 892065) at the Navy Yard (river mile 93.2), both of which are monitored by the DRBC.

In addition, water quality has been analyzed at the project site, including data presented in Table 7 of Appendix C and one surface water sample collected as part of the sediment characterization

sampling event conducted 9 March through 9 April 2010 by Weston Solutions, Inc. The sample was collected from the Delaware River at the Southport Development Project site and the results of these analyses are presented in Table 11a of a SCR provided in Appendix A. Detected concentrations in the surface water sample were compared to acute and chronic DRBC SQOs and PADEP WQC. All detected concentrations of VOCs and inorganic analytes met available criteria. Also, note that SVOCs, pesticides, and PCB Aroclors were not detected in the site water sample.

As of 2010, a fish consumption advisory is in effect for this area of the Delaware River (Zone 3) because of the occurrence of PCBs and mercury. Consumption of White perch (*Morone americana*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), and striped bass (*Morone saxatilis)* should be limited to one meal per month. American eel (*Anguilla rostrata*) and carp (*Cyprinus carpio)* should not be consumed at all (http://www.fish.state.pa.us/fishpub/summary/sumconsumption.pdf).

Streamflow significantly affects Delaware Estuary water quality; high freshwater flows commonly result in improved water quality by limiting the upstream movement of seawater and reducing the concentration of dissolved substances. High flows also aid in maintaining lower water temperatures during warm weather and in supporting higher concentrations of dissolved oxygen. Under certain conditions, however, high streamflow can transport large quantities of nutrients to the estuary, which may result in algal blooms (Krejmas et al., 2009).

In October 2003, Normandeau Associates, Inc. (Normandeau) conducted water quality measurements in the areas adjacent to Piers 122 and 124 during fish sampling (Normandeau, 2004; Tables 1 through 3). The data confirm the freshwater nature of the surface water in the vicinity of the proposed facility. No salinity was measured on separate dates, and tidal events and specific conductance did not exceed 201 microsiemens per centimeter (µmohs/cm) (note that a slightly higher conductivity [243 µmohs/cm] was measured during sampling conducted by WESTON in spring 2010). The water was well oxygenated at the surface (8.5 to 9.4 mg/L) and at depth (8.6 to 9.8 mg/L) and pH ranged from 6.7 to 7.7. Water temperature ranged from 13.7 degrees Celsius (°C) to 15.3°C during the sampling (Normandeau, 2004).

3.3.4.1 Floodplain

The proposed Southport project site is located within the City of Philadelphia Flood Management District C (development sites that can discharge directly to the Delaware River main channel or Schuylkill River major tributary without using city infrastructure); see Figure 3-2. Sites within Flood Management District C may discharge stormwater without control of proposed conditions peak runoff rate. In addition, the City of Philadelphia's channel protection requirement does not apply to discharges to tidal waters.

3.3.5 Coastal Zone

The Coastal Zone Management Act of 1972 (reauthorized in 1990) encourages voluntary participation by states in a program to protect, preserve, develop, restore, and/or enhance the natural coastal resources along all U.S. coastlines (the Atlantic, Pacific, and Arctic Oceans, the Gulf of Mexico, the Great Lakes, and Long Island Sound). Resources to be preserved or protected include wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs. The Coastal Zone Management programs for both Pennsylvania and New Jersey were considered for this document and are discussed in Appendix B.

3.3.5.1 Pennsylvania Coastal Zone Management Program

The Pennsylvania Coastal Zone Management program, under PADEP jurisdiction, was approved by the U.S. Department of Commerce in 1980. All administrative departments and independent boards and commissions are directed to act consistently with the goals, policies, and objectives of the Coastal Zone Management Program under Executive Order 1980-20.

Information regarding the Pennsylvania coastal zone was derived from *Commonwealth of Pennsylvania Coastal Resources Management Program Technical Guidance Document*, prepared by PADEP (2003). Pennsylvania defines the coastal zone in the Southport area as follows:

- Extends eastward to the New Jersey state boundary, which is the middle of the Delaware River;
- Extends southward to the Delaware state boundary;
- Extends northward to the falls at Morrisville, where the tidal influence on the Delaware River ends;

- Extends westward inland, varying in width from 1/8 mile in urban areas like Philadelphia, Bristol, and Chester to over 3.5 miles in Falls Township, Bucks County, to include floodplains of the Delaware and Schuylkill rivers and the upper limit of tidal influence on their tributaries and tidal and freshwater coastal wetlands.

The sections of the Pennsylvania Coastal Zone Management Program that pertain to the Southport Development Project include the following:

- Provisions under the Floodplain Management Act (1978).
- Provisions under the Dam Safety Act (1978) and Administrative Code (1929).
- Provisions under the Solid Waste Management Act (1980) Sections 6018.10-6018.1003; the Dam Safety and Encroachments Act (1978) Section 693.1; Clean Streams Law (1937) Section 691.1; Storm Water Management Act (1978) Section 680.1; Conservation District Law (1986) Section 849; the Wildlife Resource Conservation Act (1982) Section 5301; the Fish and Boat Code (1980) Section 101; the Game and Wildlife Code (1986), 35PA CSA Section 101; and Pennsylvania Sewage Facilities Act (1966), 35 PS Sections 750.1. Under the Pennsylvania Code: 25 PA Code Chapters 16, 71, 91, 92, 93, 94, 95, 96, 99, 100, 102, 105, 106, 107, 109, 289, and 299; 17 PA Code Chapters 45 and 47; and 58 PA Code Chapters 75 and 133.
- Provisions under the Pennsylvania Constitution, Article I, Section 27; and Historic Preservation Act (1978), 71 PS Sections 1047.1).
- Ports.
- Provisions under the Solid Waste Management Act (1980), 35 PS Sections 6018.101-6018.1003; the Sewage Facilities Act (1966), 35 PS Sections 750.1; the Clean Streams Law (1937), 35 PS Sections 691.1.
- Provisions under the Air Pollution Control Act (1960), 35 PS Sections 4001; the Administrative Code of 1929, 71 PS Section 510-1; 25 PA Code Chapters 121, 123, 124, 127, 129, 131, 133, 135, 137, and 141.

See Appendix B for more detailed information on how these sections of the Pennsylvania Coastal Zone Management Program pertain to the Southport Development Project.

3.3.5.2 New Jersey Coastal Zone Management Program

The New Jersey coastal area includes parts of the Delaware River and Bay and other tidal streams of the Coastal Plain. The Coastal Zone Management provisions for New Jersey are discussed in Appendix B.

The proposed Southport Marine Terminal is located in Philadelphia, PA, at the northeastern end of the former Philadelphia Naval Shipyard. The activities associated with Southport, including the activities requiring a federal permit from USACE, will not occur in the New Jersey coastal zone. Certain dredging and disposal of dredged material activities subject to permitting by USACE under Section 10 of the Rivers and Harbors Act or under Section 404 of the Clean Water Act and that occur in Pennsylvania, however, are subject to a consistency determination under the New Jersey Coastal Management Plan. As described below, the dredging and disposal activities associated with construction of the Southport terminal that require a permit from USACE are consistent with the New Jersey Coastal Management Program.

A review of the Coastal Zone Management rules (N.J.A.C. 7:7E) determined that the following policies may be applicable to the proposed dredging activities:

- 7:7E-3 - Special Areas.
  - *7:7E-3.5 – Finfish migratory pathways*
  - *7:7E-3.7 – Navigation channels*
  - *7:7E-3.11 – Ports*
  - *7:7E-3.38 – Endangered or threatened wildlife or plant species habitats*
- 7:7E-4 – General Water Areas
  - *7:7E-4.6 – Maintenance dredging*
  - *7.7E-4.7 – New dredging*
  - *7:7E-4.8 – Dredged material disposal*
  - *7:7E-4.18 – Realignment of water areas*
- 7:7E-8 – Resource Rules
  - *7:7E-8.2 – Marine Fish and Fisheries*
  - *7:7E-8.4 – Water Quality*
  - *7:7E-8.5 – Surface Water Use*

3.3.6 Climate Change and Sea Level Rise

In June 2009, PADEP published the Pennsylvania Climate Impact Assessment, which reported the results of climate modeling for the Commonwealth (Titus et al., 2009). The models predicted the average temperature for Pennsylvania will increase 4 to 7°F by the end of the century. Precipitation will increase between 6 and 10%, but most of this increase will occur during the winter months; winter precipitation will increase between 8 and 15%. The models indicated an increase in drought from late spring through early fall, with longer dry periods and greater intensity precipitation, when it occurs. In summer months, runoff will likely decrease, but will increase by 5 to 10% in winter. The reduced summer flows compounded by higher sea level may result in increased salt water intrusion in coastal waters, including the Delaware River. Climate warming and its effects are likely to continue well beyond the next 100 years because of the amount of greenhouse gas (GHG) already in the atmosphere (Shortle et al., 2009).

Sea level is rising at a rate of 2.75±0.12 mm/year (approximately 0.1 inch per year) in Philadelphia (Shortle et al., 2009). This rate amounts to approximately 1 inch of sea level rise for every 10 years. Thus, sea level at the Southport site could rise approximately 2 inches in 20 years; by approximately 4 inches in 40 years; and by 0.5 ft in 60 years, if the rate of rise is constant.

The wharf deck and roadways were designed to an elevation of 11.4 ft NAVD88. This is equivalent to the 200-year elevation plus an additional 1.4-ft allowance for a theoretical 100 years of sea level rise. Incidentally, 11.4 ft is also equal to the 500-year flood with no sea level rise considered. This a very conservative design estimate since sea level rise due to climate change is anticipated to be less than the 100-year storm elevation plus estimated sea level rise in 100 years' time. The recommended deck elevation of 11.4 ft accounts for anticipated sea level rise during the anticipated 100+ year operating life of the facility.

3.3.7 Hazardous, Toxic, and Radioactive Waste

3.3.7.1 Asbestos-Containing Material

Asbestos containing material (ACM) is a material that contains more than 1% asbestos as determined using the methods specified in the National Emission Standard for Hazardous Air Pollutants in Appendix E, Subpart E, 40 CFR Part 763, Section 1, Polarized Light Microscopy

(PLM). Section X, Subpart D of the Asbestos Inspections and Reports-Analysis Section, in the Philadelphia Department of Public Health's Asbestos Control Regulations (amended March 1993), also requires samples to be analyzed by PLM.

ACM has been known to exist at several locations within the former Navy family housing area, Mustin Field. Dewberry & Davis conducted an ACM survey in 1995 throughout 922 housing units. ACM was detected, above the EPA/PADEP standard of 1% in 75 of 94 buildings sampled, in vinyl floor tile, vinyl sheet flooring, sink coatings, and asphalt shingles (Dewberry & Davis, 1995). Results of a subsequent ACM survey in 1997 by AET Environmental, Inc. (AET) corroborated the results of Dewberry & Davis. During the AET survey, ACM was detected in floor tile, linoleum, and sink coatings.

WESTON confirmed the asbestos content of internal building materials of approximately 10% of the units originally surveyed by Dewberry & Davis in 1995. WESTON also inspected and, as necessary, sampled suspect materials not identified in the original report (such as vapor barriers underneath flooring, drywall, drywall joint compound, fire stop, mastic materials, and insulation). All samples collected during the confirmation survey were analyzed using PLM, and a PLM point count or transmission electron microscopy (TEM) confirmation was conducted for detected samples below 1% (WESTON, 2010a).

Friable materials located on-site are as follows: thermal systems insulation in Building 904, vinyl sheeting located in the kitchens and bathrooms of all of the dwellings, brown vapor barrier paper located within the roof matrix of the TEM Community Center (TEM-CC) (Building 1011), and drywall, drywall joint compound, and surfacing material located underneath the kitchen sinks of the dwellings (WESTON, 2010a). Asphalt-shingled roofs at the Mustin Field residences were negative for asbestos, including the townhomes, flats, and at the brick structures at Emmons and DuPont Streets. It should be noted that the Dewberry & Davis report identified roofing shingles containing greater than 1% asbestos. However, Biddle Road is not part of the Mustin Field Base Housing complex and is not within the footprint of the proposed project. Mustin Field Housing was demolished as an action under a separate state permit to address a public safety issue. Asbestos was abated during this demolition.

3.3.7.2 Lead

AET conducted a lead-based paint (LBP) survey in 1995 (EA Engineering, Science, and Technology, 1998b). In accordance with Housing and Urban Development (HUD), the federal standard for any paint that contains lead equal to or greater than 0.5% by weight is considered LBP. No LBP (greater than 0.5% by weight) was detected in 795 samples of damaged paint collected from the former Mustin Field housing units. No LBP sampling was conducted in Buildings 998 or 1031 because they are not residential buildings.

A survey of water provided to Buildings 974, 981, 997, 998, 1011, and 1031 indicated the presence of lead above the USEPA action level in all locations (EA Engineering, Science, and Technology, 1998b). Buildings 904, 905, 996, 1024, 1066, 2201, and 2301 through 2385 were not tested.

3.3.7.3 Polychlorinated Biphenyls

Results of an Environmental Baseline Survey (EBS) conducted in 1998 (EA Engineering, Science, and Technology, 1998b) concluded that no areas of the east end of the Philadelphia Navy Yard required remediation for PCBs. In March 2010, WESTON submitted samples of transformer oils collected from transformers in the Mustin Field housing area to a laboratory for analysis; no PCBs were detected in any of the samples.

According to the USEPA Region 3 Web site, “various PCB transformers have been remediated and cleanup is ongoing at additional sites.” Particular sites are not listed, but PCBs were not detected in the east end (EA Engineering, Science, and Technology, 1998b).

3.3.7.4 Pesticides/Herbicides

Sampling and analysis conducted by EA Engineering, Science, and Technology in 1998 indicated that no pesticides or herbicides are present in concentrations exceeding action levels in the east end of the Navy Yard (EA Engineering, Science, and Technology, 1998b).

3.3.7.5 Underground Storage Tanks

Four former underground storage tanks (USTs) were present, at Buildings 981, 997, 1011, and 1031 (EA Engineering, Science, and Technology, 1998b). Buildings 981 and 997 are located west of the Southport Development site, outside the project boundary; Buildings 1011 and 1031

are located within the project boundary in the Mustin Field housing area. All four USTs contained fuel oil. EA Engineering, Science, and Technology (1998b) reported that the UST at Building 1031 was closed by PADEP and requires no further action (NFA). Additional sampling was requested for the UST at Building 1011, and 2 years of additional monitoring was required for the USTs at Buildings 981 and 997.

According to the USEPA Region 3 Web site, "several underground…storage tanks have been removed or closed…in some areas, leaks were identified and follow-up investigations or cleanups completed."

3.3.7.6 Radiological

Results of an EBS conducted in 1998 (EA Engineering, Science, and Technology, 1998b) concluded that no areas of the east end of the Philadelphia Navy Yard required remediation for radiological materials.

3.3.7.7 Radon

In 1991, the Navy assessed 110 housing units for radon. All results were less than the USEPA action level of 4 picocuries/liter, indicating that no radon issues were present in the east end of the Philadelphia Navy Yard per Department of the Navy (EA Engineering, Science, and Technology, 1998b).

3.3.7.8 Unexploded Ordnance

According to the EBS completed by EA Engineering, Science, and Technology in 1998, no unexploded ordnance (UXO) was located in the east end of the Philadelphia Navy Yard.

3.3.7.9 Medical Waste

According to the EBS completed by EA Engineering, Science, and Technology in 1998, no medical wastes were located in the east end of the Navy Yard.

3.3.7.10 Installation Restoration Program Sites

The east end of the former Naval Shipyard included three Installation Restoration Program (IRP) sites:

- Debris disposal site (IRP Site 1), located along the southeasternmost shoreline within the proposed Southport area.
- Blasting grit disposal site (IRP Site 2), located north of IRP Site 1 along the easternmost shoreline within the proposed Southport Project Development area.
- Former pistol range, located adjacent to the northwestern boundary of the proposed Southport Project Development area.

In its 1998 EBS report, EA Engineering, Science, and Technology stated that removal actions were planned for the debris and blasting grit disposal sites. The sites would be listed for NFA upon completion of removal actions. The USEPA Region 3 Web site indicates that "removal and off-site disposal of approximately 6,000 tons of debris, blasting grit, and other surface material from east end of the Navy Yard was completed." No date for this effort is included in the Web site information.

Additional information from the USEPA Region 3 Web site includes the following:

- A Federal Facility Remedial Investigation was started on 1 February 1997 and completed on 30 August 1997.
- A Federal Facility Removal was started on 1 January 1996 and completed on 30 July 1998.
- A Record of Decision (ROD) for the east end (Southport location) is listed on 4 September 1998, but there is no document found on the Web site.
- The Navy Yard is not listed on the National Priorities List (NPL) but is considered a removal-only site.
- The east end (IRP Site 1 and IR Site 2) is considered a NFA site.

Lead-contaminated soil was removed at the former pistol range; this site was listed by 1998 as NFA (EA Engineering, Science, and Technology, 1998b).

3.3.8 Air Quality

3.3.8.1 Air Quality Standards and Regulations

USEPA has established primary and secondary National Ambient Air Quality Standards (NAAQS) under the Clean Air Act Amendments of 1990 (CAAA). The CAAA also set emission limits for certain air pollutants from specific sources, set new source performance standards

based on best demonstrated technologies, and established national emission standards for hazardous air pollutants (HAPs).

The CAAA specifies two sets of standards—primary and secondary—for each regulated air pollutant. Primary standards define levels of air quality necessary to protect public health, including the health of sensitive populations such as people with asthma, children, and the elderly. Secondary standards define levels of air quality necessary to protect against decreased visibility and damage to animals, crops, vegetation, and buildings. Federal air quality standards are currently established for six pollutants (known as criteria pollutants), including carbon monoxide (CO); nitrogen dioxide (NO_2); ozone (O_3); sulfur oxides (SO_X), commonly measured as sulfur dioxide (SO_2); lead; and particulate matter equal to or less than 10 micrometers in aerodynamic diameter (PM_{10}), and particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$). Although O_3 is considered a criteria pollutant and is measurable in the atmosphere, it is often not considered a pollutant when reporting emissions from specific sources, because O_3 is not typically emitted directly from most emissions sources. It is formed in the atmosphere from its precursors—nitrogen oxides (NO_x) and VOCs—that are directly emitted from various sources. Thus, emissions of NO_x and VOCs are commonly reported instead of O_3.

The NAAQS for the six criteria pollutants are shown in Table 3-2. Units of measure for the standards shown in this table are micrograms per cubic meter of air ($\mu g/m^3$), except for ozone, which is in parts per million (ppm).

USEPA classifies the air quality within an Air Quality Control Region (AQCR) according to whether the region meets federal primary and secondary air quality standards. An AQCR or portion of an AQCR may be classified as in attainment, nonattainment, or unclassified with regard to the air quality standards for each of the criteria pollutants. “Attainment” describes a condition in which standards for one or more of the six pollutants are being met in an area. The area is considered an attainment area for only those criteria pollutants for which the NAAQS are being met. “Nonattainment” describes a condition in which standards for one or more of the six pollutants are not being met in an area. “Unclassified” indicates that air quality in the area cannot be classified and the area is treated as attainment. An area may have all three classifications for different criteria pollutants.

The CAAA requires federal actions to conform to any applicable State Implementation Plan (SIP), as determined according to regulations USEPA has promulgated for implementing this requirement (USEPA, 2003a and 2003b). The CAAA calls upon states to develop and implement individual SIPs, which in part must meet a variety of prescribed criteria and overall must be designed to achieve the NAAQS in nonattainment areas (i.e., areas not currently attaining the NAAQS for any criteria pollutant) or to maintain attainment of the NAAQS in attainment, unclassified, or maintenance areas (i.e., areas that were nonattainment areas but are currently attaining that NAAQS). General conformity refers to federal agency actions other than those conducted in accordance with specified transportation plans (which are subject to the Transportation Conformity Rule). Therefore, the General Conformity regulations, which are applicable to federal actions in Pennsylvania by being incorporated by reference into Pennsylvania's regulations and USEPA-approved SIP, apply only to nontransportation federal actions in nonattainment or maintenance areas. Under these regulations, the federal agency undertaking such an action must perform a determination of conformity with the SIP if the emissions resulting from the action of a relevant pollutant in a nonattainment region exceed applicability thresholds specified for that pollutant. The federal agency must consider both direct emissions from the action itself and indirect emissions that may occur at a different time or place but are an anticipated consequence of the action to the extent the agency can practicably control and exercise continuing program responsibility for these emissions. An evaluation of the attainment status of the relevant area is used to determine whether the federal action would be subject to the General Conformity Rule.

The thresholds triggering applicability of the General Conformity regulations for emissions of relevant pollutants in nonattainment areas are 100 tons per year (tpy) for any individual criteria pollutant, except for those presented in Table 3-3.

Several actions are exempt from the General Conformity Rule, including the following:

- Actions that do not have emissions increases.
- Actions with an emissions increase that is clearly de minimis (21 actions are listed; primarily actions that are administrative, legal, or routine in nature including routine movement of mobile assets, material, and personnel as well as routine maintenance and repair).

- Actions that are not reasonably foreseeable or that respond to natural disasters or emergencies.
- Actions that have been approved under specified federal programs.

If an action triggers the applicability thresholds and is not exempt from the requirements, the regulations call for the federal agency to demonstrate and through specified analyses to document that the direct and indirect emissions would conform to the SIP.

The construction activities that would be authorized by a USACE permit as part of the Southport Development Project would be located in the City of Philadelphia on the Delaware River. Emissions from activities associated with operation of the Southport Development project once construction is completed, such as emissions from marine or truck traffic associated with the terminal, is beyond the practical control and continuing responsibility of the USACE's permit program. Therefore, these emissions fall outside the scope of this analysis.

Philadelphia is located in the Philadelphia-Wilmington-Atlantic City Nonattainment Area for 8-hour ozone, as shown in Figure 3-3, and is subject to the Pennsylvania SIP. This area is required to attain the 8-hour ozone NAAQS by 15 June 2010; however, since ozone is considered a summer issue, the area was required to demonstrate attainment during 2009. If attainment is not achieved, the Philadelphia Nonattainment Area is required to have a contingency plan to provide continued reasonable further progress toward attainment. Philadelphia's air quality report for 2009 has not been released, and it is not currently known when the report will be available to the public. For General Conformity, NO_x and VOC emissions are regulated as precursors of ozone. The applicability threshold level for the General Conformity Rule is 50 tpy for VOC emissions and 100 tpy for NO_x emissions.

In addition to the ozone nonattainment area, Philadelphia County is a nonattainment area for fine particulates ($PM_{2.5}$).

The General Conformity Rule applies to federal actions in which $PM_{2.5}$ emissions and precursors to $PM_{2.5}$ exceed the applicability threshold levels of 100 tpy. The precursors to $PM_{2.5}$ in Philadelphia are SO_2 and NO_x. Neither USEPA nor Pennsylvania has determined that VOCs or ammonia are significant precursors to $PM_{2.5}$.

A carbon monoxide maintenance area is located within the City of Philadelphia. The proposed project is not located within this maintenance area; thus, the General Conformity Rule does not apply to carbon monoxide emissions.

3.3.8.2 Greenhouse Gases

The six GHGs covered by the Kyoto Protocol are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The emissions of each GHG are calculated separately and then converted to CO_2 equivalents (CO_{2eq}) on the basis of their global warming potential (GWP, the universal unit of measurement expressed in terms of 1 unit of carbon dioxide). GWP is used to evaluate the release of different GHGs against a common basic measure of how much a given mass of GHG is estimated to contribute to global warming. It is a relative scale that compares the gas in question to that of the same mass of carbon dioxide (whose GWP is by definition 1). Table 3-4 lists the GWP of the six GHGs regulated under the Kyoto Protocol (USEPA, 2009a).

Only three of the Kyoto GHGs are considered in accounting for GHG emissions from the proposed project. These three GHGs, CO_2, CH_4, and N_2O, represent the material portions of CO_{2e} associated with the proposed project construction. The other Kyoto GHGs were not considered in the potential emissions from the proposed project because it is presumed that emissions of HFCs, PFCs, and SF_6 will be negligible: HFCs are most commonly used in refrigeration and air conditioning systems; PFCs and SF_6 are predominantly emitted from various industrial processes including aluminum smelting, semiconductor manufacturing, electric power transmission and distribution, and magnesium casting, none of which are part of the proposed project.

GHG emissions are only recently beginning to be subject to regulations under United States environmental laws. There are not ambient levels defined to identify the threshold at which GHG concentrations become problematic from the standpoint of protecting public health or the environment.

3.3.9 Aquatic Resources

The Delaware River along the Southport Development Project site provides a range of habitats for numerous aquatic species, including benthic invertebrates, finfish, and submerged aquatic

vegetation (SAV). Habitats are the places where plants and animals live, where they feed, find shelter, and reproduce. The Delaware River's aquatic resources are part of a complex food web, with phytoplankton and zooplankton at the base of the food chain, and large finfish, waterbirds, and humans at higher trophic levels.

Some aquatic resources in the vicinity of Southport are protected at the federal level under a number of environmental protection statutes including the Endangered Species Act, Fish and Wildlife Coordination Act, Anadromous Fish Conservation Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Emergency Wetlands Resources Act. The Commonwealth of Pennsylvania protects species and their habitats through the Pennsylvania Natural Heritage Program.

The Delaware River's aquatic resources within the Southport project footprint and adjacent areas are described in the following sections. Aquatic resources discovered during the various aquatic investigations within the project site are referenced in Figure 3-4.

3.3.9.1 Benthic Invertebrates

Benthic macroinvertebrates are large, generally soft-bodied organisms without a backbone that live in or on the bottom sediment in the river. Environmental factors dictate the benthic community present at a particular site. Substrate type, temperature, salinity, and dissolved oxygen concentrations are the key environmental factors for benthic invertebrates.

Benthic habitats within the Southport project footprint and adjacent areas include deep open water, subtidal, intertidal, and the stormwater channel (see Figure 3-4). The substrate within the affected environment of the Southport Development Project site consists mainly of soft sediments, sand, and cobbles depending on location within the project area. Normandeau Associates, Inc., conducted a benthic investigation in October 2003 to evaluate the benthic infaunal community in the vicinity of the Southport Development Project site. The study areas consisted of four interpier areas between the Packer Avenue Marine Terminal and the land that was formerly part of the Philadelphia Naval Shipyard. The eastern edge of the study area ended at the pier lines. Most of the macroinvertebrates present were oligochaete worms. Others included fingernail clams (*Musculium transversum*), aquatic insects, and the Asiatic clam (*Corbicula fluminea*). The benthic macroinvertebrate found in these interpier areas is nearly

identical to communities found throughout the freshwater tidal areas of the Delaware River (Normandeau, 2004).

On 13 and 14 May 2010 macrobenthic invertebrate samples were collected to evaluate that community as a food source for fish species utilizing the habitats for foraging as part of the Spring 2010 Fish and Macrobenthic Survey (Appendix C). A standard (6 by 6 inch) stainless-steel petite ponar dredge grab sample of sediment was collected from a total of 30 macrobenthic invertebrate sampling locations. A total of 13 samples were collected from the river off the interpier area and off the southern and southeastern shoreline below the interpier area. A total of 15 samples were collected from the interpier area and 2 samples were collected from the stormwater channel. Benthic macroinvertebrate sampling locations are shown in Figure 3-4.

Substrate conditions in river channel and shoal area along the southern shore precluded collection of sediments as a single ponar grab. In areas where partial grabs occurred due to the presence of hard-packed sand and/or cobble, samples were obtained from multiple grabs. As a result, sediment volumes were highly variable between samples. Two locations yielded atypical samples with one consisting of a single large cobble and another consisting of leaf pack without appreciable mineral sediment.

A total of 65 taxa were collected and identified from the study area. A detailed listing of the taxa present at each of the 30 sampling locations is contained in Appendix C. Taxa richness in the samples ranged from 2 to 17 in the samples from the river off the interpier area and southeastern and southern shorelines, from 1 to 16 in the interpier area, and from 13 to 18 in the stormwater channel. It is notable that the river sample with 17 taxa was the single large cobble sample. Examination of this cobble and other smaller cobbles collected in the river samples indicated low embeddedness. Shannon diversity (base e) values ranged from 0.66 to 2.13 in the river samples, from 0 to 2.13 in the interpier area samples, and from 1.79 to 1.99 in the stormwater channel samples. Shannon evenness (equitability) values ranged from 0.37 to 1.0 (complete equitability) in the river samples, from 0.35 to 0.87 in the interpier area samples, and from 0.62 to 0.67 in the stormwater channel samples. At most locations, tubificids of the genus *Limnodrilus* were the dominant taxon.

Modified Hilsenhoff Biotic Integrity (HBI) index values ranged from 4.4 (in the leaf pack sample) to 9.5 in the river samples, from 6.6 to 10.0 in the interpier area samples, and from 6.7 to

7.3 in the stormwater channel samples. In the interpier area, which was characterized by soft fine unconsolidated substrate, most (11 of 15) samples had HBI values greater than 9. As expected for the upper Delaware River estuary, Ephemeroptera (mayflies) and Trichoptera (caddisflies) were poorly represented with the mayfly *Caenis* sp. present in a stormwater channel sample and the caddisfly *Ceraclea* sp. present in a single river sample. The amphipod crustacean *Gammarus fasciatus* was present at a number of samples from the river and interpier areas and in a stormwater channel sample. The isopod crustacea *Cyathura polita* and *Exosphaeroma papillae* were present in some river locations with only limited occurrence in the interpier area.

Based on the range of substrate type and the diversity and abundance of macrobenthic invertebrates present in the study area and the results of fish survey, the macrobenthic invertebrate community at the proposed Southport Development Project provides a significant source of forage for fish utilizing the site.

3.3.9.2 Finfish

Habitat

Fish habitats in the vicinity of the proposed Southport Development Project include the following:

- Subtidal and intertidal zones along the eastern and southern boundary of the Navy Yard.
- Intertidal marsh, and subtidal areas, with shallow to deep water south of existing Pier 124 and immediately north of the east end of the former Philadelphia Naval Shipyard.
- The stormwater channel.

The intertidal marsh and subtidal areas in the interpier areas may be considered ecologically important because of the emergent wetland and SAV along the shoreline (primarily in the interpier area), which may be used by macroinvertebrates as a substrate and by small fish as cover, and because of the plants, which are a source of dissolved oxygen for the water. In addition to the emergent vegetation and SAV, the man-made embayment in this location provides calm water for fish common to this habitat type, as evidenced by the eight fish species verified in seine collections done by Normandeau (Normandeau, 2004).

During its Sensitive Species Habitat Survey, Versar (2007) indicated the study area in the vicinity of the proposed Southport Development Project site does not appear to provide suitable habitat for either the fourspine stickleback (*Apeltes quadracus*) or threespine stickleback (*Gasterosteus aculeatus)*. The nearshore habitats have been adversely affected by industrial development (presence of industrial-debrislike concrete rubble as shore protection) and are affected by present-day shipping traffic. Shipping traffic in the Delaware River, especially tugboats, often creates large wakes that break along the shoreline. Combined with the broad range of tide stage (6 ft), the nearshore habitats of the Southport Development Project site observed by Versar in 2007 were almost entirely devoid of aquatic vegetation that might support breeding sticklebacks (Versar, 2007).

The subtidal and intertidal zones along the eastern and southern boundary of the Navy Yard are potential striped bass breeding habitat according to the Pennsylvania Fish and Boat Commission (PFBC) (2010).

To augment existing data from past studies in this reach of the Delaware River, fish sampling was performed on 27–29 April 2010 to characterize seasonal use of aquatic habitats in the immediate vicinity of the project area. Additional fish sampling was performed between 1 and 3 June 2010 to complete the survey field effort. In addition to characterizing the fish community, macrobenthic invertebrate samples were collected to evaluate that community as a food source for fish species utilizing the habitats for foraging. The following summarizes the results of the fish sampling and the complete report for the spring 2010 fish and macrobenthic survey is provided in Appendix C.

Prior to sampling, a *Technical Plan* (WESTON, 2010a), which describes field collection activities, was prepared with input from National Marine Fisheries Service (NMFS) and PFBC representatives. Sampling was performed under a Scientific Collection Permit (SCP) No. 389. Gear types included backpack and boat-mounted electrofishers, a 5-ft by 50-ft beach seine, trotlines, and an 8-ft Mini-Missouri trawl. Sampling areas included stillwater areas between existing piers and shore (referred to as the interpier area), the nearshore reach of the Delaware River off the interpier area and the southeastern and southern shorelines below the interpier area, and a stormwater channel that empties into a mudflat in the farthest downstream interpier area. Sampling locations for the April and June sampling rounds are shown in Figure 3-4.

Habitat types within the study area are diverse with substrate types ranging from unconsolidated sandy silt through hard-packed sand and cobble substrates with some areas containing leaf pack. Overhanging brush and coarse rubble provide structure for fish along the southeastern and southern shoreline. The stormwater channel is shallow and the presence of the stone weir near confluence with the Delaware River at the lowermost interpier area appears to exclude most large predator fish species, thus providing a refuge for smaller fish species.

Species

Table 3-5 lists the finfish that have been known to use the tidal fresh salinity zone of the Delaware River, according to NOAA (1994).

Normandeau conducted a fish investigation in October 2003 to evaluate the fish community in the vicinity of the Southport Development Project site. A combination of electrofishing, gill netting, and seining were used to capture finfish to identify individuals. All of the fish species identified in the study area, except the fourspine stickleback, are common and widely distributed in the tidal Delaware River. This species is known to prefer quiet waters along the freshwater tidal Delaware River and its tributaries, but it has been encountered infrequently in recent years. Fourspine stickleback prefer quiet waters containing SAV (Cooper, 1983), such as that present in this embayment (Normandeau, 2004). Fish species found include the following: American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), white perch, striped bass, banded killifish (*Fundulus diaphanous*), fourspine stickleback, and mummichogs (*Fundulus heteroclitus*) (Normandeau, 2004).

Versar conducted another fish investigation in May 2007. Nine species of fishes were collected in the vicinity of the Southport Development Project site and represent those common in fresh to slightly brackish waters: eastern silvery minnow (*Hybognathus regius*), channel catfish, striped killifish (*Fundulus majalis*), mummichog, white perch, tessellated darter (*Etheostoma olmstedi*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and pumpkinseed (*Lepomis gibbosus*) (Versar, 2007). (The striped killfish noted in the Versar study were more likely to have been the more euryhaline banded killifish [*Fundulus diaphanus*]. Striped killifish are seldom found in freshwater and are generally restricted to salt water in lower estuaries [Murdy et al., 1997]. Male striped killifish are very similar in appearance to banded killifish but the adult female has horizontal stripes.)

PFBC has been conducting striped bass electrofishing surveys at various fixed sampling locations along the Delaware River annually since 1997. During most years, two runs were conducted at each site on different days. The site called the "upper Navy Yard" is completely within the footprint of the Southport Development Project site, except that it does not include the berths at the east end of the Navy Yard. Table 3-6 shows the total number of striped bass captured from each location from 1997 to 2007 (PFBC, 2010).

The Philadelphia Water Department (PWD) also conducted electrofishing in the interpier areas in November 2009 to provide more recent data on fall fish utilization of the project site than the 2003 Normandeau study (Normandeau, 2004). Results of the PWD study indicate that the Southport area serves as a refuge for young-of-year species including blueback herring and American shad. The fish counts are provided in Table 3-7 and the sampling locations are shown in Figure 3-4.

To augment existing data from past studies in this reach of the Delaware River, fish sampling was performed on 27–29 April 2010 as described in Subsection 3.3.9.2 under the Habitat subheading. A summary of all fish captured within the project area and fish captured within subareas of the site defined as the stormwater channel, the interpier area, and the river (consisting of the channel and southern/southeastern shorelines below the interpier area) is provided in Table 3-8. Community metrics for the overall collection and by area for the combined April and June rounds are also provided in Table 3-8. Detailed information on individual sampling activities by gear type and area are contained in Appendix C.

A total of approximately 6,000 fish representing 27 different species were collected during the study. A total of 1,387 fish representing 15 different species were collected during the April round. The banded killifish (*Fundulus diaphanus*) was the dominant species in the stormwater channel followed by the mummichog (*F. heteroclitus*). American eel (*Anguilla rostrata*) were also abundant in the stormwater channel with sizes ranging from 4.5 to 37.5 cm. Banded killifish were also dominant in the interpier area followed by channel catfish (*Ictalurus punctatus*) in the April sampling round. Channel catfish were the dominant species in the river sampling areas during April. No young-of-the-year fish were captured during the April sampling round.

In the June sampling round, the eastern silvery minnow (*Hybognathus regius*) was dominant in the stormwater channel followed by banded killifish. In the interpier area, mummichog was the

dominant species in the June sampling round followed by white perch (*Morone americana*). In June sampling in the river area, a single beach seine pull at a gravel beach area along the southeastern shoreline yielded approximately 4,000 young-of-the-year alosids (potentially blueback herring [*Alosa aestivalis*], alewife [*A. pseudoharengus*], American shad [*A. sapidissima*], or hickory shad [*A. mediocris*]). Other than young-of-the-year alosids, the dominant species in the river area was eastern silvery minnow, closely followed by channel catfish in the June sampling round. Striped bass (*Morone saxatilis*) adults were present in both the April and June sampling rounds and young-of-the-year striped bass were present in the June sampling round.

Fish species common throughout the areas sampled included brown bullhead (*Ameiurus nebulosus*), American eel, tessellated darter (*Etheostoma olmstedi*), eastern silvery minnow, channel catfish, and white perch. Adult fish species present in the study area with low abundances (i.e., fewer than five specimens captured) included white catfish (*A. catus*), yellow bullhead (*A. natalis*), brown bullhead, the nonindigenous goldfish (*Carassius auratus*), white sucker (*Catostomus commersoni*), redbreast sunfish (*Lepomis auritus*), bluegill sunfish (*L. macrochirus*), largemouth bass (*Micropterus salmoides*), spottail shiner (*Notropis hudsonius*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), and hogchoker (*Trinectes maculatus*).

In conclusion, the study area supports a diverse fish community typical of the tidal freshwater Delaware River. Most of the fish encountered in the spring 2010 survey are freshwater species but euryhaline species such as the hogchoker are also present. No rare, threatened, or endangered species were encountered during the aquatic survey.

3.3.9.3 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson Act), enacted in 1976 and amended in 1986 and 1996, established a management system for the marine fishery resources of the United States. The Magnuson Act requires each of eight Regional Fishery Management Councils to evaluate the effects of habitat loss or degradation on managed fishery stocks and take actions to mitigate damage. Recognizing the importance of fish habitat to the productivity and sustainability of U.S. marine fisheries, Congress added habitat conservation provisions to the Act in 1996.

The renamed Magnuson-Stevens Act of 1996 calls for direct action to stop or reverse the continued loss of fish habitats, and mandates the identification of essential fish habitat (EFH) for managed species of marine, estuarine, and anadromous fish, mollusks, and crustaceans. EFH is broadly defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Act requires the Regional Fishery Management Councils to describe and identify the essential habitat for their managed species, minimize to the extent practicable adverse effects on EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH.

The Magnuson-Stevens Act also establishes measures to protect EFH. Federal agencies, such as the USACE, must consult with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH. In turn, NMFS must provide recommendations to federal and state agencies on such activities to conserve EFH. These recommendations may include measures to avoid, minimize, or mitigate adverse effects on EFH resulting from the proposed action. The Magnuson-Stevens Act requires cooperation among NMFS, Regional Fishery Management Councils, fishing participants, federal and state agencies, and others to achieve EFH protection, conservation, and enhancement.

The NMFS submitted a response letter dated October 22, 2010 to the Regulatory Branch of the Philadelphia District, U.S. Army Corps of Engineers, commenting on the District's Public Notice (CENAP-OP-R-2009-0933-1) for the Southport Project. In this letter, the NMFS stated that the mixing zone of the Delaware River has been designated as EFH for 14 managed fish species and that the mixing zone is considered to be those areas of the river where the salinities range from 25 ppt to 5 ppt. The letter also stated that the mixing zone generally extends to just above the confluence of the Schuylkill River. The implication is that the Southport Project site is located within the mixing zone because of its proximity to the Schuylkill River confluence and, therefore, EFH is present there.

In December 2010, Normandeau Associates, Inc., as a subcontractor to Weston Solutions, Inc., prepared an EFH assessment (Appendix K - Attachment 1) to evaluate the potential impacts on EFH associated with development and operation of the proposed Southport Development Project.

The Southport Project site is located at the interface of the Delaware Estuary freshwater tidal zone and the mixing zone. However, because salinity varies markedly at many points in the upper estuary as a function of freshwater discharge, the position of the salt line will vary markedly. The term "salt line" refers to the 7-day average location of the 250 mg/l (ppm), or 0.25 ppt, isochlor, and is used as an approximate indicator of the upstream penetration of ocean-derived salinity.

Figure 1 of Appendix K – Attachment 1 is a histogram of the daily salt line location for the period January 1, 1998 through November 30, 2008 (U.S. Army Corps of Engineers 2009). For the entire 10.9 years, the salt line was as far upstream as River Mile (RM) 90 in late summer 2005, and at or below RM 40 during multiple high-flow periods in 2006, a range that exceeds 50 miles along the axis of the estuary. The average location over this period is about RM 71, just upstream of the Delaware Memorial Bridge and near the mouth of the Christina River in Wilmington, Delaware. Based on monthly averages, the maximum salt line penetration occurs in October (RM 81) with the minimum in April (RM 61), reflecting the typical seasonal pattern of freshwater discharge to the estuary. Therefore, a general observation is that location of the salt line varies directly with the volume of freshwater discharge, and is located in the twenty-mile long zone between RM 61 and RM 81 during an "average" year.

Of greatest importance, however, is that the 7-day average 250 mg/l isochlor did not move upstream of RM 90 throughout the 10.9 year period. This location is approximately five miles downstream of the Southport Project site. Therefore, water conditions at the Southport Project site should be considered freshwater.

Since the 14 fish species require saline water as the preferred condition and survey data shows that these 14 species were either collected only in small numbers or were absent from survey collections made 10 to 36 miles downstream of the Southport Project area (see Appendix K – Attachment 1), the Southport Project site should not be considered EFH for these species.

3.3.9.4 Submerged Aquatic Vegetation

SAV is a diverse assembly of rooted macrophytes found in shoal areas. SAV normally occurs in water depths to 6 ft below MLLW ft, the depth to which sunlight penetration generally permits the growth of rooted aquatic plants. SAV is an important food source and habitat for many organisms in the Delaware River.

During the Aquatic and Benthic Resources Study done by Normandeau (2004), SAV was observed in the interpier area south of Pier 124 from the south side of the sheet pile breakwater to the edge of the land that was formerly part of the Philadelphia Naval Shipyard (see Figure 3-4). Three species of SAV were identified: waterweed (*Elodea nuttallii*), wild celery (*Vallisneria americana*), and hydrilla (*Hydrilla verticillata*). Wild celery was the most abundant and hydrilla is considered to be invasive and can be a nuisance where it is abundant.

The results of the sensitive species habitat survey conducted by Versar in May 2007 indicated that the nearshore subaquatic vegetation habitats in the Southport Development Project area have been adversely impacted by industrial development (presence of industrial debris) and are affected by present-day shipping traffic. Shipping traffic in the Delaware River, especially tugboats, often creates large wakes that break along the shoreline, with impacts compounded by a broad tidal range (6 ft). Consequently, the nearshore habitats of the proposed Southport Development Project site were almost entirely devoid of aquatic vegetation, similar to nearshore fish habitats (Versar, 2007).

A more comprehensive SAV survey of the Southport Development Project footprint was conducted during late June 2010 (see Appendix E for the full report). The results of the survey identified approximately 1 acre of the slip area with established SAV, as depicted in Figure 3-4. The dominant (and only vascular plant species) identified in this area was wild celery. Musk grass (*Chara vulgaris*), an algae species, was found intermixed with wild celery and in several discreet, very small (several square feet) patches along the eastern shore of the Navy Yard property. Populations of SAV identified were restricted to depths from 3 ft to 6 ft below MLW.

3.3.9.5 Marine Mammals

Marine mammals are known to infrequently visit the Delaware River in the vicinity of the Southport Development Project. A north Atlantic right whale (*Eubalaena glacialis*) was seen swimming in the area in 1995, a beluga whale (*Delphinapterus leucas*) was seen swimming in the area in 2005, and a dolphin (species unknown) was seen swimming in the area in 2008. These sightings are rare and usually indicate that the animal is sick or lost. Records indicate that the endangered humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*) and north Atlantic right whale have occasionally been sighted in the Delaware Bay and the

approach to the Delaware Bay. These Rare, Threatened, and Endangered (RTE) species are discussed in more in section 3.3.12.

3.3.10 Wetlands and Other Waters

During the fall of 2009, WESTON investigated the proposed Southport Development Project site to identify and delineate waters of the United States, which includes wetlands (see Appendix F). WESTON conducted the delineation to determine areas that would be regulated under federal (Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act) and state (Chapter 105 – Dam Safety and Water Management) wetland and water programs.

Previous studies and delineations, including a wetland delineation map completed in 1995 by TAMS Consultants, Inc., were used as a general guide to determine potential wetland locations and boundaries. General reconnaissance of the site was conducted to determine the presence of hydrophytic vegetation. Further investigation was conducted where hydrophytic vegetation was found to determine whether the sample point location contained the three criteria required for jurisdictional wetland status: hydrophytic vegetation, hydric soil, and the presence of wetland hydrologic conditions.

The actual field investigations were conducted during September, October, and November 2009. The resulting identification and delineation of wetlands was conducted using the method that the U.S. Army Corps of Engineers Philadelphia District (CENAP) currently uses to delineate wetlands in the Atlantic Coastal Plain Region (ERDC, 2008), recent USACE and USEPA guidance related to Jurisdictional Determinations (JD), and best professional judgment.

These field investigations culminated in a report (see Appendix F) that includes information necessary for the USACE to make a JD of the extent of wetlands and other waters of the United States on the Southport Development Project site. CENAP (Mr. Ed Bonner) visited the site on 30 April 2010 to review the proposed wetland/water boundaries. As a result of this visit, wetland/water boundary lines were modified. The redelineated boundaries were surveyed and incorporated into a JD application package submitted to CENAP (Appendix F). CENAP issued a JD for the Southport project on 14 June 2010 (see Appendix F).

Wetland/Water Delineation Results

Figure 3-5 and Appendix F depict the extent of wetlands and other waters within the project footprint, excluding areas east of the footprint where excavation of the Delaware River would occur. Table 3-9 summarizes the acreages of these delineated areas and a detailed drawing of the wetland areas is presented in Appendix F. The berthing area or dredging template to be dredged, including both nearshore and deepwater areas, is approximately 39 acres.

Nontidal Freshwater Wetlands – The site is characterized by a history of land use activities resulting in the creation of isolated depressions where water ponds and vegetation common in disturbed areas (e.g., common reed) is present. These depressions are assumed to be the result of the placement of fill and site grading, resulting in a perched water table. Six isolated depressions having wetland character were identified and delineated (flagged) during site investigations. The presence of hydrophytic vegetation and evidence of wetland hydrologic conditions (standing water, water-stained leaves, adventitious roots) indicate that the areas function as wetland. All are considered to be the result of historic site disturbance (fill and grading) related to historic land use. None of the wetland areas is associated with surface water features, including stormwater management systems. Vegetation consists of primarily dense stands of common reed with soft rush (*Juncus effusus*), silky dogwood (*Cornus amomum*), and black willow (*Salix nigra*) present in some areas (particularly Wetland E; see Appendix F) where the size and density of common reed is generally less robust.

Stormwater Channel – A stormwater channel traverses the property (conveying stormwater from the Norfolk Southern property located west of the site) to the north of the former Mustin Field runway and discharges into the Delaware River at the north boundary of the Navy Yard property (Figure 3-5). The portion of the channel traversing the site is tidal, with flows restricted by a rock weir located at the eastern end. Three 10- to 12-inch-diameter plastic pipes allow flow through the weir during low tide. The weir is overtopped by approximately 1 ft to 2 ft during high tide.

Tidal Freshwater Wetland – An area of emergent intertidal wetland (0.2 acres) was identified between the northern boundary of the Navy Yard property and a sheet pile area south of Pier 124 (Figure 3-5). The dominant vegetation in this low marsh area was spatterdock (*Nuphar luteum var. advena*). The intertidal area in this portion of the site extends into mudflats.

Other Intertidal Waters – North of the Navy Yard, the shoreline is a combination of 1) bulkheads, and 2) narrow, steep areas characterized by minimal vegetation and construction rubble. There is a larger intertidal zone (primarily characterized by mudflats) between the north end of the Navy Yard and an area of sheet piles south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow and consists of primarily construction rubble and stone. The Mean High Water elevation (Section 10 Rivers and Harbors Act jurisdiction) is 3.04 ft NAVD88. The Spring High Water elevation (Section 404 Clean Water Act jurisdiction) is 4.48 ft NAVD88. The tide elevations were derived from NOAA data for the gauging station closest to the site (Philadelphia USCG Station, Station ID: 8545240), located approximately 3 miles upstream. Shallow water zones (extending to 6.6 ft below the MLLW water elevation of -3.15 NAVD88) are present along the Delaware River at the north, east, and south edges of the Southport Development Project site.

3.3.11 Terrestrial Resources

Philadelphia County supports a limited variety of mammals, birds, and herptiles (reptiles and amphibians) because of the amount of industrial development in the area. A few habitat types that are suitable for terrestrial resources are present on the Southport Development Project site.

3.3.11.1 Habitat Types

Habitat is an area with the combination of resources such as food, cover, water, and environmental conditions (temperature, precipitation, presence or absence of predators and competitors) that promotes occupancy by individuals of a given species and allows those individuals to survive and reproduce (DCNR, 2010).

Habitat type is used to describe the type of vegetation an area supports. In September and October 2009 botanist Joseph R. Arsenault (Arsenault) conducted a botanical survey of the proposed Southport Development Project site (see Appendix D). During the fall of 2009, Arsenault observed and documented habitat types present on the Southport Development Project site (see Appendix D). WESTON conducted an investigation at the proposed Southport Development Project site to identify and delineate waters of the United States (wetlands and other waters) (see Appendix F). Habitat types found within the Southport Development Project site are described below.

Southport Development Project Site

According to Arsenault's botanical survey (see Appendix D), as many as seven unique types of plant communities are present on the Southport Development Project site, ranging from tidal shores to upland woodlands. Arsenault and WESTON determined that the following habitat types exist on the site:

Tidal Areas

North of the Navy Yard, the shoreline is a combination of 1) bulkheads, and 2) narrow, steep revetments characterized by minimal vegetation and construction rubble. There is a larger intertidal zone (primarily characterized by mudflats) between the north end of the Navy Yard and an east-west aligned sheet pile structure south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow, and consists of construction rubble and stone.

Although the revetment areas experience tidal fluctuations because of the rocky/rubble substrate, which extends outward below MLLW, these communities lack plant life.

The tidal portion of the stormwater channel located in the northern part of the Southport Development Project site and the shallow side channel located in the interpier area south of the sheet pile breakwater (see Figure 3-5) mostly lack vegetation. The stormwater channel is covered with riprap and the channel was created from concrete rubble. Sediment has filled the areas between the riprap and concrete fill. These areas are overshadowed by woody cover, which limits sunlight and available space for tidal plants.

The mudflat habitat is a broad tidal area on the western end of the interpier area south of the sheet pile breakwater (see Figure 3-5). This area provides gentle slopes and fine silt sediment characteristic of slow-moving tidal conditions. This area supports a 0.2-acre patch of yellow pond-lily (*Nuphar lutea*) in the lower portion and scattered black willow (*Salix nigra*) and other opportunistic woody species in higher elevations.

Nontidal Wetlands

The nontidal wetlands are dominated by *Phragmites australis,* and are found in the area between the former Navy housing and the Delaware River shoreline (see Figure 3-5). Some lower

growing species are present on occasion. See the Wetland section of this report for more detailed information about the nontidal wetlands located on the Southport Development Project site.

Upland Habitats

Upland communities consist of woodlands and old fields. Limited woodland areas consist of primarily thin stands of young trees with varying undercover species. These wooded areas are primarily limited to the river's edge. The more common tree species include box elder (*Acer negundo*), mulberry (*Morus* spp.), black cherry (*Prunus serotina*), tree of heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*) and black locust (*Robinia pseudoacacia*). Common shrub species include blackberry (*Rubus allegheniensis*), false indigo (*Amorpha fruticosa*), and silky dogwood (*Cornus amomum*).

The old field areas are characterized by a diversity of species mixes consisting of both native and invasive species. Some upland areas are dominated by common reed (*Phragmites australis*) in varying density. Common in these areas are dense stands of Asiatic tearthumb (*Polygonum cuspidatum*). Fields lacking common reed are dominated by areas of warm season grasses with mixtures of native and invasive species. This includes broomsedge (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), common wormwood (*Artemisia vulgaris*), black knapweed (*Centaurea nigra*), camphorweed (*Heterotheca subaxillaris*), and bush clover (*Lespedeza* spp.). Arsenault found two Pennsylvania endangered species—velvety panic-grass *(Panicum scoparium)* and forked rush (*Juncus dichotomus)*—in one of these recovering areas.

3.3.11.2 Mammalian Habitats

During a Botanical Survey for the Southport Development Project site Arsenault observed white-tailed deer (*Odocoileus virgianus*) and eastern cottontail (*Sylvilagus floridanus*) near the project site (Appendix D). Other mammals that are more than likely to occur within the proposed Southport Development Project site include house mouse (*Mus musculus*), meadow vole (*Microtus pennsylvanicus*), Norway rat (Rattus norvegicus), opossum (*Didelphis marsupialis*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), deer mouse (*Peromyscus maniculatus*), and white-footed mouse (*Peromyscus leucopus*) (EA Engineering, Science, and Technology, 1997). Additional species that could occur in the area are listed in Table 3-10.

3.3.11.3 Avian Habitats

Consistent with the diversity of vegetation communities and intertidal, subtidal, and open-water habitats, a diverse assemblage of avian species has been documented at the Southport Development Project site. In May 2007, Versar observed 55 species of birds on or in the immediate vicinity of the Southport Development Project site (Versar, 2007). A pair of Pennsylvania threatened, adult bald eagles (*Haliaeetus leucocephalus*) constructed a nest in a tall cottonwood tree in the south-central area of the proposed site (see Figure 3-5), but this nest has not been occupied since 2008. Great blue heron (*Ardea herodias*), with moderately rare breeding populations and moderately secure nonbreeding populations, were observed. Versar did not observe any habitats within the site that would be suitable for great blue heron breeding. Blackpoll warbler (*Dendroica striata*), with extremely rare breeding populations in Pennsylvania, were also observed. Blackpoll warblers do not nest in this area; the individuals observed were most likely migrants (Versar, 2007).

The following data relate to the entire Philadelphia Navy Yard property, not solely the proposed Southport Development Project site. The data come from the Delaware Valley Ornithological Club Philadelphia Mid-Winter Bird Census (Keith Russell, 2010) and encompass 12 of the last 23 years. However, the data do not incorporate species that may reside at the Navy Yard in the summer or those that may stop through during their migration in the spring and fall.

Over 60 terrestrial bird species have been identified during the Philadelphia Mid-Winter Bird Census at the Philadelphia Navy Yard. The most common birds found include the ring-billed gull (*Larus delawarensis*), rock dove or pigeon (*Columba livia*), double-crested cormorant (*Phalacrocorax auritus*), Canada goose (*Branta canadensis*), herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*), and European starling (*Sturnus vulgaris*) (Keith Russell, 2010).

Although many species visit or reside in the Navy Yard property, two such species are of particular concern: the osprey (*Pandion haliaetus*) and the bald eagle (*Haliaeetus leucocephalus*). The osprey (Pennsylvania threatened) has not been documented at the site since 2003 (Pennsylvania Natural Heritage Program, 2008). Bald eagles have not used the site for nesting since 2008 (USFWS, 2010c), but they and their nests are protected by the Bald and

Golden Eagle Protection Act. For further information about the bald eagle at the site, please see the Threatened and Endangered Species section of this report.

3.3.11.4 Herptile (Reptile and Amphibian) Habitats

The Southport Development Project site has a diversity of upland, wetland, and water habitats that have documented use by, or could be used by, reptile and amphibian species. These include upland fields, scrub/shrub and wooded areas, nontidal emergent wetlands, tidal wetlands, intertidal rubble areas and mudflats, subtidal areas, and deeper water. Several studies have been conducted assessing the use of the site by reptiles and amphibians; these studies are summarized below.

Versar conducted field surveys for reptiles and amphibians, focusing on redbelly turtle and southern leopard (*Rana catesbeiana*) frog in May 2007. During the surveys, Versar sighted one state threatened redbelly turtle, one yellow-bellied slider (*Trachemys scripta scripta*), and a red-eared slider (*Trachemys scripta elegans*). Although these three species of turtle were found in the water adjacent to the site, Versar concluded that the nearshore and upland areas do not serve as suitable habitat for these species. Versar searched for suitable habitat for the state-endangered southern leopard frog and found only one pond. Call surveys were conducted and minnow traps were set, but the only species observed or caught were the following: spring peeper (*Pseudacris crucifer*), bullfrog (*Rana catesbeiana*), mummichog, and spring peeper tadpoles. Versar concluded that habitat for the southern leopard frog is nonexistent because of the presence of a permanent population of fish, which feed on amphibian eggs, as well as the highly territorial bullfrogs.

Herpetological Associates, Inc. (HA) conducted a Phase I Habitat Evaluation for amphibian and reptile species in October 2009 (see Appendix D). HA determined that none of the wetlands provide the typical combination of hydrology and vegetation that is considered suitable habitat for either the southern (coastal plain) leopard frog (*Lithobates sphenocephala*) or the New Jersey chorus frog (*Pseudacris kalmi*), but increased rainfall during the spring months may provide sufficient water for breeding habitat. Redbelly turtles (*Pseudemys rubriventris)* are not expected to inhabit these wetlands, although they are known to exist in the Delaware River within the immediate vicinity of the study site and may occupy the wetlands periodically during the active season. None of the wetlands provided suitable bog turtle (*Glyptemys muhlenbergii*) habitat. HA

did observe an eastern (black) ratsnake (*Pantherophis alleghaniensis*) within the Southport Development Project site.

HA also examined the Southport project footprint for suitable redbelly turtle habitat, including uplands, the southern and eastern shoreline, and Pier 124 cove and stormwater channel. The Delaware River, cove area, and stormwater channel provided suitable redbelly turtle aquatic habitat, though no redbelly turtles were observed. Suitable nesting habitats were determined to be present in the upland areas of the site, where tree and shrub cover is limited and sparse herbaceous vegetation and sandy soil dominate. The southern and eastern shoreline of the proposed Southport Development Project site was observed to be steeply sloped with eroded banks, lined with trees and shrubs, and littered with concrete and construction debris. These steep banks form a significant barrier to redbelly turtles, which limits access to the site for nesting. However, access to suitable nesting habitat was determined to be possible from the cove area and stormwater channel.

An additional Phase II redbelly turtle nesting habitat assessment was conducted by HA at the Southport site in June and early July 2010 to satisfy a request from PFBC. This Phase II survey did not reveal the presence of turtle nesting on the Southport site. Detailed results of the assessment are provided in Appendix D.

Records indicate that the federally threatened loggerhead (Caretta caretta), federally endangered Kemp's ridley (Lepidochelys kempi), federally endangered leatherback (Dermochelys coriacea), and federally endangered green (Chelonia mydas) sea turtles have occasionally been sighted in the Delaware Bay and the approach to the Delaware Bay. These RTE species are discussed in more detail in section 3.3.12.

3.3.12 Rare, Threatened, and Endangered (RTE) Species

Certain species of plants and animals are protected by federal and state regulations under the Endangered Species Act (ESA) of 1973, and the Pennsylvania Natural Heritage Program. Lists of the federally and state designated RTE species potentially present in the project area (Philadelphia County) are provided in Table 3-11. These species occur in a wide variety of habitats, including habitat types not present within the project area.

Federally listed species potentially occurring in Philadelphia County include the threatened bog turtle (*Glyptemys muhlenbergii*), endangered shortnose sturgeon (*Acipenser brevirostrum*), endangered Atlantic sturgeon (*Acipenser oxyrhynchus*), endangered dwarf wedgemussel (*Alasmidonta heterodon*), and threatened small-whorled pogonia (*Isotria medeoloides*). NMFS also expressed concern over certain species of marine mammals and a few species of sea turtle that may be found in the Delaware Bay and approach channels. Federally listed whale species include humpback whale, fin whale, and North Atlantic right whale. Listed sea turtles include federally threatened loggerhead, federally endangered Kemp's ridley, federally endangered leatherback, and federally endangered green sea turtles. The bog turtle, shortnose sturgeon, dwarf wedgemussel, and small-whorled pogonia are also listed as endangered in the Commonwealth of Pennsylvania.

A Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review was used to search for potential impacts to RTE species within the project footprint. The PNDI search (search I.D. 20090901208135) results indicated that further consultation with Pennsylvania Game Commission (PGC), Pennsylvania Department of Conservation and Natural Resources (DCNR), and Pennsylvania Fish and Boat Commission (PFBC) was necessary. Below is a summary of the PNDI results and the correspondence with those agencies regarding potential RTE species present within each site. Detailed results of the PNDI search as well as the correspondence between WESTON and the agencies are presented in Appendix G.

Further consultation with PGC, DCNR, and PFBC was required to evaluate potential impacts to state-listed RTE species within the Southport Development Project area. These agencies were contacted to obtain further information on RTE species potentially present within the project footprint. The following Pennsylvania-listed species were determined to be potentially present in the project area: bald eagle (*Charadrius melodus* [threatened]), redbelly turtle (*Pseudemys rubriventris*] [threatened]), coastal plain leopard frog (*Rana utricularia* [endangered]), New Jersey chorus frog (*Pseudacris feriarum kalmi* [endangered]), eastern mudminnow (*Umbra pygmaea* [potential candidate]), field dodder (*Cuscuta pentagona* [proposed threatened]), bugleweed (*Lycopus rubellus* [endangered]), velvety panic-grass (*Panicum scoparium* [endangered]), Walter's barnyard grass (*Echinochloa walteri* [endangered]), multi-flowered mud-plantain (*Heteranthera multiflora* [endangered]), and forked rush (*Juncus dichotomus* [endangered]).

Shortnose Sturgeon

In a letter dated October 22, 2010, NMFS expressed concern that the Project may have an impact on shortnose and Atlantic sturgeon, and requested consultation under Section 7 of the Endangered Species Act. In December 2010, Normandeau Associates, Inc., as a subcontractor to Weston Solutions, Inc., prepared a Biological Assessment (Appendix K – Attachment 1) for shortnose sturgeon and Atlantic sturgeon in the upper tidal Delaware River.

The Delaware River has been identified as supporting a population of shortnose sturgeon (*Acipenser brevirostrum*), a Federally-listed endangered species. The shortnose sturgeon was placed on the original Endangered Species List pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.). The shortnose sturgeon is also a Pennsylvania listed endangered species.

Relatively recent studies have collected numerous shortnose sturgeon in the tidal freshwater region of the Delaware River. A total of 1,371 shortnose sturgeon was collected between RM 102 and 133 (Philadelphia to Trenton) during 1981 to 1984 (Hastings *et al.* 1987). The Florence to Trenton (RM 124 to 132) segment of the river yielded the great majority of the fish (98.3%). Virtually all (98.9%) were collected in the channel. Shortnose sturgeon were collected throughout the year in the freshwater tidal zone, with lower catches from December to April. These lower catches may be due to low catchability during this period rather than reduced abundance. Multiple techniques were utilized to estimate the population in the Trenton-Florence area, and estimates ranged from approximately 6,000 to 14,000. The higher number is more likely, as two of the three techniques yielded results near 14,000. More recent efforts to estimate the shortnose sturgeon population have indicated abundance between 10,757 and 13,589 (Environmental Research and Consulting, Inc. and O'Herron Biological and Environmental Consulting 2006).

Data from sonic tracking during the period 1983 through 1987 enabled O'Herron *et al.* (1993) to further define the areas used and the seasonal pattern of movement of adult shortnose sturgeon in the Delaware River (Figure 1). Shortnose sturgeon that overwintered in the upper tidal river near Trenton, New Jersey, began traveling upstream in late March to the non-tidal river where spawning presumably occurred from late March through April. After spawning, sturgeon travelled rapidly downstream into the tidal portion of the river near Philadelphia, where they

remained through the end of May. Before the end of June, most sturgeon moved upstream to the non-tidal river near Trenton, where most apparently remained for the summer and winter. In general, the same pattern was apparent for both sexes.

Atlantic Sturgeon

The Delaware River has been identified as supporting a remnant population of Atlantic sturgeon (*Acipenser oxyrhynchus*). The Atlantic sturgeon is listed as endangered by the Commonwealth of Pennsylvania. On January 6, 2010 the National Marine Fisheries Service (NMFS) announced that it would consider listing Atlantic sturgeon as threatened or endangered under the Endangered Species Act. On October 6, 2010, NOAA issued a Federal Register Notice (75 FRN 618) that identified the Hudson River and Delaware River Atlantic sturgeon stocks as a distinct population segment (DPS) called the New York Bight DPS. Citing precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed, the limited amount of current spawning, and impacts and threats that have and will continue to prevent population recovery, this DPS was listed as endangered by NMFS on February 6, 2012 (77 FRN 5880).

Atlantic sturgeon distribution in the Delaware Estuary appears to be dependent upon the season. Brundage and Meadows (1982b) reported 130 recorded captures of Atlantic sturgeon in the Delaware Estuary between November 1958 and July 1980. Atlantic sturgeon were collected in the Delaware Bay region (RM 0 to 34) during most months, although catch was greatest from March through May (14 to 23 fish per month) and lowest from July through August (1 fish per month). A migration from the Delaware Bay region to the lower tidal river (RM 35 to 79) and the upper tidal river (RM 79 to 135) is suggested by peak captures in these areas from June to September, which is coincident with the period of least abundance in the Delaware Bay. Subsequently, (after September) abundance declined in the tidal river and increased in the Delaware Bay region, suggesting a return to overwintering areas.

Results of telemetry studies indicated that adult Atlantic sturgeon move upriver in late spring and early summer, followed by a more quiescent period during August and September, and an outmigration during October and November. Contrary to the findings of Lazzari et al. (1986), Simpson and Fox (2007) found that juvenile Atlantic sturgeon concentrated in three specific areas: Artificial Island, Cherry Island Flats, and the Marcus Hook Anchorage. During the

summer months, the juveniles, like adults, displayed little movement compared to spring and fall months. Although no Atlantic sturgeon eggs were collected, based upon gonadal biopsies of captured Atlantic sturgeon, Simpson and Fox (2007) concluded that the lower limit of spawning appeared to be near Tinicum Island while the upper limit is likely to be near the fall line at Trenton, New Jersey. They also postulated that the substrate composition between Marcus Hook and Tinicum Island represent suitable spawning habitat for the Atlantic sturgeon.

The telemetry studies of Simpson and Fox (2007) also identified two important characteristics of Atlantic sturgeon movement. These studies suggested that Atlantic sturgeon utilized tidal currents for passive transport as well as active swimming, and that Atlantic sturgeon do not appear to be using shallow water habitats at night. Additional site specific information can be found in Appendix K – Attachment 1 of this document.

Dwarf Wedgemussel

The dwarf wedgemussel is a small, freshwater mussel that occurs on muddy sand, sand, and gravel bottoms in creeks and rivers of various sizes. In parts of the range, dwarf wedgemussels also occur in clay banks and small riffle areas. This species requires areas with a slow to moderate current, little silt deposition, and well-oxygenated, unpolluted water. The U.S. Fish and Wildlife Service (USFWS) considers Philadelphia County as a location in which the dwarf wedgemussel is unlikely to occur (USFWS, 2010a).

Small-whorled Pogonia

The small-whorled pogonia is a member of the orchid family. This orchid grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams (USFWS, 2010b). This habitat type does not exist within the project site so it is unlikely that the small-whorled pogonia exists within the Southport Development Project site and none were found during the T&E surveys conducted by Arsenault.

Marine Mammals

Federally endangered humpback whales can be found in high latitude feeding grounds such as the Gulf of Maine in the Atlantic and Gulf of Alaska in the Pacific, during the summer months.

In the winter, they migrate to calving grounds in subtropical or tropical waters such as the Dominican Republic in the Atlantic and the Hawaiian Islands in the Pacific (NOAA, 2010c).

Federally endangered fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally. Fin whales are migratory, moving seasonally into and out of high-latitude feeding areas, but the overall migration pattern is complex, and specific routes have not been documented (NOAA, 2010d).

Federally endangered North Atlantic right whales have occurred historically in all the world's oceans from temperate to subpolar latitudes. They primarily occur in coastal or shelf waters, although movements over deep waters are known. For much of the year, their distribution is strongly correlated to the distribution of their prey. During winter, right whales occur in lower latitudes and coastal waters where calving takes place. Right whales migrate to higher latitudes during spring and summer. The majority of individuals in the western North Atlantic population range from wintering and calving areas in coastal waters off the southeastern United States to summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and Scotian Shelf (NOAA, 2010e).

Records indicate that the endangered humpback whale, fin whale and right whale have occasionally been sighted in the Delaware Estuary. However, since the introduction of the Endangered Species Act in 1973, whales have been sighted with increasing frequency along the New Jersey and Delaware Coast, and have become the subject of a growing whale watch industry in the mid-Atlantic (USACE, 2009).

During the Philadelphia District's Endangered Species monitoring program in September 1992, humpback whales were sighted at Fenwick Island and Bethany Beach. Two to six northern right whales have been sighted each winter off of Long Island and off of New Jersey Beaches. Historical observations also indicate that humpback and fin whales are present offshore near the mouth of the Chesapeake Bay. While population numbers are not available, presence of these whales is reported in the months of January, February, and March (USACE, 2009).

Sea Turtles

Federally threatened loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Loggerheads are the most abundant species of sea turtle found in U.S. coastal waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs primarily in the subtropics (from North Carolina through southwest Florida). Adult loggerheads are known to make extensive migrations between foraging areas and nesting beaches. During non-nesting years, adult females from U.S. beaches are distributed in waters off the eastern U.S. and throughout the Gulf of Mexico, Bahamas, Greater Antilles, and Yucatán (NOAA, 2010f).

Federally endangered Kemp's ridley sea turtles are distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard, from Florida to New England. Nesting occurs mainly in Mexico. Occasional nesting has been documented in North Carolina, South Carolina, and the Gulf and Atlantic coasts of Florida (NOAA, 2010g).

Federally endangered leatherback sea turtles nesting grounds are located around the world, with the largest remaining nesting assemblages found on the coasts of northern South America and west Africa. The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support minor nesting colonies, but represent the most significant nesting activity within the United States. Adult leatherbacks are capable of tolerating a wide range of water temperatures, and have been sighted along the entire continental coast of the United States as far north as the Gulf of Maine (NOAA, 2010h).

Federally endangered green sea turtles are globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30° North and 30° South. In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico (NOAA, 2010i).

Based on sea turtle monitoring and stranding statistics, these four species of sea turtles occur occasionally in and around the Delaware Estuary (USACE, 2009).

Bald Eagle

The bald eagle is listed as threatened in the Commonwealth of Pennsylvania and is also protected under the Federal Bald and Golden Eagle Protection Act. In 2006 or 2007, a pair of bald eagles built a nest adjacent to the abandoned Navy housing at the east end of the Philadelphia Navy Yard (see Figure 3-5). The Commonwealth, through DGS, procured a biological consultant, Normandeau, to periodically monitor the nest from 2007 through the present. The nest was observed to be occupied in the spring of 2007, although the nest was abandoned in April of that year with no young produced. The nest was also observed to be occupied during periods in the spring and summer of 2008, with confirmation that the pair fledged one eaglet (USFWS, 2010c).

In March 2009, one adult bald eagle was observed near, but not in, the nest during an aerial survey. Eagles were not observed in the nest during the aerial survey and it was not possible to safely determine whether eggs or eaglets were present. During a boat survey also conducted in March 2009, the eagle nest was observed from the Delaware River. One adult bald eagle was observed perched on the nest tree, approximately 5 ft from the nest, but it was not possible to determine whether an adult, eggs, or eaglets were present in the nest. In June 2009 a land observation survey was conducted, but no adult bald eagles or offspring were observed on or in the nest tree or in the vicinity. Based on these observations and anecdotal evidence from security and other Navy Yard personnel, Normandeau concluded that, while the adult pair exhibited territorial behavior, they did not fledge young in 2009 (USFWS, 2010c).

In 2010, Normandeau conducted surveys by air and land to determine whether the eagle pair was using the nest. During the survey, no bald eagles were observed using the nest tree or the surrounding areas. One anecdotal observation (12 March 2010) of a bald eagle near the nest being harassed by two red-tailed hawks (*Buteo jamaicensis*) was reported by an engineering consultant on-site for another purpose, but this observation could not be confirmed. Normandeau returned to observe on March 2010 after this observation, but no eagles were observed in or in the vicinity of the nest. Except for this one unconfirmed sighting, neither eagles nor evidence of nest-building activities were observed at the nest site from late January to mid-March in 2010 and the nest remained unoccupied during the 2010 nesting season (USFWS, 2010c). A supplement to the application for take of an abandoned bald eagle nest has been developed and is being provided to the appropriate resource agencies. It should be noted that routine monitoring of

the nest has been conducted since the application was submitted, and no nesting activities have been observed.

Bog Turtle, Redbelly Turtle, Coastal Plain Leopard Frog, and New Jersey Chorus Frog

In May 2007, Versar conducted a Sensitive Species Habitat Survey of the proposed Southport Development Project site and focused on four state-listed species, including the redbelly turtle and southern leopard frog (Versar, 2007). HA conducted a Phase I habitat evaluation for threatened and endangered amphibian and reptile species on 6 October 2009 at the proposed Southport Development Project site (see Appendix D). The targeted species were the bog turtle, redbelly turtle, coastal plain leopard frog, and New Jersey chorus frog. In summary, none of the investigated habitats provide suitable bog turtle habitat; the site is considered extremely marginal for the targeted frog species. Although the river cove area at the back of the Pier 124 mudflat and stormwater channel provide suitable aquatic habitat for the redbelly turtle, the turtles would not use the cove and ditch during low tide and during the overwintering months. More detailed information on each species is presented below.

The bog turtle is listed as federally threatened and as endangered in Pennsylvania. HA determined that none of the investigated wetlands within the project site provide suitable habitat for bog turtle (see Appendix D).

The redbelly turtle is listed as threatened in Pennsylvania, and occurs only in the lower Delaware River and lower Susquehanna River regions. This species is typically associated with deep ponds, lakes, streams, rivers, and brackish marsh habitats. Redbelly turtles can be spotted basking on logs and other structures extending over water; however, they are also very wary and will drop into the water at the slightest disturbance. In May 2007, Versar conducted a sensitive species habitat survey of the proposed Southport Development Project site and one redbelly turtle was observed on a large drift log in the man-made embayment south of Pier 124 (Versar, 2007). HA determined that it is unlikely that redbelly turtles would inhabit the wetlands within the Southport site, although they may occupy the wetlands periodically during the active season. The cove south of Pier 124 and stormwater channel provide potential access to upland areas for redbelly turtles seeking nesting sites. However, the concrete rubble shoreline along the southern edge of the site provides a formidable barrier to redbelly turtles, which may limit their access to

the site for nesting (see Appendix D). HA conducted an additional nesting survey in June and early July 2010 to satisfy a request from PFBC. This Phase II survey did not reveal the presence of turtle nesting on the Southport site (see Appendix D).

Both the coastal plain leopard frog and the New Jersey chorus frog are listed as endangered in Pennsylvania. The coastal plain leopard frog may inhabit marshes, ponds, and slow-moving streams and the New Jersey chorus frogs can be found in densely vegetated wetlands or open marshes, often breeding in temporary bodies of water. Both species are considered endangered because of the loss of their breeding sites to industrial activity (PNHP, 2010a). During its survey, Versar did not observe the coastal plain leopard frog or appropriate habitat for the species (Versar, 2007). HA determined that none of the wetlands within the proposed Southport Development Project site provide suitable habitat for the coastal plain leopard frog or New Jersey chorus frog, although increased rainfall during the spring months may provide sufficient water for breeding habitat (see Appendix D).

Eastern Mudminnow

The current status of the eastern mudminnow in Pennsylvania is that it is a vulnerable species and a candidate to become endangered or threatened in the future. The eastern mudminnow is uncommon in the lower Delaware River watershed and may use the water column and areas over sand, mud, and debris in the project area, where they are able to quickly burrow into the substrate to escape from predators. Note that no eastern mudminnows were encountered in the spring 2010 fish study conducted by WESTON or previous studies conducted at the site.

Velvety Panic-Grass, Forked Rush, Bugleweed, Field Dodder, Walter's Barnyard Grass, and Multi-Flowered Mud-Plantain

In May 2007, Versar conducted a Sensitive Species Habitat Survey of the Southport Development Project site and focused on four state-listed species, including velvety panic-grass. In the fall of 2009, Arsenault conducted a botanical survey of the proposed Southport Development Project site (see Appendix D). The targeted species were velvety panic-grass, forked rush, bugleweed, field dodder, Walter's barnyard grass, and multi-flowered mud-plantain. More detailed information on each species is presented below.

Velvety panic-grass is listed as endangered in Pennsylvania and has been documented in a few southeastern counties. Velvety panic-grass grows in damp to seasonally wet clearings, abandoned fields, marshes, and disturbed ground. Recent field surveys have yielded discoveries of more populations of the species, so this rarity status may be amended to reflect a lesser-degree conservation significance. Some of the known populations of velvety panic-grass have threats from habitat loss, competition, and exotic species (PNHP, 2010d). A vegetation survey of the Southport project that Versar conducted in May 2007 did not identify velvety panic-grass at the proposed facility (Versar, 2007). The subsequent survey conducted by Arsenault identified velvety panic-grass at three locations within the old field habitat, two along the northern and eastern portions of the parcel and the other toward the southern portions of the parcel. The eastern and southern velvety panic-grass locations are also within the footprint of the proposed facility (see Figure 3-5 and Appendix D).

Forked rush is listed as endangered in Pennsylvania and has been documented historically in some southern, particularly southeastern, counties. Forked rush grows in moist to damp old fields, marshes, openings, clearings, and ditches. The viability of populations of this species and its habitat may be enhanced by creating buffers around wetlands, controlling invasive species, and protecting the natural hydrology around wetlands (PNHP, 2010g). A vegetation survey of the Southport Development Project site, conducted by Arsenault, identified forked rush at the old field habitat near the eastern portions of the parcel and within the footprint of the proposed facility (see Figure 3-5 and Appendix D).

Bugleweed grows in intertidal marshes, mudflats, shorelines, and ditches. In Pennsylvania, the species has been documented historically in several eastern counties, but particularly along the lower Delaware River (PNHP, 2010c). A vegetation survey of the Southport Development Project site, conducted by Arsenault, identified bugleweed at one location within the Southport site in the northeastern portions of the parcel, near the limit of the stormwater channel, within the footprint of the proposed facility (see Figure 3-5 and Appendix D).

Field dodder is listed as proposed threatened in Pennsylvania and grows in various types of open habitats, including old fields, clearings, thickets, and various types of open ground. The Pennsylvania Biological Survey has assigned field dodder a rarity status of “undetermined,” which means that more field surveys and analysis are required before a more permanent rarity

status, if appropriate, can be designated (PNHP, 2010b). A vegetation survey of the Southport Development Project site, conducted by Arsenault, identified field dodder at two locations within the footprint of the proposed facility in the northeastern portions of the site (see Figure 3-5 and Appendix D).

Walter's barnyard grass is listed as endangered in Pennsylvania and has been documented historically only in a few southeastern counties. Walter's barnyard-grass grows in marshes, ditches, and on shorelines, including intertidal wetlands. The species does appear to be able to thrive in certain types of disturbed ground. The general habitat of this species has threats from exotic species, dredging and filling, and water pollution (PNHP, 2010e). A vegetation survey of the Southport Development Project site, conducted by Arsenault, did not identify Walter's barnyard grass at or in the vicinity of the project site. Arsenault determined that the site does not have suitable habitat due to high-energy tidal flows in the habitats in which the grass would be expected to be found (see Appendix D).

Multi-flowered mud-plantain is listed as endangered in Pennsylvania and has been documented historically only in a few southeastern counties along the Delaware River. Multi-flowered mud-plantain grows in intertidal marshes, mudflats, and shorelines along the lower Delaware River. The plants are subjected to daily cycles of exposure and inundation. The known populations have threats from exotic species, dredging and filling, and water pollution (PNHP, 2010f). A vegetation survey of the Southport Development Project site conducted by Arsenault did not identify multi-flowered mud-plantain at or in the vicinity of the project site. Arsenault determined that the site does not have suitable habitat due to the lack of tidal marsh (see Appendix D).

3.3.13 Recreation

The Delaware River's waters, shorelines, and nearby parks provide an excellent opportunity for public use and enjoyment. Typical recreational activities in the area include fishing, boating, and walking along the riverfront. A brief review of some of the area's recreational resources follows.

3.3.13.1 Parks

Philadelphia County in Pennsylvania and Gloucester and Camden Counties in New Jersey have numerous local parks, state parks, public access sites, preserves, and museums. Some of the parks near the proposed Southport Development Project site include Franklin Delano Roosevelt

Park and John Heinz National Wildlife Refuge in Pennsylvania and Red Bank Battlefield and Johnson Parks in New Jersey. The Pennsylvania parks are separated from the Southport Development Project site by major and interstate highways as well as industrial areas. The New Jersey parks are located across the Delaware River from the site.

Franklin Delano Roosevelt Park in Philadelphia, originally designed in 1914, is roughly 300 acres in area. It is located approximately 3 miles from the Southport Development Project site. The most notable aspects of the park are its many lakes and its golf course. Facilities are available for a variety of sports ranging from skateboarding to tennis (http://www.fairmountpark.org/FdrPark.asp).

The John Heinz National Wildlife Refuge at Tinicum in Pennsylvania is part of the National Wildlife Refuge System and is managed by the USFWS. The refuge is located approximately 7.7 miles from the Southport Development Project site. It consists of approximately 1,200 acres of freshwater tidal wetlands. This free-admission refuge is open year round and includes an environmental education center, hiking trails, and areas designated for canoeing and fishing (http://www.fws.gov/heinz/welcome.htm).

3.3.13.2 Fishing

Desirable sport fish species that are found in the Delaware River include largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), channel catfish, tiger muskellunge (*E. masquinongy x lucius*), Atlantic herring (*Clupea harengus*), and American shad (A*losa. sapidissima*). More information is available at the following Web site: (http://www.nj.gov/dep/fgw/wwartjs.htm#delawareres).

The striped bass or “striper” is a favorite sport fish among recreational anglers. Stripers grow large, lack teeth, and can be caught in saltwater or freshwater, depending on the season (they are anadromous).

Fishing regulations for the Delaware River are presented on PFBC’s Web site: http://fishandboat.com/fishpub/summary/delaware.html. Although it does not focus on the section of the Delaware closest to the project area, a creel survey, or angler survey, of the Delaware River, conducted by Versar for PFBC, provides much valuable information. The creel survey covers almost 280 river miles. Smallmouth bass were the most frequently caught fish in

the survey. Channel catfish and striped bass were the most frequently caught fish in tidal portions of the Delaware River (Versar, 2003).

3.3.13.3 Boating

The Delaware River offers many seasonal recreational activities, such as power boating and sail boating. Both the Pennsylvania and New Jersey banks of the river have marinas, public-access boat ramps, and docks. The nearest public-access boat ramp is the West Deptford Municipal Boat Ramp, immediately across the Delaware River from the project site in New Jersey. By boat, this ramp is located approximately 2.2 miles from the Southport Development Project site. On the Pennsylvania side of the river, the Frankford Arsenal Boat Ramp is approximately 11 miles northeast of the project site and the City of Chester Boat Ramp is approximately 14 miles southwest of the site near the Commodore Barry Bridge. A list of Delaware River boat access sites in Pennsylvania and New Jersey is available online: http://www.state.nj.us/dep/fgw/pdf/delacces.pdf

3.3.13.4 Other Recreational Resources

Many locations along the banks of the Delaware River, in both New Jersey and Pennsylvania, are used as promenades.

Many Philadelphians enjoy the river from Penn's Landing, which hosts live concerts in summer and ice skating in winter. Penn's Landing is located approximately 5 miles from the site and its facilities are run by the Delaware River Waterfront Corporation. More information about the Delaware River Waterfront Corporation, Penn's Landing, and scheduled events is available at the following Web site: (http://www.delawareriverwaterfrontcorp.com/).

3.3.13.5 Wild and Scenic Rivers/National Heritage Rivers

A Wild and Scenic River is defined by The Wild and Scenic Rivers Act, P.L. 90-542 (as amended) (16 U.S.C. 1271-1287) as "certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

The National Park Service National Wild and Scenic Rivers System Web site (www.nps.gov/rivers) lists designated rivers by state. The Delaware River is designated as a Wild and Scenic River about 50 miles upstream of the proposed Southport project site. However, the shoreline immediately upstream of the proposed site, and a significant portion of the shoreline downstream of the proposed site, is developed with marine terminals and other port-related facilities.

3.3.14 Cultural Resources

The Louis Berger Group, Inc. (Berger) conducted a Phase IA Cultural Resources Assessment (see Appendix H) for the proposed Southport Development Project site. The assessment was conducted in January 2010 with the objective of investigating the potential for previously undocumented archaeological resources to exist within the project site boundary and recording the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP) within the project site boundary.

Archaeology

The Southport Development Project site was historically marshland and open water until between 1940 and 1957 when additional land was created through the use of dredged materials and fill. The area assumed its current manufactured configurations as late as between 1963 and 1970. As a result, due to the mid-to-late twentieth century development/land use history, the Southport Development Project site is considered to have no potential for containing significant historic archaeological remains.

Dredging in the Delaware River between Marcus Hook and Allegheny Avenue has likely seriously disturbed or destroyed any submerged archaeological resources (shipwrecks) that may have existed in the river (Cotter et al., 1992). Therefore, the Southport Development Project site does not possess the potential to contain submerged archaeological resources.

As a result of the documentary review and pedestrian reconnaissance conducted by Berger, the Southport Development Project site does not possess the potential to contain intact significant archaeological resources.

Historic Architecture

The Phase IA Cultural Resources Assessment also conducted a preliminary survey of historic architectural resources greater than 50 years of age within the Southport Development Project site boundary and immediate vicinity.

The former military housing within the Project Area did not meet the 50-year criteria for listing on NRHP and was not of exceptional importance, required to meet Criteria Consideration for properties achieving significance within the past 50 years. These buildings were subsequently removed in 2011-2012 for public safety reasons as a separately permitted activity,

The abandoned Mustin Airfield is also located in the northwestern portion of the site. Previous surveys of the airfield as part of the Naval Complex Philadelphia survey and evaluation did not recommend eligibility (John Milner Associates, Inc., 1994). No further investigations are recommended for the airfield due to its previous designation as ineligible.

The NRHP-listed Philadelphia Naval Shipyard Historic District (CRGIS Key# 86856) is located to the west of the Southport Development Project site. Although the central core of the district is located 1.5 miles west of the site, the World War II era Seaplane Hangar (Building 653), which is a non-adjacent portion of the historic district, is located immediately west of the Southport Development Project site. The Seaplane Hangar, constructed in 1943, is a contributing resource to the Philadelphia Naval Shipyard Historic District and has significance in the areas of architecture and history.

As a result of ongoing demolition of the structures on Pier 122, notably the unloaders, the NHRP-eligible Pier 122 and associated buildings no longer possess sufficient integrity of design, setting, materials, and association. Berger has reevaluated Pier 122 and its associated buildings and determined that this resource no longer meets the significance criteria for listing on NHRP.

As with Pier 122, the Greenwich Coal Pier (Pier 124) and many of the associated structures are in the process of being dismantled within and east of the project area. Because of the resulting loss of historic fabric and architectural integrity, no additional work is recommended for Pier 124.

3.3.15 Socioeconomics

Demographics, employment, and environmental justice are discussed in the following sections.

Population

Table 3-12 contains the combined demographic information for the City of Philadelphia, which includes the Philadelphia Navy Yard and three adjacent areas to the North and West. Information was obtained for the four locations from the U.S. Census Bureau database (Year 2000 Census data, U.S. Census Bureau, 2000a, b, c, and d). According to the Census Bureau, the population in the Philadelphia Navy Yard and the surrounding areas (zip codes 19112 [Philadelphia Navy Yard], 19113 [West of Navy Yard], 19153 [West of Navy Yard], and 19148 [North of Navy Yard]) in 2000 was 61,062.

Employment and Income

The Philadelphia Navy Yard (former Philadelphia Naval Shipyard) and the surrounding areas consist of approximately 23,000 jobs as of 2000. The majority of the approximately 23,000 jobs include education, health, social services, retail trade, manufacturing, professional, scientific, and management.

Environmental Justice

Executive Order 12898, signed in 1994, is a presidential directive to all federal agencies to make environmental justice a part of all programs, policies, and activities. The order augments Title VI of the Civil Rights Act of 1964 by making the prohibition of discrimination based on race, color, and national origin more specific. USEPA defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” Environmental justice seeks equal protection from environmental and public health hazards for all people regardless of race, income, culture, and social class. Additionally, environmental justice means that no group of people, including racial, ethnic, or socioeconomic groups (which includes low-income and minority populations), should bear a disproportionate share of the negative environmental consequences resulting from industrial, land-use planning and zoning, municipal and commercial operations, or the execution of federal, state, local, and municipal programs and policies.

The Commonwealth of Pennsylvania established the Office of Environmental Advocate and formed an environmental justice advisory board in April 2002 to address environmental justice concerns for its citizens.

Within the zip code (19112) that encompasses the Philadelphia Naval Shipyard, 24.9% of the population is considered minority, which includes citizens of African, Asian, and Native American descent, and those of mixed races. The median household income is $41,994 (in 1999 dollars), and 9.2% of families and 12.4% of individuals live below the poverty level (see Table 3-13). There are no residential neighborhoods adjacent to the Southport Development Project site.

3.3.16 Transportation

Delaware River

The Delaware River divides Pennsylvania and New Jersey and provides a partial boundary between Pennsylvania and New York. It is used for both commercial and recreational purposes. The Port of Philadelphia, one of the major ports along the East Coast, is located on the Delaware River. Several types of cargo ships, including container, tanker, dry bulk, and break bulk, bring commodities including refined petroleum products, meat, fruit, wine, and paper products (Bureau of Transportation Statistics) to the Port of Philadelphia. Philadelphia reported 3,006 vessel calls in 2008, which is the number of vessels on the river (Maritime Administration, 2009).

Railroads

Philadelphia has railway service for public transportation and commercial freight transportation. For public transportation, Philadelphia is serviced by Amtrak, Southeastern Pennsylvania Transportation Authority (SEPTA), and Port Authority Transit Corporation (PATCO). Amtrak provides public transportation to major cities along the east coast and across the United States. SEPTA provides public transportation in Philadelphia and in several surrounding counties. PATCO provides service from the Philadelphia region to portions of New Jersey. Commercial freight transportation services by railway for the Port of Philadelphia terminals are provided by CP Rail System, CSX Transportation (CSXT), and Norfolk Southern (NS) (http://www.worldportsource.com/ports/USA_PA_Port_of_Philadelphia_79.php). Commercial freight transportation provided by CSX currently runs from the industrial track parallel to

Delaware Avenue to Packer Avenue Marine Terminal. CP Rail provides commercial transportation to Packer Avenue Marine Terminal and would be able to provide service to Southport if additional railway spurs are constructed. In addition to commercial railways currently in place, an Intermodal Terminal south of Greenwich Yard as well as additional track is being proposed by NS (Shaw Environmental, 2004). The map of the railroad system in the vicinity of the proposed project site is presented in Figure 3-6.

Highways and Roadways

The Philadelphia region contains many interstate highways that provide ease of access to major cities including New York, Baltimore, and Washington, DC. Interstate 95 is located north and south of the proposed Southport project area. Interstate 95 provides a direct link to New York and Baltimore. Interstate 76, north of the project site, provides access to western Pennsylvania and to New Jersey via the Walt Whitman Bridge or Interstate 676 and the Benjamin Franklin Bridge.

Roads servicing the project area include South Broad Street, Packer Avenue, Oregon Avenue, Christopher Columbus Boulevard, Darien Street, Lawrence Street, and, potentially, Delaware Avenue. South Broad Street runs north/south and consists of three lanes in both directions. Within the project area surroundings are nine signalized intersections and two intersections with signage. The posted speed limit in this area on Front Street is 35 mph; for Packer Avenue, Pattison Avenue, Oregon Avenue, and Christopher Columbus Boulevard, 30 mph; and for Darien Street, 25 mph. Neither South Broad Street nor Lawrence Street has posted speed limits (McMahon Associates, Inc., 2010). Delaware Avenue, a north/south running street adjacent to the Delaware River, currently does not extend southward into the project area. However, it may be extended southward as part of the Southport development.

McMahon Associates, Inc., completed a detailed traffic study in December 2009, the scope of which included an evaluation of the existing weekday morning, weekday midday, and weekday afternoon peak hours (see Appendix I). An evaluation of the future opening year (2014) and the future horizon year (2024), both without development and upon full build-out of the proposed marine terminal was performed at each of the following study intersections:

- South Broad Street and Packer Avenue

- Eastbound I-76 Ramp/Darien Street and Packer Avenue
- Pattison Avenue and Lawrence Street
- Pattison Avenue and Front Street
- Front Street and Packer Avenue
- Front Street and Westbound I-76 Off Ramp/Southbound I-95 On Ramp
- Front Street and Southbound I-95 Off Ramp/Northbound I-95 On Ramp
- Front Street and Oregon Avenue
- Columbus Boulevard and Oregon Avenue
- South Columbus Boulevard and Packer Avenue Marine Terminal
- South Delaware Avenue and Packer Avenue Marine Terminal

Daily traffic counts were conducted in the vicinity for a continuous 7-day period. Based on the counts, approximations of the two-way daily traffic volume are as follows:

- 5,800 vehicles per day along Pattison Avenue, between Lawrence Street and Front Street.
- 3,600 vehicles per day along Pattison Avenue, between Front Street and Packer Avenue Marine Terminal access.
- 3,200 vehicles per day along Columbus Boulevard, between Packer Avenue Marine Terminal access and Oregon Avenue.
- 9,400 vehicles per day along Oregon Avenue, between Columbus Boulevard and Front Street.
- 6,400 vehicles per day along Front Street, between Pattison Avenue and Packer Avenue.

Manual turning movement traffic counts were completed at all of the study area intersections during the typical weekday (5:00 a.m. to 7:00 p.m.). In order to assess the existing traffic conditions, these existing traffic volumes were subjected to detailed capacity/level-of-service analysis, in accordance with accepted methodologies, for the highest peak hour during each weekday morning (5:00 a.m. to 9:00 a.m.), weekday midday (12:00 p.m. to 3:00 p.m.), and weekday afternoon (3:00 p.m. to 7:00 p.m.) peak period, which serves as the basis for this existing conditions evaluation. The *Revised Navy Yard Access Traffic Report for Temporary*

Access prepared by Boles, Smyth, Assoc. Inc. & DMJM Harris/AECOM, last revised 27 July 2006 was reviewed for consistency of the traffic volumes at the South Columbus Boulevard/South Delaware Avenue/Packer Avenue intersection. It should be noted that where discrepancies occurred, the higher of the two volumes was used to provide a conservative assessment of existing conditions.

Seasonal adjustment factors contained in the PennDOT publication, *2006 Pennsylvania Traffic Data*, were reviewed to ensure that the collected counts reflect typical conditions. The collected traffic data reflect higher-than-average data, and therefore, seasonal adjustment factors were not utilized to adjust the data. The four highest consecutive 15-minute peak intervals during these traffic-count periods constitute the peak hours that are the basis of this traffic analysis. It should be noted that while most of the intersections' single highest peak hour during the morning and midday peak period occurred at approximately 8:00 a.m. to 9:00 a.m. and 12:00 p.m. to 1:00 p.m., respectively, there was no such consistency during the weekday afternoon peak period, with the highest peak hour occurring at different times for the various study intersections ranging from 3:00 p.m. to 7:00 p.m.

3.3.17 Noise

Noise is defined as unwanted sound that is disruptive and diminishes the quality of the surrounding environment. It is emitted from many sources including airplanes, factories, railroads, power generation plants, highway vehicles, etc. The magnitude of noise is described by its sound pressure. A logarithmic scale is used to relate sound pressure to a common reference level, as the range of sound pressure varies greatly. This is called the decibel (dB). A weighted decibel scale is often used in environmental noise measurements (weighted-A decibel scale or dBA). This scale emphasizes the frequency range to which the human ear is most susceptible. A 70-dBA sound level can be moderately loud, like an indoor vacuum cleaner. A 120-dBA can be uncomfortably loud, like a military jet takeoff at 50 ft, and a 40-dBA sound level can be very quiet and is the lowest limit of urban ambient sound.

The degree of disturbance or annoyance of unwanted sound depends on 1) the amount and nature of intruding noise, 2) the relationship between the background noise and the intruding noise, and 3) the type of activity occurring at the location where the noise is heard. Human response to noise varies from individual to individual and is dependent on the ambient environment in which

the noise is perceived. Wind, temperature, and other conditions can change the sound volume perceived at distances from the noise source.

To ensure a suitable living environment, HUD has developed a noise abatement and control policy, as provided in 24 CFR Part 51. According to this policy, noise 65 dBA and below is considered acceptable, noise above 65 dBA but below 75 dBA is normally acceptable, and noise above 75 dBA is unacceptable. Regulatory thresholds by state and local governments can also provide criteria to judge the significance of noise impacts.

The proposed project site is a nonresidential area. Present land use in the area is predominantly port-related, light industrial, former military, or undeveloped. No environmentally sensitive areas such as schools, hospitals, and low-income areas are near the proposed project site. Existing noise in the area originates from the operation of the surrounding terminals and businesses, boat traffic, and highway traffic.

SECTION 3

TABLES

Table 3-1
Philadelphia County Average Monthly Wind Speeds

Month	Avg. Wind Speed (mph)		Month	Avg. Wind Speed (mph)
January	10.3		July	8.2
February	10.9		August	8.0
March	11.3		September	8.3
April	10.8		October	8.8
May	9.5		November	9.6
June	8.8		December	10.0

Table 3-2
National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10mg/m^3)	8 hour	None	
	35 ppm (40 mg/m^3)	1 hour		
Lead	0.15 μg/m^3	Rolling 3-Month Average	Same as Primary	
	1.5 μg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 μg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
	0.100 ppm	1 hour	None	
Particulate Matter (PM_{10})	150 μg/m^3	24 hour	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15 μg/m^3	Annual (Arithmetic Mean)	Same as Primary	
	35 μg/m^3	24 hour	Same as Primary	
Ozone	0.075 ppm (2008 std)	8- Hour	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm (1300 μg/m^3)	3 hour
	0.14 ppm	24 hour		

Table 3-3
General Conformity Regulations (Thresholds that are not 100 tpy)

	Tons/year
Ozone (VOCs or NO_x)	
Serious NAAs	50
Severe NAAs	25
Extreme NAAs	10
Marginal or moderate NAAs inside an ozone transport region	
VOCs	50
PM_{10} (Serious NAAs)	70
Pb (All NAAs)	25

Table 3–4
Global Warming of Kyoto Protocol Greenhouse Gases

Gas	Chemical Formula	GWP[a]
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	HFCs	various
Perfluorocarbons	PFCs	various
Sulfur hexafluoride	SF_6	23,900

[a] Source: USEPA 2009a.

Table 3-5
List of Known Finfish in the Tidal Fresh Salinity Zone of the Delaware River

Common Name	Species Name	Life Stage						
		Adults	Spawning Adults	Juveniles	Larvae	Eggs	Mating	Parturition
Daggerblade grass shrimp	*Palaemonetes pugio*	R	R	R	R	R		
Blue Crab	*Callinectes sapdisu*	R		A			R	
Shortnose sturgeon	*Acipenser brevirostrum*	R		R				
Atlantic sturgeon	*Acipenser oxyrhynchus*	R	R	R	R	R		
American eel	*Anguilla rostrata*	R		C	R			
Blueback herring	*Alosa aestivalis*	C	A	A	A	A		
Alewife	*Alosa pseudoharengus*	C	C	C	A	C		
American shad	*Alosa sapidissima*	A	A	A	A	C		
Atlantic menhaden	*Brevoortia tyrannus*	R		R	R			
Bay anchovy	*Anchoa mitchilli*	R		R	R			
Channel catfish	*Ictalurus punctatus*	C	R	C	R	R		
Sheepshead minnow	*Cyprinodon variegatus*	R	R	R	R	R		
Killifishes	*Fundulus species*	C	C	C	C	C		
Silversides	*Menidia species*	R		R				
White perch	*Morone americana*	A	A	C	A	A		
Striped bass	*Morone saxatilis*	C	C	C	C	C		
Yellow perch	*Perca flavescens*	C	C	C	C	C		
Bluefish	*Pomatomus saltatrix*			R				
Spot	*Leiostomus xanthurus*			C				
Mullets	*Mugil species*			R				
Gobies	*Gobiosoma species*	R	R	R	R	R		
Hogchoker	*Trinectes maculatus*	C		C				

Relative Abundance:
A = Abundant
C = Common
R = Rare
Source: NOAA, 1994

Table 3-6
Delaware Estuary Striped Bass Electrofishing Catch Comparisons
1997-2007

Station	1997		1998		1999		2000		2001		2002		2003		2004	2005		2006	2007	
STB3 - Comm Barry Bdg	1	22	4	0	0	5	5	3	1	4	3	6	2	0		2	2	0	1	0
STB5 - Chester Isd	**12**	**15**	**4**	**20**	**4**	**1**	**2**	**1**	**1**	**2**					**1**					
STB6 - Monds Isd	4	14	3	3	2	6	8	12	5	12	0	1	0	0	0	4	3	0	1	0
STB7 - Lower Tinicum	8	7	6	2	3	6	9	2	1	7	4	6	0	26	5	6	8	6	4	2
STB8 - Upper Tinicum	2	5	8	0	7	0	3	2	1	0	37	5	12	15	6	9	0	6	0	5
STB8 Sand Bar new2007																			3	7
STB16 - Mobile Oil	2	10	15	7	3	0	18	9	3	20	2	0	2	1	10	1	0	0	3	0
STB18 - Mantua Ck	39	25	6	6	15	16	10	28	7	12	3	1	20	3	1	20	55	24	5	10
STB19 - Woodburry Ck	**8**	**5**	**5**	**2**	**9**	**17**	**3**	**12**	**0**	**2**	**0**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**0**
STB20 - Ferry Slip	25	27	3	5	5	0	0	9	3	3	3	63	22	20	20	5	36	40	12	13
STB23 - Upper Navy	11	21	22	12	8	11	9	30	6	27	7	27	30	8	9	3	17	6	2	10
STB24 - Big Timber Ck	1	2	4	0	0	1	1	1	0	1	0	0	1	0	4	0	0	0	0	0
STB25 - Lower Navy	22	76	5	26	12	24	4	2	1	22	0	19	18	6	9	16	25	62	1	9
STB26 - UPS	2	5	9	10	2	0	1	0	0	6	4	0	0	1	0	0	0	2	0	4
STB28 - Lower Petty Isd	10	8	15	4	11	22	2	1	11	12	37	5	1	5	7	4	1	69	3	7
STB29 - Upper Petty Isd	2	10	29	6	12	0	4	16	3	13	0	1	1	0	6	4	9	6	0	6
STB30 - Betsy Ross Bdg	13	5	6	10	14	3	22	8	10	0	19	15	6	3	1	4	6	6	0	2
STB31 - Tacony-Palmyra Bdg	41	41	4	12	14	3	12	16	11	3	56	8	4	7	5	4	1	2	0	2
STB32 - Riverton	7	9	4	4	11	7	16	4	18	6	26	20	3	32	3	2	3	1	1	0
STB33 - Cinnaminson	13	5	4	6	5	0	11	7	36	1	46	3	9	9	4	2	0	3	3	5
STB34 - Pennypack Ck	**6**	**0**	**1**	**3**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**1**								
STB35 - Dredge Harbor	19	8	17	7	3	6	18	3	3	2	16	3	1	1	3	1	2	3	1	0
STB36 - Rancocus Ck													10	3	4	0	1	1	1	0
STB39 - Breakwater										50	10	3	3	1	9	0	7	6	1	9

Total number of striped bass captured during standard 1000 second run
Source: PFBC, 2010

Table 3-7
PWD Electrofishing Results: Fish Species Collected

Common Name	Scientific Name	Number Collected	Percent Contribution
blueback herring	*Alosa aestivalis*	302*	53.7
American shad	*Alosa sapidissima*	202*	35.9
white catfish	*Ameiurus catus*	1	0.2
American eel	*Anguilla rostrata*	1	0.2
common carp	*Cyprinus carpio*	7	1.2
gizzard shad	*Dorosoma cepedianum*	4	0.7
banded killifish	*Fundulus diaphanus*	35	6.2
channel catfish	*Ictalurus punctatus*	1	0.2
pumpkinseed sunfish	*Lepomis gibbosus*	8	1.4
striped bass	*Morone saxatilis*	1	0.2
TOTAL		562	100

* Denotes young-of-year (juvenile fish)

Source: PWD, 2009.

Table 3-8

Summary of Spring 2010 Fish Collections

Species	All Locations			Stormwater Channel			Interpier Area			River		
	April	June	Combined	April	June	Combined	April	June	Combined	April	June	Combined
Blueback herring (*Alosa aestivalis*)	0	2	2	0	0	0	0	2	2	0	0	0
Alewife (*Alosa pseudoharengus*)	0	1	1	0	0	0	0	1	1	0	0	0
Alosid Young of Year (*Alosa* sp. YOY)[1]	0	4006	4006	0	0	0	0	6	6	0	4000	4000
White catfish (*Ameiurus catus*)	0	1	1	0	0	0	0	0	0	0	1	1
Yellow bullhead (*Ameiurus natalis*)	3	0	3	0	0	0	3	0	3	0	0	0
Brown bullhead (*Ameiurus nebulosus*)	0	4	4	0	1	1	0	2	2	0	1	1
American eel (*Anguilla rostrata*)	51	17	68	46	11	57	2	1	3	3	5	8
Goldfish (*Carassius auratus*)	1	0	1	0	0	0	0	0	0	1	0	1
White sucker (*Catostomus commersonii*)	1	0	1	0	0	0	0	0	0	1	0	1
Common carp (*Cyprinus carpio*)	5	7	12	0	0	0	4	1	5	1	6	7
Gizzard shad (*Dorosoma cepedianum*)	2	4	6	0	0	0	2	2	4	0	2	2
Tessellated darter (*Etheostoma olmstedi*)	7	23	30	7	6	13	0	4	4	0	13	13
Banded killifish (*Fundulus diaphanus*)	1060	52	1112	905	16	921	155	36	191	0	0	0
Mummichog (*Fundulus heteroclitus*)	176	201	377	176	3	179	0	198	198	0	0	0
Eastern silvery minnow (*Hybognathus regius*)	14	67	81	14	23	37	0	15	15	0	29	29
Channel catfish (*Ictalurus punctatus*)	43	47	90	0	1	1	20	16	36	23	30	53
Redbreast sunfish (*Lepomis auritus*)	0	1	1	0	1	1	0	0	0	0	0	0
Pumpkinseed sunfish (*Lepomis gibbosus*)	0	12	12	0	11	11	0	1	1	0	0	0
Bluegill sunfish (*Lepomis macrochirus*)	3	0	3	3	0	3	0	0	0	0	0	0
Largemouth bass (*Micropterus salmoides*)	0	2	2	0	2	2	0	0	0	0	0	0
White perch (*Morone americana*)	14	126	140	13	3	16	0	111	111	1	12	13
Striped bass (*Morone saxatilis*)	5	41	46	0	0	0	2	20	22	3	21	24
Morone sp. YOY	0	8	8	0	0	0	0	8	8	0	0	0
Spottail shiner (*Notropis hudsonius*)	2	0	2	2	0	2	0	0	0	0	0	0
Yellow perch (*Perca flavescens*)	0	1	1	0	0	0	0	1	1	0	0	0
Black crappie (*Pomoxis nigromaculatus*)	0	1	1	0	0	0	0	1	1	0	0	0
Hogchoker (*Trinectes maculatus*)	0	3	3	0	0	0	0	0	0	0	3	3
Taxa richness (number of species; s)	15	22	27	8	11	13	7	18	19	7	12	14
Number of individuals (N)	1387	4627	6014	1166	78	1244	188	426	614	33	4123	4156
Shannon diversity, base e			1.15			0.52			0.41			0.42
Shannon equitability (evenness), base e			0.35			0.20			0.14			0.16
Simpson's dominance			0.48			0.57			0.86			0.93
Percent dominant taxon			66.6%			74.0%			32.2%			96.2%

[1]Alosid YOY may be blueback herring, alewife, American shad, or hickory shad

Table 3-9
Delineated Waters of the United States
Southport Development Project

ID	Area (Acres)	Total Area (Acres)
Nontidal Isolated Wetlands		
Wetland A	0.05	3.75
Wetland B	0.57	
Wetland C	0.13	
Wetland D	1.21	
Wetland E	1.66	
Wetland F	0.13	
Intertidal / Subtidal		
Stormwater (Intertidal) Channel	0.73	12.98
Intertidal NAVD88 (elevation -3.15 ft to 4.48 ft)	5.88	
Subtidal NAVD88 (elevation -9.75 ft to -3.15 ft)	7.10	
Deep Water*		
Deep Water NAVD88 (elevation < -9.75 ft)	4.71	4.71

* Deep water in dredged template not included.

See Appendix K for more detail

Table 3-10
List of Mammalian Species
Potentially Present within the Southport Development Project Area

Common Name	Species
Short-tailed shrew	*Blarina brevicauda*
Least shrew	*Cryptotis parva*
Masked shrew	*Sorex cinereus*
Eastern mole	*Scalopus aquaticus*
Star-nosed mole	*Condylura cristata*
Big brown bat	*Eptesicus fuscus*
Silver-haired bat	*Lasionycteris noctivagans*
Red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*
Little-footed bat	*Myotis leibii*
Northern long-eared bat	*Myotis septentrionalis*
Little brown bat	*Myotis lucifugus*
Evening bat	*Nycticeius humeralis*
Eastern pipistrelle	*Pipistrellus subflavus*
Appalachian cottontail	*Sylvilagus obscurus*
Woodchuck or groundhog	*Marmota monax*
Gray squirrel	*Sciurus carolinensis*
Fox squirrel	*Sciurus niger*
Eastern chipmunk	*Tamias striatus*
Red squirrel	*Tamiasciurus hudsonicus*
Southern flying squirrel	*Glaucomys volans*
Beaver	*Castor canadensis*
Red-backed vole	*Clethrionomys gapperi*
Pine or woodland vole	*Microtus pinetorum*
Muskrat	*Ondatra zibethicus*
Southern bog lemming	*Synaptomys cooperi*
Meadow jumping mouse	*Zapus hudsonius*
Coyote	*Canis latrans*
Gray fox	*Urocyon cinereoargenteus*
Red fox	*Vulpes vulpes*
Ermine or short-tailed weasel	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*

Source: (Carnegie Museum of Natural History, 2001.)

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Philadelphia County Plant Species						
Aeschynomene virginica	Sensitive Joint-vetch	G2	SX	PX	PX	
Aletris farinosa	Colic-root	G5	S1	TU	PE	
Alopecurus aequalis	Short-awn Foxtail	G5	S3	N	PT	
Amaranthus cannabinus	Waterhemp Ragweed	G5	S3	PR	PR	
Ammannia coccinea	Scarlet Ammannia	G5	S2	PE	PT	
Andropogon gyrans	Elliott's Beardgrass	G5	S3	N	PR	
Aristida longespica var. geniculata	Spiked Needlegrass	G5T5?	SU	TU	WATCH	
Asclepias rubra	Red Milkweed	G4G5	SX	PX	PX	
Asclepias variegata	White Milkweed	G5	S1	TU	PE	
Asplenium pinnatifidum	Lobed Spleenwort	G4	S3	N	PR	
Baccharis halimifolia	Eastern Baccharis	G5	S3	PR	PR	
Bidens bidentoides	Swamp Beggar-ticks	G3G4	S1	PT	PE	
Bidens laevis	Beggar-ticks	G5	S1	N	PE	
Carex hyalinolepis	Shore-line Sedge	G4G5	SX	PX	PX	
Chamaesyce polygonifolia	Small Sea-side Spurge	G5?	S2	PT	PT	
Chasmanthium laxum	Slender Sea-oats	G5	S1	PE	PE	
Chrysopsis mariana	Maryland Golden-aster	G5	S1	PT	PE	
Cirsium horridulum	Horrible Thistle	G5	S1	PE	PE	
Cladium mariscoides	Twig Rush	G5	S2	PE	PE	
Clitoria mariana	Butterfly-pea	G5	S1	PE	PE	
Collinsia verna	Spring Blue-eyed Mary	G5	S4	PR	WATCH	
Cuscuta campestris	Dodder	G5	S2	N	PT	
Cuscuta pentagona	Field Dodder	G5	S2	N	PT	
Cyperus diandrus	Umbrella Flatsedge	G5	S2	PE	PE	
Cystopteris tennesseensis	Bladder Fern	G5	S1	N	TU	
Desmodium laevigatum	Smooth Tick-trefoil	G5	SU	N	TU	
Desmodium nuttallii	Nuttalls' Tick-trefoil	G5	S2	TU	TU	
Desmodium obtusum	Stiff Tick-trefoil	G4G5	SU	N	TU	
Echinochloa walteri	Walter's Barnyard-grass	G5	S1	PE	PE	
Elatine americana	Long-stemmed Water-wort	G4	SU	PX	PE	
Eleocharis obtusa var. peasei	Wrights Spike Rush	G5TNR	S1	PE	PE	
Eleocharis parvula	Little-spike Spike-rush	G5	S1	PE	PE	
Elephantopus carolinianus	Elephant's Foot	G5	S3	PE	PR	
Ellisia nyctelea	Ellisia	G5	S2	PT	PT	
Epilobium strictum	Downy Willow-herb	G5?	S3	PE	PR	
Erianthus giganteus	Sugar Cane Plumegrass	G5	SX	PX	PX	
Eryngium aquaticum	Marsh Eryngo	G4	SX	PX	PX	
Eupatorium rotundifolium	A Eupatorium	G5	S3	TU	TU	
Eurybia spectabilis	Low Showy Aster	G5	S1	PE	PE	

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Philadelphia County Plant Species Cont'						
Euthamia tenuifolia	Grass-leaved Goldenrod	G5	S1	PT	PT	
Fimbristylis annua	Annual Fimbry	G5	S2	PT	PT	
Galactia regularis	Eastern Milk-pea	G5	SX	PX	PX	
Galactia volubilis	Downy Milk-pea	G5	SX	PX	PX	
Gentiana saponaria	Soapwort Gentian	G5	S1S2	TU	PE	
Glyceria obtusa	Blunt Manna-grass	G5	S1	PE	PE	
Gratiola aurea	Golden Hedge-hyssop	G5	S1	TU	PE	
Heteranthera multiflora	Multiflowered Mud-plantain	G4	S1	PE	PE	
Hydrocotyle umbellata	Many-flowered Pennywort	G5	SH	PX	PX	
Hypericum densiflorum	Bushy St. John's-wort	G5	S3	PT	PR	
Hypericum stragulum	St Andrew's-cross	G4	S2	N	PT	
Isotria medeoloides	Small-whorled Pogonia	G2	S1	PE	PE	LT
Juncus biflorus	Grass-leaved Rush	G5	S2	TU	PT	
Juncus dichotomus	Forked Rush	G5	S1	PE	PE	
Juncus scirpoides	Scirpus-like Rush	G5	S1	PE	PE	
Juniperus communis	Common Juniper	G5	S2	N	TU	
Lathyrus palustris	Vetchling	G5	S1	TU	PE	
Lathyrus venosus	Veiny Pea	G5	S2	N	PE	
Lemna obscura	Little Water Duckweed	G5	SX	PX	PX	
Lemna perpusilla	Minute Duckweed	G5	S1S3	N	TU	
Lemna valdiviana	Pale Duckweed	G5	SH	PX	PX	
Leucothoe racemosa	Swamp Dog-hobble	G5	S2S3	TU	PT	
Limosella australis	Awl-shaped Mudwort	G4G5	SX	PX	PX	
Lycopodiella appressa	Southern Bog Clubmoss	G5	S2	PT	PT	
Lycopus rubellus	Bugleweed	G5	S1	PE	PE	
Lyonia mariana	Stagger-bush	G5	S1	PE	PE	
Lythrum alatum	Winged-loosestrife	G5	S1	TU	PE	
Matelea obliqua	Oblique Milkvine	G4?	S1	PE	PE	
Micranthemum micranthemoides	Nuttall's Mud-flower	GH	SX	PX	PX	
Monarda punctata	Spotted Bee-balm	G5	SH	PE	PE	
Muhlenbergia uniflora	Fall Dropseed Muhly	G5	S2	PE	PT	
Myriophyllum heterophyllum	Broad-leaved Water-milfoil	G5	S4	PE	SP	
Oenothera oakesiana	Evening-primrose	G4G5Q	S2	N	PT	
Opuntia humifusa	Prickly-pear Cactus	G5	S3	PR	PR	
Oxypolis rigidior	Stiff Cowbane	G5	S2	TU	PT	
Panicum commonsianum var. commonsianum	Commons' Panic-grass	G5TNR	SH	TU	PX	

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Philadelphia County Plant Species Cont'						
Panicum polyanthes	Panic-grass	GNR	S4	N	WATCH	
Panicum scoparium	Velvety Panic-grass	G5	S1	PE	PE	
Passiflora lutea	Passion-flower	G5	S2	PE	PT	
Phaseolus polystachios	Wild Kidney Bean	G5	S1S2	N	PE	
Phlox pilosa	Downy Phlox	G5	S1S2	TU	PE	
Phyllanthus caroliniensis	Carolina Leaf-flower	G5	S1	PE	PE	
Physalis virginiana	Virginia Ground-cherry	G5	S1S2	TU	PE	
Pinus echinata	Short-leaf Pine	G5	S1S2	N	PT	
Piptochaetium avenaceum	Blackseed Needlegrass	G5	S1	N	PE	
Pluchea odorata	Shrubby Camphor-weed	G5	S1	TU	PE	
Poa autumnalis	Autumn Bluegrass	G5	S1	PE	PE	
Polygala cruciata	Cross-leaved Milkwort	G5	S1	PE	PE	
Potamogeton vaseyi	Vasey's Pondweed	G4	S1	PE	PE	
Prenanthes serpentaria	Lion's-foot	G5	S3	N	PT	
Ptilimnium capillaceum	Mock Bishop-weed	G5	SX	PE	PX	
Pycnanthemum verticillatum var. pilosum	Hairy Mountain-mint	G5T5	SH	TU	PX	
Pyrola chlorantha		G5	S1	N	PE	
Quercus falcata	Southern Red Oak	G5	S1	PE	PE	
Quercus phellos	Willow Oak	G5	S2	PE	PE	
Ranunculus aquatilis var. diffusus	White Water-crowfoot	G5T5	S3		PR	
Ranunculus flammula	Lesser Spearwort	G5	SH	TU	PX	
Ranunculus pusillus	Spearwort	G5	S1	N	PE	
Sagittaria calycina var. spongiosa	Long-lobed Arrow-head	G5T4	S1	PE	PE	
Sagittaria subulata	Subulate Arrowhead	G4	S3	PR	PR	
Schoenoplectus fluviatilis	River Bulrush	G5	S3	PR	PR	
Schoenoplectus smithii	Smith's Bulrush	G5?	S1	PE	PE	
Scleria pauciflora	Few Flowered Nutrush	G5	S2	PT	PT	
Senna marilandica	Wild Senna	G5	S3	TU	PR	
Sericocarpus linifolius	Narrow-leaved White-topped Aster	G5	S1	PE	PE	
Sisyrinchium fuscatum	Sand Blue-eyed Grass	G5?	SH	PX	PX	
Solidago uliginosa	Bog Goldenrod	G4G5	S2	N	PT	
Sparganium androcladum	Branching Bur-reed	G4G5	S1	PE	PE	
Spiranthes lucida	Shining Ladies'-tresses	G5	S3	N	PT	
Spiranthes vernalis	Spring Ladies'-tresses	G5	S1	PE	PE	
Strophostyles umbellata	Wild Bean	G5	S2	N	PE	
Stylosanthes biflora	Pencilflower	G5	S2	TU	PE	

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Philadelphia County Plant Species Cont'						
Symphyotrichum novi-belgii	New York Aster	G5	S2	PT	PT	
Trichostema setaceum	Blue-curls	G5	S1	PE	PE	
Triosteum angustifolium	Horse-gentian	G5	S1	TU	PE	
Triphora trianthophora	Nodding Pogonia	G3G4	SH	PE	PE	
Triplasis purpurea	Purple Sandgrass	G4G5	S1	PE	PE	
Tripsacum dactyloides	Eastern Gamma-grass	G5	S1	TU	PE	
Veratrum virginicum	Virginia Bunchflower	G5	S1	N	PE	
Vernonia glauca	Tawny Ironweed	G5	S1	PE	PE	
Viburnum trilobum	Highbush-cranberry	G5T5	S3S4	TU	PR	
Viola brittoniana	Coast Violet	G4G5	S1	PE	PE	
Woodwardia areolata	Netted Chainfern	G5	S2	N	PT	
Zizania aquatica	Indian Wild Rice	G5	S3	PR	PR	

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Philadelphia County Vertebrate Species						
Umbra pygmaea	Eastern Mudminnow	G5	S3	PC	CP	
Botaurus lentiginosus	American Bittern	G4	S1B	PE	PE	
Enneacanthus obesus	Banded Sunfish	G5	S1	PE	PE	
Nycticorax nycticorax	Black-crowned Night-heron	G5	S2S3B	PE	PE	
Glyptemys muhlenbergii	Bog Turtle	G3	S2	PE	PE	LT
Rana sphenocephala	Coastal Plain Leopard Frog	G5	S1	PE	PE	
Casmerodius albus	Great Egret	G5	S1B	PE	PE	
Rallus elegans	King Rail	G4	S1B	PE	PE	
Ixobrychus exilis	Least Bittern	G5	S1B	PE	PE	
Falco peregrinus	Peregrine Falcon	G4	S1B,S1N	PE	PE	
Asio flammeus	Short-eared Owl	G5	S1B,S3N	PE	PE	
Acipenser brevirostrum	Shortnose Sturgeon	G3	S1	PE	PE	LE
Acipenser oxyrinchus	Atlantic Sturgeon	G3	S1	PE	PE	LE
Noturus gyrinus	Tadpole Madtom	G5	S1	PE	PE	
Gasterosteus aculeatus	Threespine Stickleback	G5	S1	PE	PE	
Haliaeetus leucocephalus	Bald Eagle	G5	S2B	PT	PT	
Pandion haliaetus	Osprey	G5	S2B	PT	PT	
Pseudemys rubriventris	Redbelly Turtle	G5	S2S3	PT	CA	
Tyto alba	Barn Owl	G5	S3B,S3N		CR	
Kinosternon subrubrum	Eastern Mud Turtle	G5	S1		PX	
Phocoena phocoena	Harbor Porpoise	G4G5	SNA			
Phoca vitulina	Harbor Seal	G5	SNA			
Cistothorus palustris	Marsh Wren	G5	S2S3B		CR	
Circus cyaneus	Northern Harrier	G5	S3B,S4N		CA	
Podilymbus podiceps	Pied-billed Grebe	G5	S3B,S4N		CR	
Aphredoderus sayanus	Pirate Perch	G5	SX		PX	
Lasionycteris noctivagans	Silver-haired Bat	G5	SUB		CR	
Rallus limicola	Virginia Rail	G5	S3B			

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Philadelphia County Invertebrate Species						
Alasmidonta heterodon	Dwarf Wedgemussel	G1G2	S1	PE	PE	LE
Alasmidonta varicosa	Brook Floater	G3	S2		PE	
Anodonta implicata	Alewife Floater	G5	S3S4		CU	
Atrytonopsis hianna	Dusted Skipper	G4G5	S2			
Callophrys gryneus	Juniper Hairstreak	G5	S3			
Celithemis eponina	Halloween Pennant	G5	S2S3			
Datana ranaeceps	A Hand-maid Moth	G3G4	S1			
Enallagma durum	Big Bluet	G5	S3			
Euphyes conspicuus	Black Dash	G4	S3			
Gomphaeschna antilope	Taper-tailed Darner	G4	SH			
Hemileuca maia	Barrens Buckmoth	G5	S1S2			
Hesperia metea	Cobweb Skipper	G4G5	S2			
Lampsilis cariosa	Yellow Lampmussel	G3G4	S3S4		CU	
Lasmigona subviridis	Green Floater	G3	S2		CU	
Libellula incesta	Slaty Skimmer	G5	S3S4			
Libellula needhami	Needham's Skimmer	G5	SH			
Ligumia nasuta	Eastern Pondmussel	G4	S1		N	
Lycaena hyllus	Bronze Copper	G5	S3			
Nastra lherminier	Swarthy Skipper	G5	S3			
Nicrophorus americanus	American Burying Beetle	G2G3	SH			
Papilio cresphontes	Giant Swallowtail	G5	S2			
Satyrium titus	Coral Hairstreak	G5	S3			
Speyeria idalia	Regal Fritillary	G3	S1			
Stylurus plagiatus	Russet-tipped Clubtail	G5	S1			

Basic Global Rank Codes and Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

The Nature Conservancy (6 August 1996 version)

G2 **Imperiled** - Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or stream miles (10 to 50).

G3 **Vulnerable** - Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4 **Apparently Secure** - Uncommon but not rare, and usually widespread. Possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5 **Secure** - Common, typically widespread and abundant. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

G#G# **Range Rank** - A numeric range rank (e.g., G2G3) is used to indicate uncertainty about the exact status of a taxon.

? **Inexact Numeric Rank** - Denotes inexact numeric rank.

Q **Questionable Taxonomy** - Taxonomic status is questionable; numeric rank may change with taxonomy.

T **Infraspecific Taxon** (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species= basic rank (e.g.., a G1T2 subrank should not occur). A population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T rank to denote the taxon's questionable taxonomic status.

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

State Rank Codes and Definitions

The Nature Conservancy (6 August 1996 version)

SX	**Extirpated** - Element is believed to be extirpated from the "state" (or province or other subnational unit).
SH	**Historical** - Element occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an Element would become SH without such a 20-year delay if the only known occurrences in a state were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, SH-ranked Elements would typically receive an S1 rank. The SH rank should be reserved for Elements for which some effort has been made to relocate occurrences, rather than simply ranking all Elements not known from verified extant occurrences with this rank.
S1	**Critically Imperiled** - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals or acres.
S2	**Imperiled** - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 occurrences or few remaining individuals or acres.
S3	**Vulnerable** - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences.
S4	**Apparently Secure** - Uncommon but not rare, and usually widespread in the state. Usually more than 100 occurrences.
S5	**Secure** - Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.
SU	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible, the most likely rank is assigned and a question mark added (e.g.., S2?) to express uncertainty, or a range rank (e.g.., S2S3) is used to delineate the limits (range) of uncertainty.
S#S#	**Range Rank** - A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the Element. Ranges cannot skip more than one rank (e.g.., SU should be used rather than S1S4).

Pennsylvania Plant Status Codes and Definitions

Native Plant Species Legislative Authority: Title 17 Chapter 45, Conservation of Native Wild Plants, January 1, 1988; Pennsylvania Department of Conservation and Natural Resources.

PE	**Pennsylvania Endangered** - Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.
PT	**Pennsylvania Threatened** - Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.
PR	**Pennsylvania Rare** - Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.
Disjunct	Significantly separated from their main area of distribution
Endemic	Confined to a specialized habitat.
Limit of Range	At or near the periphery of their natural distribution
Restricted	Found in specialized habitats or habitats infrequent in Pennsylvania.
PX	**Pennsylvania Extirpated** - Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.
TU	**Tentatively Undetermined** - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxanomic uncertainties, limited evidence within historical records, or insufficient data.

Table 3-11
List of Rare, Threatened, and Endangered Species Potentially Found Within Philadelphia County

Pennsylvania Biological Survey (PBS) Suggested Status Definitions

Note: the same PBS Status codes and definitions are used for all PNDI tracked species.

PE	**Pennsylvania Endangered** - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.
PT	**Pennsylvania Threatened** - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".
PR	**Pennsylvania Rare** - Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.
Disjunct	Significantly separated from their main area of distribution
Endemic	Confined to a specialized habitat.
Limit of Range	At or near the periphery of their natural distribution
Restricted	Found in specialized habitats or habitats infrequent in Pennsylvania.
PX	**Pennsylvania Extirpated** - Species that have disappeared from Pennsylvania since 1600 but still exist elsewhere.

Federal Status Codes and Definitions

Native Plant and Animal Species Legislative Authority: United States Endangered Species Act of 1973: Public Law 93-205. U.S. Fish and Wildlife Service.

LT	**Listed Threatened** - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Null value	Usually indicates that the taxon does not have any federal status. However, because of potential lag time between publication in the Federal Register and entry in the central databases and refresh of this website, some taxa may have a status which does not yet appear.

Table 3-12
Demographic Information for City of Philadelphia

General Characteristics	Number	Percent
Total Population	1,517,550	
Male	705,107	46.5
Female	812,443	53.5
Median age (years)	34.2	
Under 5 years	98,161	6.5
18 years and over	1,134,081	74.7
65 years and over	213,722	14.1
One race	1,483,976	97.8
White	683,267	45
Black or African American	655,824	43.2
American Indian or Alaska Native	4,073	0.3
Asian	67,654	4.5
Native Hawaiian and Other Pacific Islanders	729	0
Some other race	72,429	4.8
Two or more races	33,574	2.2

Source: U.S. Census 2000 data

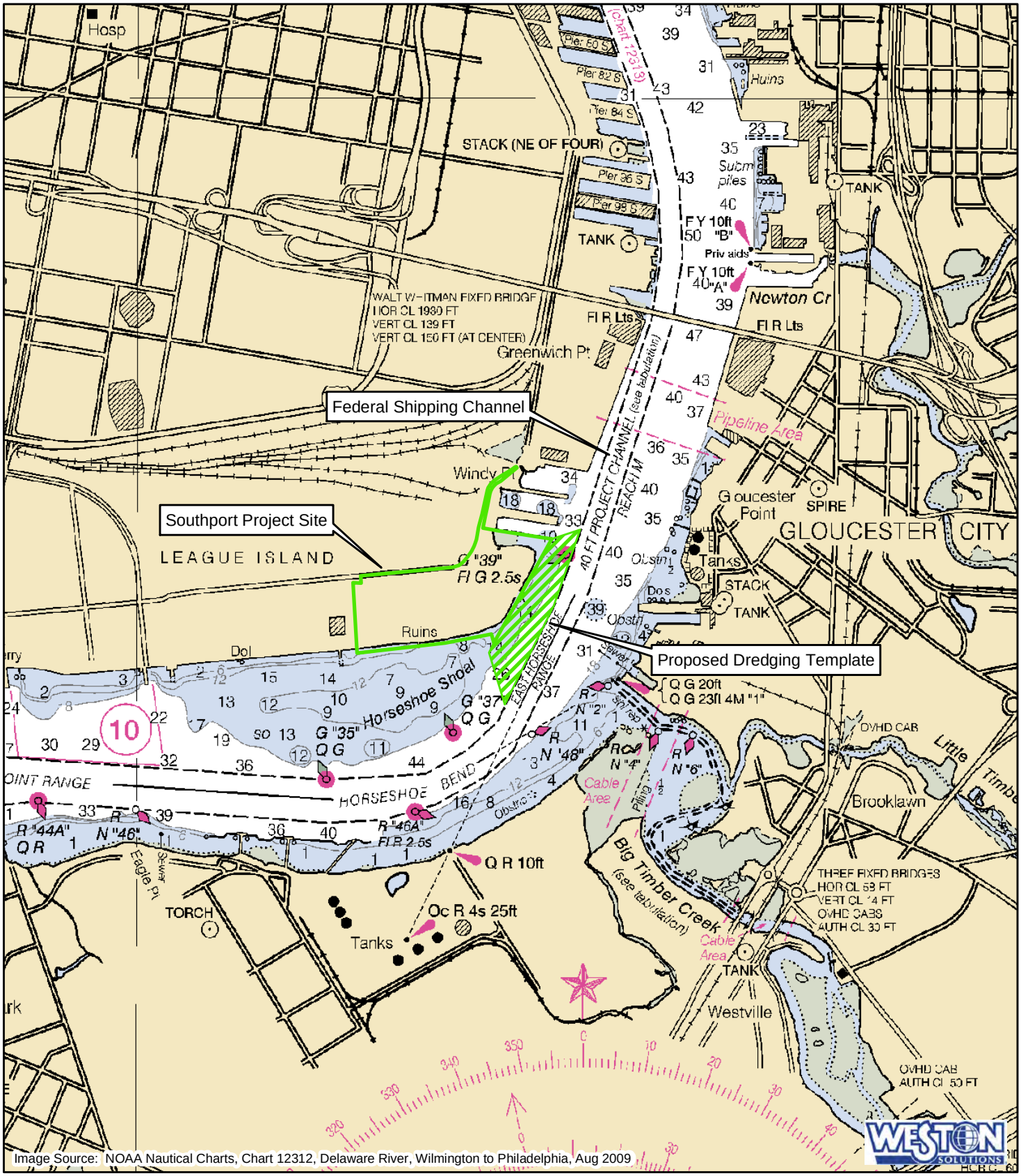
Table 3-13
Demographic Information for Zip Code 19112 (Philadelphia Navy Yard), 19113 (West of Navy Yard), 19153 (West of Navy Yard), 19148 (North of Navy Yard)

General Characteristics	Number	Percent
Total Population	61,062	
Male	28,361	46.4
Female	32,701	53.6
Median age (years)	34.2-37.3	
Under 5 years	3,601	
18 years and over	46,685	
65 years and over	10,077	
One race	59,531	97.5
White	40,376	66.1
Black or African American	12,536	20.5
American Indian or Alaska Native	123	0.2
Asian	5,450	8.9
Native Hawaiian and Other Pacific Islanders	39	0
Some other race	1,007	1.6
Two or more races	1,531	2.5

Source: U.S. Census 2000 data

SECTION 3

FIGURES



Legend

- Southport Project Site Boundary
- Proposed Dredging Template

N
W E
S

0 1,250 2,500
Feet

Figure 3-1
Delaware River Hydraulic Features Relative to the Southport Terminal Site

Southport Development Project
Philadelphia, PA

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Legend

Southport

Flood Zones

- 0.2 Percent Annual Chance Flood Hazard
- A - No Base Flood Elevations Determined
- AE - Base Flood Elevations Determined
- X - Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood

N W E S

0 250 500 Feet

Figure 3-2
100-Year Floodplain
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

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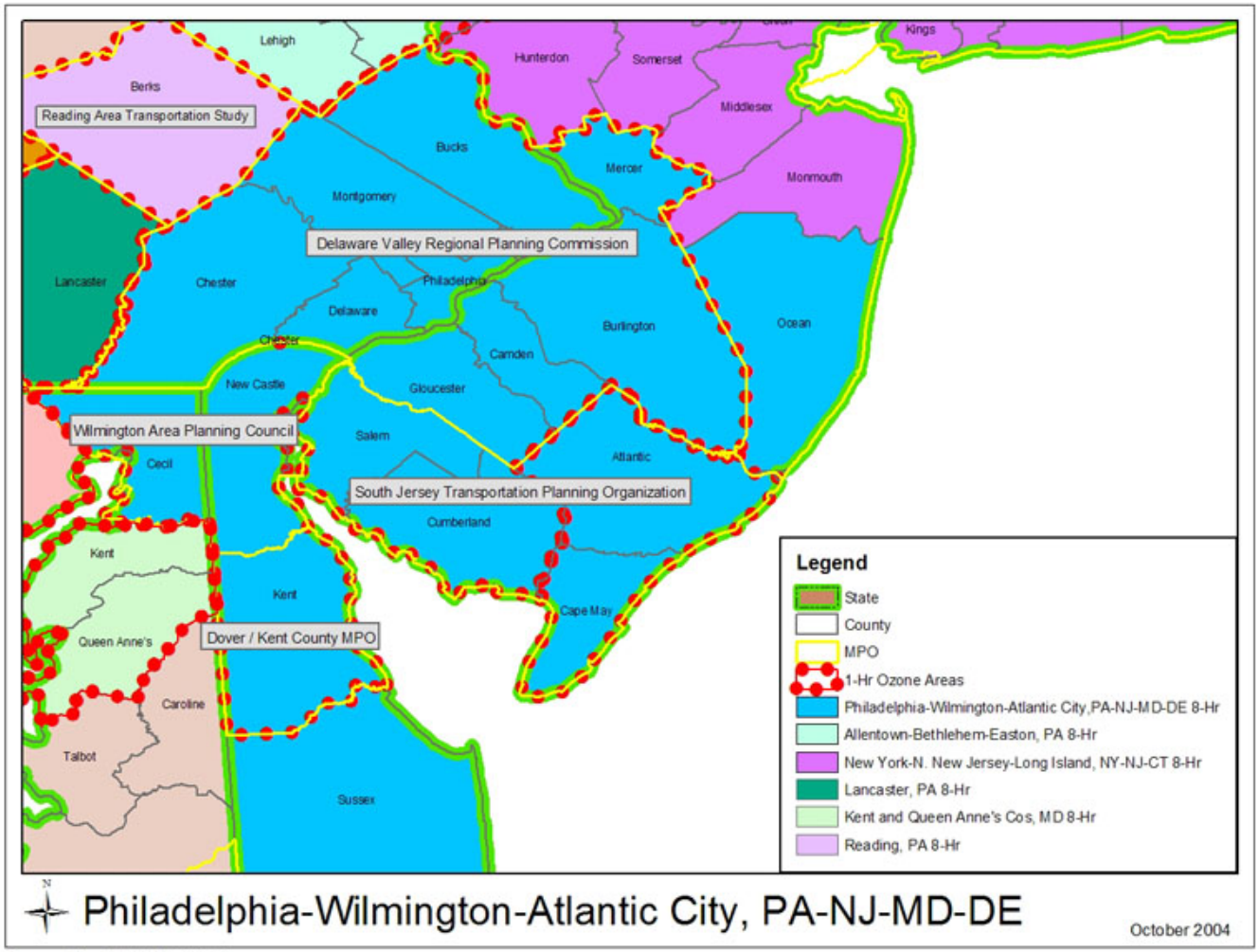
Figure 3–3
Hour Ozone Nonattainment Area in the Philadelphia Area



Prepared by FHWA-HEPN-40

Legend

- Proposed Southport Development Project Footprint (Option B)
- Proposed Dredging Template
- Intertidal Zone *
- Subtidal Zone *
- Stormwater Channel
- Macrobenthic Sample Locations - Samples Collected During May Benthic Sampling Conducted by WESTON
- Fish Sample Locations - Samples Collected During April & June Fish Sampling Conducted by WESTON
- Striped Bass Breeding Habitat (PA Fish and Boat Commission)
- Track of the PWD, November 2009 Electrofishing Run

SAV Sample Points

- Barren
- Supports SAV
- Approximate Location of SAV bed

* Location of Submerged Aquatic Vegetation (SAV) Survey Conducted by Joseph R. Arsenault

N
W E
S

0 300 600 1,200 Feet

Figure 3-4
Aquatic Resource Inventory
Southport Development Project
Philadelphia, Pennsylvania

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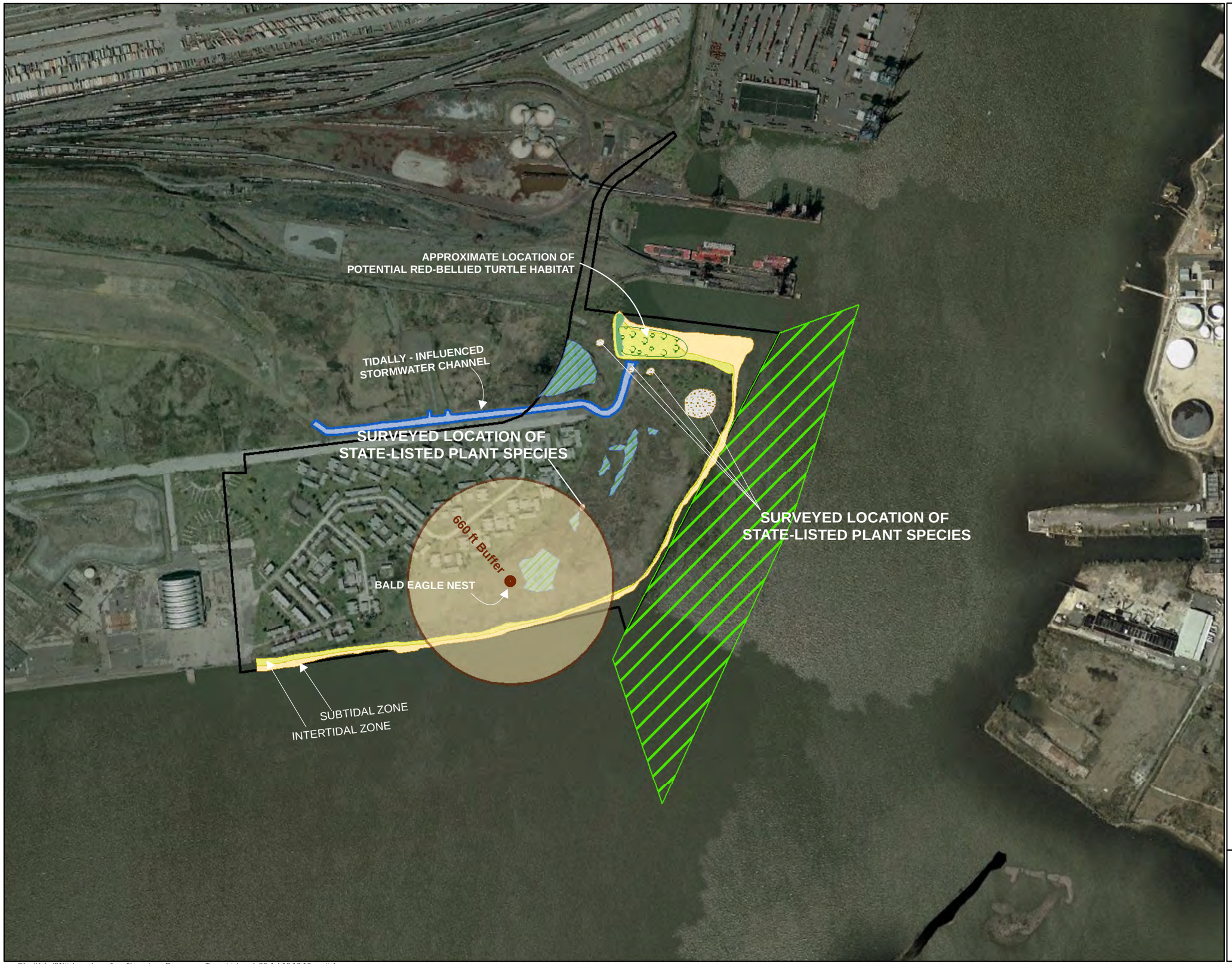

Legend

- Proposed Southport Development Project Footprint (Option B)
- Proposed Dredging Template
- Intertidal Zone
- Subtidal Zone
- Stormwater Channel
- Blad Eagle Nest 660 ft Buffer
- Surveyed Location of State - Listed Species - Joseph R. Arsenault
- Red-Bellied Turtle Habitat - Herpetological Associates, Inc.
- Non-Tidal Wetlands - WESTON
- Intertidal Wetlands - WESTON

N
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0 300 600 1,200 Feet

Figure 3-5
Terrestrial Resource Inventory
Southport Development Project
Philadelphia, Pennsylvania

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Legend

Southport

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0 700
Feet

Figure 3-6
Railroads
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

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4. ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Alternatives for the proposed Southport Development Project were subject to a comprehensive screening process as described in Section 2 in order to identify the recommended plan for the proposed action. This section evaluates the environmental impacts of the federal action associated with implementing the recommended plan, including those resulting from construction, dredging, and dredged material placement. Environmental impacts evaluated under NEPA typically include direct impacts, which are caused by the action and occur at the same time and place, and indirect impacts, which are caused by the action and are later in time or farther removed in assistance but still reasonably foreseeable, to the extent attributable to those portions of the project over which USACE has sufficient control and responsibility to warrant federal review. (See 40 CFR Part 1508 and 33 C.F.R. Part 325, Appendix B.)

4.2 NO ACTION ALTERNATIVE

4.2.1 Physical Conditions

The No Action Alternative would have no effect on the physical conditions of the area since construction of the wharf and bulkhead, filling and alteration of the existing shoreline, and dredging of 1.3 mcy of material from the river bottom would not occur. There would be no effects on the site hydrology and bathymetry, tidal range, river hydraulics, and sediment transport in the Delaware River as a result of the No Action Alternative.

4.2.2 Geology, Soils, and Sediments

Geology, soils, and sediments would not be impacted under the No Action Alternative. Because grading and filling of the site and dredging and dredged material placement would not occur, there would be no increase in the cross-sectional area of the river resulting from the increased channel depth. Without any alterations of the river channel, shoaling rates and locations are not expected to change in the vicinity of the proposed Southport facility.

4.2.3 Groundwater

Implementation of the No Action Alternative is not expected to impact the existing groundwater resources.

4.2.4 Surface Water Quality

Surface water quality would not be affected. Since ground disturbance and increased stormwater flow would not occur at the proposed Southport Development Project site, the surrounding surface waters would not experience additional turbidity by maintaining the status quo. Likewise, the temporary impacts from dredging and dredged material placement would not occur.

4.2.5 Coastal Zone

Implementing the No Action Alternative would have no effect on Coastal Zone Management because no alteration of the coastal zone or adjacent areas would occur.

4.2.6 Climate Change and Sea Level Rise

Implementing the No Action Alternative will have no effect on climate change or sea level rise since construction and operation of the container terminal would not occur.

4.2.7 Hazardous, Toxic, and Radioactive Waste

Implementing the No Action Alternative would not affect HTRW at the site since construction and operation of the container terminal would not occur.

4.2.8 Air Quality

Implementing the No Action Alternative involves no construction or subsequent operation of a container terminal. This would result in no increase in short- or long-term air emissions from construction, dredging, or disposal of dredged materials.

4.2.9 Aquatic Resources

Construction and filling of open-water habitat along the shoreline would not occur under the No Action Alternative. Since dredging and the wharf/bulkhead construction would not occur, the existing benthic habitat would not be impacted. Maintaining the status quo would not cause any additional impacts to finfish, fish habitat, SAV, or benthic species.

4.2.10 Wetlands

There would be no impacts to isolated or tidal wetlands under the No Action Alternative since construction and operation of the container terminal would not occur.

4.2.11 Terrestrial Resources

The clearing and grading of approximately 116 acres of primarily terrestrial habitat would not occur. Mammalian, avian, herpetile, and plant species or habitats would not be affected by maintaining the status quo.

4.2.12 Rare, Threatened, and Endangered (RTE) Species

Under the No Action Alternative the container terminal would not be built and operated, construction activities and dredging would not occur, and ship traffic would not increase. The aquatic or terrestrial RTE species and habitat known to exist in the project or action areas would not be affected.

4.2.13 Recreation

Recreational activities and recreational resources in the project area would not be affected by maintaining the status quo.

4.2.14 Cultural Resources

The Phase IA Cultural Resources Assessment conducted in January 2010 (see Appendix H) concluded that the proposed project site is considered to have no potential for containing significant historic archaeological remains and the existing architecture greater than 50 years of age does not meet the criteria to be eligible for listing on NRHP. Any known or unknown cultural resources on or adjacent to the project site would not be affected by maintaining the status quo.

4.2.15 Socioeconomics

Significant beneficial impacts to the local and regional economy would not be realized under the No Action Alternative. The regional socioeconomic beneficial impacts of the construction and operation of the proposed Southport facility would include business revenue impacts, employment impacts, personal earnings impact, and tax revenue impacts. If the facility were not built, approximately $871.0 million of projected business revenue to local service providers (Econsult, 2010) would not be generated during the startup year alone. Approximately 7,310 direct, induced, and indirect annual jobs (Econsult, 2010) would not be generated. It is estimated that $52.3.2 million of local purchases would not be made during the startup year to support the

terminal operations and the state and local governments would not realize a projected $149.6 million increase in annual tax revenue (Econsult, 2010).

Construction and operation of the proposed Southport facility is critical in maintaining the City of Philadelphia's position in the very competitive container shipping trade. Failure to build the terminal will severely constrain Philadelphia's ability to compete for new and growing container traffic on the East Coast, resulting in loss of market share to other Mid-Atlantic U.S. ports such as New York, Norfolk, and Baltimore. Ultimately, this will have a negative impact on the local and regional economies, particularly in terms of employment, business revenue, and tax revenue.

4.2.16 Transportation

There would be no impacts to the surrounding transportation system by not building the container terminal at the proposed Southport site and maintaining the status quo. The projected vehicular traffic increase resulting from the construction activities and long-term operation of the terminal would not occur. Without a terminal, the projected increase of approximately 260 ships per year visiting the proposed terminal would not occur.

4.2.17 Noise

Since construction and subsequent operation of the proposed Southport site would not occur, noise would not increase from the current ambient levels in the proposed project area.

4.2.18 Short-term Uses Versus Long-term Productivity

Under the No Action Alternative, there would be no change in land use at the proposed Southport site. Maintaining the status quo would have no effect on long-term economic productivity at the location and little effect on long-term productivity.

4.2.19 Irreversible or Irretrievable Commitments of Resources

The No Action Alternative would not cause the irreversible or irretrievable commitments of resources. No environmental resources would be permanently lost. There would be no change in land use and funds and irretrievable energy resources would not be used for the construction and operations at the proposed Southport site.

4.2.20 Cumulative Effects

Maintaining the status quo by not constructing the proposed Southport facility, combined with past, present, and reasonably foreseeable actions, would not cause additional cumulative effects.

4.2.21 Mitigation

No impacts would occur under the No Action Alternative; therefore, no mitigation is required.

4.3 PREFERRED ALTERNATIVE

4.3.1 Physical Conditions

Figure 1-2 shows the project footprint for the preferred alternative. Existing river depths at the proposed project site range from 0 to -45 ft MLLW. The polygonal-shaped dredging template shown in Figure 2-12 is approximately 650 ft wide and 2,600 ft long. The proposed wharf structure, which defines the near-shore edge of the berthing template, is between 498 ft and 688 ft from the Federal navigation channel. The template extends riverward to the Federal channel, providing a berthing area and an access channel. The berthing areas would be dredged initially to -42 ft mean lower low water (MLLW) (-40 ft + 2-ft optional overdredge). Should the ongoing Delaware River Main Channel Deepening Project be completed and should deeper-draft vessels begin calling at the Port of Philadelphia, the berthing areas could be dredged to -47 ft MLLW (-45 ft + 2-ft optional overdredge). It is likely the terminal would operate for several years at -42 ft MLLW before operating at -47 ft MLLW (WESTON, 2010b).

4.3.1.1 Bathymetry

Dredging would cause the bathymetry within the dredging template to change. This change is not anticipated to impact river hydraulic conditions of the Delaware River or sediment transport patterns. As shown in Figure 4-1, the overall cross section of the river would be minimally impacted by the proposed dredging, which accounts for an approximately 16% change in the total cross section. A small increase in cross-sectional area would be observed relative to the entire cross section of the river and the main conveyance is expected to remain the Federal channel. The proposed depths are the same (-40 + 2-ft overdredge) similar to those maintained at the adjacent Packer Avenue Marine Terminal, which is located similarly in the margin of the river cross section.

However, localized impacts are expected to occur within the dredging template area. Due to increased depths at the project site, flows through this area are likely to decrease slightly, causing sediment to settle at minimally higher rates than are currently experienced. It is typical to experience deposition after creating new berthing areas or channels because nature tends to fill voids. However, it should be noted the area to be dredged is not a known shoaling area and already experiences localized scouring, so increased sediment deposition rates are not expected to be significant. Sediment deposition within the dredging template would need to be managed by periodic maintenance dredging to ensure target operational depths. Annual maintenance dredging quantities are expected to be approximately 20,000 cy every 2 years, similar to those at neighboring Packer Avenue Marine Terminal.

4.3.1.2 Tides and Currents

Construction of the berthing area is anticipated to have no impact on the tides and negligible impact on currents of the Delaware River. Currently, maximum currents at the site range from 3 to 5 mph. Significant eddies and turbulence exist immediately downstream of the project site due to the abrupt widening of the entire river cross section and a bend in the Federal channel. The change in bathymetry due to dredging of the proposed template is not expected to impact the existing river hydraulics that influence river currents, as discussed below.

4.3.1.3 River Hydraulics and Sediment Transport

Construction of the berthing areas and associated dredging of the proposed template, as shown in Figure 2-12, will have limited impacts on the river hydraulic conditions and sediment deposition and transport patterns. Currently, depths within the dredge template that are closest to the Federal channel, an area of approximately 3 acres, exceed the maintained depth of the Federal channel of 40 ft. Current sediment transport patterns that cause this area of the river to experience localized scouring to depths greater than the average are not anticipated to be affected in any way. Therefore, the proposed dredging activity should not affect the maintenance of the Federal channel.

Also, as described in Section 3, the flow through the Federal channel is considered to be the dominant discharge, meaning that this conveyance carries the largest quantity of water per cross-sectional area and therefore dictates sediment transport patterns and shape of the channel bed. At the project site, the Federal shipping channel is approximately straight and then, downstream of

the project site, it bends toward the west (the Horseshoe Bend). The proposed dredging activities do not extend to the edge of the Federal channel due to naturally occurring 42 to 44 ft MLLW depths berthward of the channel edge. Deepening the berth would therefore not directly impact the Federal channel and would therefore have negligible impact on existing sediment transport patterns upstream or downstream of the project site. At the northern end of the project site, the two piers would likely continue to experience sediment deposition due to the slower flow velocities caused by the widening of the river at this point and the influences of these man-made structures.

Downstream of the project site, sediment deposition rates currently experienced within the Horseshoe Shoals are not anticipated to change because the berth dredging will not impact the predominant forcing factors for sediment transport. As such, no significant changes are expected to the existing depths in this area. Similar to the existing conditions, sediment would be transported and deposited in the Horseshoe Shoal via the Federal channel. The material would settle to a depth limited by velocities in those areas, and reach equilibrium. At times of higher flows and hydraulic energy, such as snowmelt and/or rainy periods, the shoal would erode. This pattern is typical for a bend in a river channel and a similar pattern to what is occurring now. Because no change is expected to the main hydraulic influence and transport mechanism at the site (the Federal channel), and changes in the cross section of the river are minimal and localized, no significant changes to Horseshoe Shoal are expected following the deepening of the berthing areas.

4.3.2 Geology, Soils, and Sediments

4.3.2.1 Geology

Clearing, grading, and construction of the container terminal is not expected to affect the geology in the study area, but impacts to the fill and soils would occur.

4.3.2.2 Soils

The proposed Southport Development Project would be initially constructed by excavation of the existing grounds to provide for the design capacities. At the same time, the land surface would be raised to 10.5 ft using appropriate fill material obtained from an outside source (11.4 ft to 12 ft

including the paving section). Approximately 789,000 cy of fill material would be needed to raise the ground surface to the desired elevation (Halcrow, 2010).

Approximately 73 acres of land at the site would be paved during construction of the terminal. Environmental impacts from paved surfaces, including increased runoff peak rates and volumes, would be mitigated through the use of Best Management Practices (BMPs) in the paved areas. Stormwater runoff from all paved areas is proposed to be directed to water quality inlets. The water quality inlets (Contech Vortech's devices) use hydrodynamic separation to remove grit from stormwater. An oil/water separator proposed for the area receiving heavy truck traffic is designed to remove oil and grease.

4.3.2.3 Sediment

The physical act of dredging causes some sediments to become suspended, temporarily increasing the suspended sediment concentration in the water column at the site and in areas immediately adjacent to and downstream of the dredging template. Some increased suspended sediment concentration would likely be experienced, and as these sediments settle, slightly increased rates of sediment deposition may occur in the short-term. These short-term effects are not anticipated to last beyond the duration of dredging activities and negative impacts to aquatic life in the long-term would not be significant. Furthermore, a majority of dredging would likely be conducted by means of hydraulic cutterhead and pipeline dredging, which substantially minimizes the amount of suspended sediments.

The dredging operations would require removal of up to approximately 1.3 million cy of sediment between the proposed bulkhead line and the existing navigational channel. Based on the sediment sampling results described in Section 3, concentrations of VOCs, SVOCs, pesticides, metals, and cyanide in bulk sediments, Toxicity Characteristic Leaching Procedure (TCLP) samples, and elutriate samples do not threaten human health or the environment, if disposed of/reused in a nonresidential setting. Specifically, exceedances were found in surficial sediment samples and not in the deep samples, indicating that the sediments containing concentrations of parameters that exceeded criteria were deposited recently at the site and the sediments to be dredged are similar to maintenance dredge material in this reach of the Delaware River. Note that all detected concentrations that exceeded criteria did not exceed the

nonresidential PADEP criteria and that all CDFs along the Delaware River that would be used for disposal of the material dredged from Southport are located in nonresidential settings.

Pending receipt of the dredged material disposal 401 WQC, the Commonwealth of Pennsylvania plans to dispose of material at the USACE Fort Mifflin CDF located in Philadelphia, PA, or another comparable fully permitted disposal facility along the Delaware River if the Fort Mifflin CDF is not available.

4.3.3 Groundwater

Construction activities expected to be utilized for the Southport facility include the demolition of existing surface structures, the addition of up to 10 ft of clean fill material, dredging, grading of the existing surface, installation of paving over large areas of the facility, stormwater management, and the installation of a series of pile-supported structures. The depth of the piles needed for this project are not definitively determined but are thought to be completed to a maximum depth of 86 ft, which is within the sands and gravels of the Q_p unit and above the clay layer protecting the aquifer. No other intrusive activities are expected to affect the site and no generation of or releases of compounds of concern are expected at the site during its construction, except for the occasional minor spill, which would be immediately remediated through planned BMPs. None of the proposed site-construction related activities are expected to have a harmful effect on the SSA underlying the site.

Hydrographs prepared for both this site (Paulachok, 1991) and other nearby sites (Enterprise Avenue Landfill Study, 1994a–d) were used to estimate vertical gradients present at the proposed Southport site. Vertical gradients have been estimated between each of the three major hydrostratigraphic units at the Site (Q_{al}, Q_p, and the K_{prm}). Vertical gradients between the Q_{al} and the Q_p are downward. Vertical gradients between the Q_p and the K_{prm} vary, with some downward and some upward. It is important to recognize that vertical gradients represent only differences in pressure head or potential between water-bearing zones. The pressure of a gradient does not mean that any significant flow is occurring. At the interface between the Q_{al} and the Q_p, there is a significant differential in hydraulic conductivity (5 orders of magnitude). With the limited head observed in the $Q_{al,}$ the communication between the Q_{al} and the underlying Q_p unit is thought to be minimal. Any compounds of concern present in the Q_{al} unit will therefore migrate at an extremely slow rate into the Q_p unit. In the case of the Q_p–K_{prm} gradient, substantial thicknesses

of plastic clays exist between zones; therefore, it is highly likely that no significant groundwater movement is occurring between zones. Extensive stratigraphic and hydrostratigraphic data collected both on-site and at nearby locations indicating the presence of different flow regimes in deep and shallow-intermediate water bearing zones strongly supports the presence of a competent confining layer between these units.

The proposed Southport Development Project site falls within the recharge (source) zone of the New Jersey Coastal Plain Aquifer. The New Jersey Coastal Plain Aquifer is recognized by USEPA as the "sole or principal source of drinking water" (SSA or sole source aquifer) for much of central and southern New Jersey. By USEPA definition, the entire unconsolidated aquifer (Q_{al}, Q_p and K_{prm} units) is considered to be part of the SSA. USEPA has determined that the aquifer, if contaminated, would create a significant hazard to public health. The SSA is thought to be susceptible to contamination through its recharge and streamflow source zones, among other potential influences.

The proposed action includes BMPs for stormwater management and pile installation to be implemented during the construction and operation of the project to ensure that the SSA is not impacted. Approximately 73 acres of the site would be paved with stormwater discharged to the Delaware River following treatment by inlet separators. Approximately 43 acres of the developed site constitute the gravel plinth areas, which collect and treat the stormwater through a sand filter. Overall, the stormwater management BMPs would reduce the likelihood of contaminants reaching the groundwater by reducing the quantity of recharged water relative to the undeveloped condition. The proposed action is not anticipated to negatively impact the New Jersey Coastal Plan SSA.

4.3.4 Surface Water Quality

Activities associated with dredged material placement and construction of the proposed project could have short-term impacts to surface water quality. Land-clearing activities, filling of open- water habitat, construction of the bulkhead facility including relocation of an existing stormwater conveyance channel, and hydraulic cutterhead dredging in open water can cause short-term impacts such as increased turbidity and siltation. However, standard erosion control measures and BMPs, such as installation of temporary silt fences and hay bales, use of turbidity curtains (if appropriate), and timely stabilization of disturbed areas, would ensure that these

effects are minimized and do not significantly impact the quality of the environment. A project-specific erosion and sediment control plan has been prepared, and all operations would comply with PADEP Draft Erosion and Sediment Control Best Management Practice (BMP) Manual (PADEP, 2009).

Dredging simulations conducted by USACE for the Delaware River Main Stem and Channel Deepening Project, Pennsylvania, New Jersey, and Delaware, indicate there would be a temporary increase in turbidity at the dredging sites and the turbidity associated with dredging would reach background levels within an hour or less after dredging stops, dependent upon the composition of the material being dredged (USACE, 2009). Thus, the short-term impacts associated with dredging and filling activities for the project would not significantly impact the quality of the environment.

Potential long-term effects to water quality associated with the proposed federal action would not be significant. The project would result in an additional 73 acres of paved area at Southport and relocation of an existing stormwater channel that currently discharges into the slip area north of the proposed facility. Activities within the paved area would include horizontal transport of containers to and from the wharf, as well as to and from trucks. The increased amount of impervious surface would likely result in increased amounts of stormwater discharge to the Delaware River. But implementation of BMPs would nullify the potential effects to the surface water quality in the vicinity of the facility and ensure that any additional stormwater discharge would not significantly impact the quality of the environment. Further discussion of mitigation for these impacts is described in Subsection 4.3.21 and Appendix K (Mitigation).

4.3.4.1 Floodplain

The City of Philadelphia stormwater ordinance and regulations (Chapters 14-1600 of Philadelphia's Code and Charter) require stormwater management, floodplain, and channel protection. The proposed marine terminal is located within the City of Philadelphia Flood Management District C (development sites that can discharge directly to the Delaware River main channel or Schuylkill River major tributary without using city infrastructure). Sites within this Flood Management District may discharge stormwater without control of the peak runoff rate conditions. Additionally, the site is exempt from the channel protection requirement because it does not apply to discharges to tidal waters.

Any impact associated with the loss of floodplain area as a result of development of the property is anticipated to be negligible considering the amount of floodplain area associated with the large-scale river system. In addition, the proposed dredging volume, combined with the upland placement of fill material, would result in no net fill. The flood storage volume within the floodplain that must be filled to construct the marine terminal is more than offset by the volume of material that must be dredged from the riverbed. Wharf construction would require the dredging of 160,000 cy of material between the existing navigational channel and the shoreline. To obtain a depth of 40 ft below MLLW (+2-ft optional overdredge), an additional 848,000 cy would be removed, bringing the total dredged volume to 1,008,000 cy. Dredging to -45 ft + 2-ft MLLW optional overdredge would provide more flood storage.

The volume of fill proposed to bring the landside portion of the site up to finished grade is 789,000 cy. Approximately 219,000 more cy of material would be removed from the channel than would be placed in the floodplain. The total dredge volume estimate for computing the net cut/fill does not include the potential dredging to 45+2-ft below MLLW. The amounts of cut and fill vary within the floodplain along the river. Figure 4-1 illustrates a cross section at the northern end of the site where the most dredging and the least amount of fill in the floodplain is required. Figure 4-2 illustrates a cross section at the southern end of the berthing areas where the least dredging and most fill in the floodplain are required. A plan view representation of the dredged area is also shown in Figure 2-12.

4.3.5 Coastal Zone

All construction work associated with the Southport facility would be conducted in accordance with all applicable policies and guidelines as required by New Jersey and Pennsylvania Coastal Zone Management Program as discussed in Section 3. It has been determined that the proposed action is consistent with these programs. A more detailed analysis is included as Appendix B.

4.3.6 Climate Change and Sea Level Rise

Implementation of the proposed alternative would have a negligible effect on climate change or sea level rise. GHG emissions from construction of the wharf facility would be typical of a large construction project and short in duration. Total annual GHG output from the project will be approximately 7,524 tpy for 2 years, which is 0.00003% of the current annual global output of

26.5 billion tons. Therefore, the individual contribution of this project to climate change is virtually zero.

4.3.7 Hazardous, Toxic, and Radioactive Waste

The proposed action consists of clean construction, which would add no hazardous, toxic, or radioactive contaminants to the environment. The proposed surface topography of the completed construction would require addition of approximately 789,000 cy of clean fill. This material would be obtained from a suitable source that can provide fill which complies with applicable regulations.

All construction materials and practices would follow the protocols indicated in the appropriate regulations and permits. Because the surface of the main 116-acre site must be elevated above the 500-year flood level to at least 11.4 ft NGVD or the 200-year storm +1 ft for projected sea level rise, the entire area would either accept fill or maintain its grade before installation of infrastructure. A few areas within the main port footprint would require excavation or cut sections. Disturbance of site soils would be limited to excavation of sediment ponds constructed as part of the erosion and sediment control during the initial stages of fill placement. In addition, construction of the main access roadway involves two areas that require cut sections and excavation of site soils totaling approximately 500 cy. The recent Phase I Site Assessment (WESTON, 2010b) does not indicate that impacted soils are present within the footprint of the sediment ponds or along the alignment of the proposed access roadway. Excavated soils would be reused as construction fill and will not increase the risk of any on-site contamination. If off-site disposal is required, applicable PADEP regulations regarding sampling analysis and disposal of impacted soils will be followed.

The dredging operations would require removal of up to 1.3 million cy of sediment between the proposed bulkhead line and the existing navigational channel. Recent sampling of this sediment has indicated that there is no significant contamination. In addition, the dredged material would not be stored on-site. It would be transported by pipeline to the USACE Fort Mifflin CDF, located west of the Navy Yard, or other approved CDF.

No hazardous wastes are anticipated to be generated by the proposed facility. The port uses rail-mounted gantry (RMG) and moves container cargo.

4.3.8 Air Quality

The following factors were considered in evaluating air quality: (1) the short-term air emissions generated from combustion engine exhaust during construction of the project; (2) the type of emissions generated; and (3) the potential for emissions to result in ambient air concentrations that exceed one of the NAAQS or SIP requirements. A conformity analysis is not required if the emissions of carbon monoxide (CO), nitrogen oxides (NO_x), VOCs, particulate matter equal to or less than 10 micrometers in aerodynamic diameter (PM_{10}), particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$), and sulfur dioxide (SO_2) are emitted in quantities less than the corresponding de minimis level or the project is not located in a nonattainment area for these pollutants or criteria pollutants for which these emissions serve as precursors. The air pollutant emission calculations for the proposed action included in the sections below are detailed in Appendix J.

4.3.8.1 Proposed Action

The proposed action would result in short-term emissions during construction activities. The combustion of fuel by the construction equipment, dredges, cranes, trucks, dredges, and other vehicles involved in the proposed action would cause an increase in CO, VOC, NO_x, SO_2, and $PM_{10,}$ $PM_{2.5}$, and GHG. Fugitive dust created by the construction equipment as it disturbs soils was estimated, as well as fugitive emissions from asphalt paving during the construction phase of the project.

USEPA estimates that the effects of fugitive dust from construction activities would be reduced significantly with an effective watering program. Watering the disturbed area of the construction site twice per day during dry periods with approximately 3,500 gallons per acre per day would reduce particulate emissions as much as 50% (USEPA, 1995). The effects from fugitive dust would last only as long as the duration of construction activity, fall off rapidly with distance from the construction site, and would not result in long-term impacts.

Specific information describing the types of construction equipment required for a task, the hours the equipment is operated, and the operating conditions vary widely from project to project. For purposes of analysis, these parameters were provided by Halcrow, Inc., which performed the design. Combustive emissions from construction equipment and related vehicle exhaust were estimated by using USEPA-approved emissions factors for heavy-duty diesel-powered

construction equipment obtained from the USEPA Nonroad model (USEPA, 2005) along with the emission factors for the estimated types and numbers of equipment expected to be used during construction. These emissions are included in Table 4-1. Construction emissions would produce slightly elevated localized air pollutant concentrations. However, the effects from construction activities would last only as long as the duration of construction activity, falling off rapidly with distance from the construction site, and would not result in long-term impacts.

Review of emissions from the proposed action in Table 4-1 indicates that the greatest impact to the local emissions during the construction phase of the project would be NO_x with 68 tons per year (tpy) and 7,524 metric tons per year of carbon dioxide equivalent (CO_{2e}). These emissions would be temporary and would be eliminated after the construction and installation activity is completed.

4.3.8.2 CAA General Conformity Rule and Regional Significance of Federal Action

The General Conformity rule is set forth in CFR, 40 CFR 93 Subpart B – Determining Conformity of General Federal Action to State and Federal Implementation Plans. According to 40 CFR 93.153(b), federal actions require a conformity determination for each pollutant for which the total of direct and indirect emissions in a nonattainment or maintenance area caused by a federal action would equal or exceed any of the rates in paragraphs 40 CFR 93.153(b)(1) or (2). The General Conformity Rule explicitly defines the scope of "Federal action" that is analyzed under the rule. When the federal action is a permit for an aspect of a non-federal undertaking, "the relevant activity is the part, portion, or phase of the non-Federal undertaking that requires the Federal permit, license, or approval" (40 C.F.R. § 93.152). For the Southport project this would include the permitted dredge/fill/waterway construction activities. The emission calculations used in this general conformity applicability determination are presented in Appendix J.

Table 4-1 compares the net emissions from the proposed action and No Action to the projected 2002 Philadelphia County emissions. All annualized emissions resulting from the federal action are below de minimis levels and less than the 10% level that USEPA would otherwise consider regionally significant under the General Conformity Rule.

The proposed action would be located in the Philadelphia County, which is designated serious nonattainment area for ozone (O_3) and $PM_{2.5}$. All other criteria pollutants are in attainment. The $PM_{2.5}$ and O_3 precursor (NO_x and VOC) emissions are subject to General Conformity requirements. In accordance with the requirements of 40 CFR 93.153, the de minimis threshold set for serious O_3 nonattainment areas is 100 tpy for NO_x and for VOC is 50 tpy.

The General Conformity requirements apply to federal actions in which $PM_{2.5}$ emissions and precursors to $PM_{2.5}$ exceed the applicability threshold levels of 100 tpy. The precursors to $PM_{2.5}$ are NO_x, VOCs, ammonia, and SO_2. Net emissions from the proposed action and no action alternatives are set forth in Table 4-1 and are compared to the projected 2002 Philadelphia County emissions, which serve as the most recent available data. The annual net emission increases associated with the proposed action and comparison with the de minimis thresholds are presented in Table 4-2. Table 4-2 shows that the emissions of VOCs, NO_x, and $PM_{2.5}$ during the construction periods of the proposed action are less than the de minimis thresholds. Table 4-1 further shows that these emissions are less than the 10% level that USEPA would otherwise consider regionally significant under the General Conformity Rule.

Little impact to local air quality would be expected from the federal action associated with the construction of the Southport Development Project. GHGs are not viewed as producing any localized impacts, and it is highly unlikely that GHGs caused by the construction of any given project could produce any significant effect by itself on ambient concentrations. Therefore, no mitigative actions would be required. BMPs would include watering the disturbed area during construction, covering dirt and aggregate trucks and/or piles, prevention of dirt carryover to paved roads, and the use of erosion barriers and wind breaks.

4.3.9 Aquatic Resources

Impacts to aquatic resources from the construction of the berthing areas and associated filling and dredging of the proposed template would occur as a result of dredging, dredged material placement, in-water container terminal construction activities, and through vessel interaction when the facility is operational. Dredging and construction would impact approximately 13 acres of deep water, intertidal, and subtidal habitat, including the stormwater channel, which would be relocated on-site and experience no net impacts. Dredging the berthing area and access channel to -42 ft MLLW (40 ft + 2-ft optional overdredge) would allow the construction of the bulkhead,

pile-supported wharf, and revetment along the shoreline berthing areas. Subsequent dredging to -47 ft (45 ft + 2-ft optional overdredge) may be conducted to accommodate larger ships when economics and regional infrastructure can support them. Dredging would be conducted using a hydraulic cutterhead dredge. This type of dredging uses a rotating cutterhead and suction to remove sediment from the channel bottom and a pipeline to transfer the sediment-water slurry into a disposal site.

Hydraulic dredging has the potential to be disruptive to both the benthic environment and the water column. Benthic invertebrates may be temporarily lost as a result of the dredging but the area would most likely be recolonized after dredging is completed. Despite their mobility, finfish also have some potential to be suctioned into the hydraulic dredge. It is unlikely that young of the year fish would be significantly impacted during hydraulic dredging due to their mobility. Hydraulic dredging, dredged material placement, and the in-water container terminal construction activities would also temporarily increase the level of turbidity and suspended solids in the vicinity of the Southport Development Project site. However, turbidity levels return to normal within hours of ceasing operations. After the terminal is operational, increased vessel traffic to and from the container terminal may displace the aquatic resources in the vicinity of the terminal on a long-term basis.

4.3.9.1 Benthic Invertebrates

As a result of the project, existing benthic invertebrates within the proposed dredging footprint would be impacted. Any existing benthic communities within the proposed dredging footprint would be temporarily lost. To the extent that suitable substrate is available within the dredging footprint, recolonization is expected to occur relatively soon after completion of dredging activities. Sediment characterization demonstrates similar material at depth with the exception of generally lower contaminant levels. Any existing benthic communities within the area to be filled to elevations above mean high water would be permanently lost. It is anticipated that dredging would result in the temporary loss of up to 35 acres of benthic habitat, and that filling and excavation within the Southport Development Project footprint would result in the permanent loss and/or alteration of approximately 13 acres of benthic habitat and the destruction of nonmotile benthos.

The loss and alteration of benthic habitat, although significant, would be mitigated in several ways to ensure that the net impacts are not significant. Further discussion of mitigation for these impacts is described in Subsection 4.3.21 and Appendix K (Mitigation).

4.3.9.2 Finfish

Because finfish, especially young of the year fish, are highly mobile, they are expected to vacate the area during construction and dredging and return following its completion. Despite their mobility, some finfish, especially benthic lithophils, have the potential to be suctioned into the hydraulic dredge. Pelagic fish, which live and swim in the water column, are less likely to be entrained. Hydraulic cutterhead dredging, dredged material placement, and in-water construction activities would increase turbidity temporarily in the project area; however, as noted above, finfish are expected to vacate the area during construction, and dredging would only be conducted during the allowable windows to prevent impacts during spawning and fish migration periods.

Dredging and construction would result in the permanent loss of approximately 2,450 linear ft of a rocky intertidal area along the southern project shoreline and alteration of aquatic habitat along 3,043 ft of the eastern and northern shorelines. Construction of the wharf along the eastern shoreline would remove habitat that is currently utilized as a probable foraging area by a number of species, including striped bass. Construction of the rock revetment and stabilization of the bank along the southern shoreline would likewise result in similar impacts to this habitat. However, the rock revetment would be constructed in such a way and with similar rubble materials that recolonization would occur and the area would eventually return to a productive foraging area for striped bass. In addition, the open-water area under the wharves would provide habitat for fish, including species that inhabit shaded, deeper-water areas (e.g., catfish) and species that utilize open-water areas higher in the water column as well as the pilings. In addition, a variety of fish habitats, primarily intertidal and subtidal, would be provided by the proposed mitigation in the area of JM. Further discussion of mitigation for these impacts is described in Subsection 4.3.21 and Appendix K (Mitigation).

The increased vessel traffic after the facility is operational should not adversely affect finfish or their habitat in the vicinity of the container terminal. Stabilizing the bank along the southern shoreline with the proposed revetment will prevent further erosion and any subsequent

sedimentation of the adjacent habitat due to hydrodynamic forces from passing ships and storm events. It is not anticipated that significant wave actions will result from the actual ships visiting Southport. These ships will already be assisted by tugs prior to turning in the vicinity of the Packer Avenue Terminal, so their maneuvering will be done at minimum speed with an insignificant wake.

Impacts resulting from the mooring and other operations of ships while in port, including the entrainment of juvenile finfish during the uptake of ballast is expected to be minimal. Unlike bulk cargo ships and tankers, containerships rarely operate completely empty of cargo and in a "ballast only" condition (ABS 1999). Since a typical voyage might involve the loading and off-loading at different terminals or ports, it is not anticipated that the Panamax containerships visiting Southport would require taking on a significant volume of ballast water while in port. Ballast water on container ships is allocated between tanks to accommodate changes in the distribution of cargo and consumables, and in response to operational needs. For this reason, the procedure for containership ballasting is more "management plan" than a ballast exchange process (ABS 1999). Proper planning of the voyage would allow the strategic placement of containerized cargos, thereby minimizing the need for ballast exchange. Many tanks could be maintained either full or empty over the total voyage. If additional ballast water is required to compensate for the subsequent unloading of cargo, the tanks could be initially ballasted in the ocean before entering the Delaware Bay.

Furthermore, the USEPA Vessel General Permit Final Factsheet states the following:

> "In the United States, the U.S. Coast Guard has requirements for the management of ballast water listed in 33 CFR Part 151, Subparts C and D. These regulations require vessels transiting to U.S. waters with ballast water that was taken on within 200 nautical miles of any shore into waters of the United States after operation beyond the U.S. EEZ to conduct one of the following ballast water management practices:
>
> - Conduct mid-ocean ballast water exchange prior to entering U.S. waters;
> - Retain the ballast water on board while in U.S waters; or
> - Use a Coast Guard approved alternative environmentally sound method to manage the ballast water. 33 CFR 151.1510(a) and 151.2035(b)."

Under no circumstances would the ballast water be discharged while in port, unless the master of the vessel decides the practices would be unsafe for the vessel. 33 CFR 151.2030(b). Because there are currently no Coast Guard-approved alternative methods, the *de facto* management practice most often used today is ballast water exchange. Any exchange of ballast water would be conducted in the open ocean.

4.3.9.3 Essential Fish Habitat

For the 14 managed species examined in the EFH assessment (Appendix K – Attachment 1), all lifestages are restricted, either by preference or functionally by distance from spawning areas, or a combination of both, to water of greater salinity than that present in the project area. This conclusion is confirmed by the fact that no lifestage of these 14 species has been collected by the Pennsylvania Fish and Boat Commission in the Delaware Estuary. Additionally, intensive collections of fish 10 to 36 miles downstream of the Southport Project site in waters of much greater salinity over long periods of time have yielded only small numbers of only four of the 14 species (Atlantic sea herring, black sea bass, bluefish, and summer flounder). In the case of black sea bass, only one individual was collected. In these same collections, no lifestage of any of the other 10 species was collected. Based on the above, it is determined that the Southport Project site should not be considered EFH for any of the 14 -managed species. Therefore, there would be no impacts to EFH as a result of the proposed action.

4.3.9.4 Submerged Aquatic Vegetation

The 1.08 acres of SAV located in the area between the sheet pile south of Pier 124 and the north shoreline of the Navy Yard would be permanently lost from the proposed Southport Project. SAV is an important food source and nursery habitat for many organisms in the Delaware River. Considered a significant aquatic resource in the Delaware Bay and River, in recent years the distribution of SAV in the Delaware River has been expanding because of improved water quality and conditions favoring the establishment of SAV (Delaware Coastal Program, 2010).

There is no building footprint for the preferred alternative that can reduce or eliminate the loss of the entire 1.08-acre SAV area within the project footprint. Therefore, compensation for the loss of this valuable aquatic habitat type would be required and was included as one of the required mitigation components (refer to Subsection 4.3.21 and Appendix K). A mitigation ratio of 3:1 (creation-to-loss) is initially proposed, with the establishment of SAV in the proposed mitigation

area footprint (Jack's Marina) or the expansion of the footprint of existing SAV areas in the Delaware River. Refer to Subsection 4.3.21 and Appendix K for more information on proposed SAV mitigation.

4.3.9.5 Marine Mammals

Although marine mammals are very rarely seen in the Delaware River in the vicinity of the project site, the right whale, beluga whale, and dolphin potentially could appear in the study area. Dredging, dredged material placement, and in-water container terminal construction activities could potentially cause short-term impacts to marine mammals. Vessel interaction once the facility is operational could potentially cause long-term impacts to marine mammals.

The proposed project is not likely to have a significant adverse effect on these marine mammals. Although the potential exists for increased turbidity associated with hydraulic cutterhead dredging activities within the vicinity of the Southport Terminal site, this increase would be minor and temporary and not affect marine mammals, which are extremely rare in the Delaware River. These marine mammals are highly mobile and should be able to avoid relatively stationary dredges and other marine-based construction equipment and the increased vessel traffic once the site is operational, RTE species of marine mammals that are found within the Delaware Bay and approach are discussed further in Subsection 3.3.12.

4.3.10 Wetlands and Other Waters

Construction of the proposed Southport Development Project would result in impacts to a combination of nontidal wetlands, tidal wetlands, tidal mudflats, and subtidal and deep-water areas (refer to Table 3-9, Figure 3-4, and Appendix F). The subtidal area includes 1.08 acres of SAV. Impacts to these areas will be fully mitigated through a combination of creation, enhancement, restoration, and preservation at an approved mitigation location, so that there will be no net impact to the quality of the environment. Refer to Subsection 4.3.21 and the Mitigation Plan in Appendix K for more information.

Nontidal Freshwater Wetlands – A total of 3.75 acres of isolated, nontidal wetland, mostly low quality and dominated by common reed, would be lost from the proposed Southport Development Project. Impacts to these regulated areas would be mitigated through a combination of creation, enhancement, restoration, and preservation at an approved mitigation

location. Refer to Subsection 4.3.21 and the Mitigation Plan in Appendix K for more information.

Intertidal and Subtidal Areas, and Stormwater Channel – Intertidal and subtidal areas are present along the north, east, and south edges of the Southport Development Project site. North of the Navy Yard, the shoreline is a combination of 1) bulkheads and 2) narrow, steep areas characterized by minimal vegetation and construction rubble. There is a larger intertidal zone (primarily characterized by mudflats) between the north end of the Navy Yard and an area of sheet piles south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow, consisting primarily of construction rubble and stone. The tidal stormwater channel located in the northern part of the Southport Development Project site is covered with riprap. The channel was created from concrete rubble and sediment has filled the areas between the riprap and concrete fill. The mudflat habitat is a tidal area on the western end of the interpier area south of the sheet pile and north of the Navy Yard. This area provides gentle slopes and fine silt sediment characteristic of slow-moving tidal conditions.

The impacted intertidal (5.88 acres) and subtidal (7.10 acres) areas would be filled and/or replaced by deep-water habitat from the construction of pile-supported marginal wharf along the north and east site footprint and stabilization of the south shoreline. This activities would result in a net loss (fill, shading and conversion to another habitat type) of 4.28 (5.88-1.60) acres of intertidal areas, including 0.20 acre of vegetated tidal wetland, 5.38 (7.10-1.75) acres of subtidal area, including 1.08 acres of SAV, and impacts to approximately 4,600 linear ft of existing shoreline. The shoreline along the southern end of the project site would be protected with a revetment and stone riprap somewhat similar to the existing shoreline but with better structural properties. Approximately 1,000 ft (0.73 acre) of an existing tidal stormwater channel would be relocated with a new outfall at the northwest corner of the site (Figure 1-2). The realigned section of the stormwater channel would remain tidal and would be lined with similar substrate to retain its habitat value. Refer to Subsection 4.3.21 and Appendix K for more information on proposed wetlands and other waters mitigation.

4.3.11 Terrestrial Resources

The Southport site consists of tidal areas, nontidal wetlands, and upland habitats. Construction of the proposed project would result in the loss of 116 acres of potential terrestrial habitat: 43 acres

of permeable gravel surfaces to provide the necessary areas for container storage and yard operations, and 73 acres of paved surface to provide an operating area for horizontal transport of containers to and from the wharf, as well as to and from trucks. However, much of the area to be cleared, filled, and converted to gravel or paved surfaces have been classified as disturbed, and the loss of potential habitation would not significantly impact the quality of the environment. No substantial impacts are expected from construction or operation activities because of the relative absence of terrestrial species within the project footprint, timing of construction, and the collection and relocation of endangered plant species.

Tidal Areas

North of the Navy Yard the shoreline is a combination of 1) bulkheads and 2) narrow, steep rocky areas characterized by minimal vegetation and construction rubble. There is a larger intertidal zone (primarily characterized by mudflats) between the north end of the Navy Yard and an area of sheet piles south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow, consisting of construction rubble and stone. The tidal portion of the stormwater channel located in the northern part of the Southport terminal site is covered with riprap and the channel was created from concrete rubble. Sediment has filled the areas between the riprap and concrete fill, creating conditions suitable for plant growth. The mudflat habitat is a tidal area on the western end of the interpier area south of the sheet pile breakwater. This area provides gentle slopes and fine silt sediment characteristic of slow-moving tidal conditions.

These tidal areas would be impacted by the construction of 3,043 ft of pile-supported marginal wharf, which will involve impacts (permanent or temporary) to approximately 5 acres of intertidal habitat in the Delaware River, including permanent impacts to approximately 5,500 linear ft of existing shoreline. The 2,450 linear ft of shoreline along the southern end of the project site would be protected with a revetment and stone riprap similar to the existing shoreline but with better structural properties. Tidal areas and habitat remaining along the southern shoreline following construction is expected to recover. Approximately 1,000 ft of an existing stormwater channel would be relocated with a new outfall at the northwest corner of the site.

Nontidal Wetlands

The 3.75 acres of nontidal wetlands are found in the area between the former Navy housing and the Delaware River shoreline. These nontidal wetlands would be filled in during the construction

of the terminal. These impacts would be mitigated as appropriate. Refer to Subsection 4.3.21 and Appendix K for more information on proposed wetland mitigation.

Upland Habitats

Upland communities at the site consist of woodlands and old fields. These upland habitats would be cleared and leveled during the construction of the terminal. These impacts would be mitigated as appropriate. Refer to Subsection 4.3.21 and Appendix K for more information on proposed wetland mitigation.

4.3.11.1 Mammalian Habitats

Mammals in the project area are primarily species commonly associated with developed areas impacted by human activity. The proposed Southport Development Project would result in the loss and conversion of all undeveloped upland areas to a combination of impervious surfaces, pervious surfaces, and landscaping. No substantial impacts are expected from construction or operation activities because of the relative absence of terrestrial species within the project footprint, timing of construction, and the collection and relocation of endangered plant species. Since there would be little upland area available for mammals and essentially little connectivity to off-site upland habitat, only those species (such as raccoons, opossums, and gray squirrels) capable of surviving within developed areas would maintain viable populations. Other species may infrequently utilize the site. A fence surrounding the facility would create a barrier to some mammalian species (e.g., deer).

Noise associated with the construction activities could have a temporary disruption on mammalian species utilizing areas adjacent to the site. However, these areas are already subject to noise impacts from truck and rail traffic.

4.3.11.2 Avian Habitats

The loss of greater than 100 acres of terrestrial and associated wetland and water habitats may impact and displace birds that utilize the site seasonally and year round, but any potential impact would not be significant because most of the project area already has been developed (former Navy housing) and provides marginal habitat (common reed dominated areas). The loss of wooded shoreline and associated intertidal and subtidal (SAV) habitats may displace some wading birds, diving ducks, and other species utilizing the shoreline, but this potential impact is

not expected to be significant because some of the displaced bird species would still frequent adjacent sites and some species would continue to utilize the southern shoreline after construction.

Noise associated with the construction activities could have a temporary disruption on avian species utilizing these areas as well as adjacent, undeveloped upland areas located west of the site. To the extent practicable, the removal of vegetation would be timed to avoid the nesting season.

4.3.11.3 Herpetile Habitats

Most of the habitat for terrestrial reptiles and amphibian species would be cleared and paved with the proposed project. Wetland-dependent species such as frogs, snakes, and turtles (RTE species are discussed further in Subsection 4.3.12) would likely be extirpated from the project area.

Impacts to the limited herpetile habitats within the project site would be mitigated to below significance threshold in several ways to ensure the net impact is not significant. Further discussion of mitigation for these impacts is described in Subsection 4.3.21 and Appendix K (Mitigation).

4.3.12 Rare, Threatened, and Endangered (RTE) Species

Federally listed species potentially occurring in Philadelphia County include the threatened bog turtle, endangered Atlantic and shortnose sturgeon, endangered dwarf wedgemussel, and threatened small-whorled pogonia. National Marine Fisheries Service (NMFS) also expressed concern over (refer to copies of correspondence located in Appendix G) certain species of marine mammals and a few species of sea turtle that may be found in the Delaware Bay and approach channels. Federally listed whale species include humpback whale, fin whale, and North Atlantic right whale. Listed sea turtles include federally threatened loggerhead, federally endangered Kemp’s ridley, leatherback, and green sea turtles. The bog turtle, shortnose sturgeon, dwarf wedgemussel, and small-whorled pogonia are also listed as endangered in the State of Pennsylvania.

The following state-listed species were determined to potentially exist in the project area: bald eagle (threatened), redbelly turtle (threatened), coastal plain leopard frog (endangered), New Jersey chorus frog (endangered), eastern mudminnow (potential candidate), field dodder (proposed threatened), bugleweed (endangered), velvety panic-grass (endangered), Walter's barnyard grass (endangered), multi-flowered mud plantain (endangered), and forked rush (endangered). Refer to Subsection 3.3.12 for more information on federal and state-listed species in the project footprint and adjacent areas.

As explained below, the project will not have significant impacts on the endangered and threatened species potentially impacted by the project.

Shortnose Sturgeon and Atlantic Sturgeon

No shortnose sturgeon were collected by multiple collection gear at the Southport Project site during spring and summer of 2010 (Weston Solutions 2010). Several factors appear to limit any excursion of shortnose sturgeon into areas such as the Southport Project site (see Appendix K – Attachment 1). First, tracking studies indicate that few shortnose sturgeon move below RM 106, and, therefore possibly enter the Southport Project site located at approximately RM 95. All spawning and nursery areas exist in the non-tidal and upper tidal reaches of the Delaware River, above approximately RM 124. Second, the few adult individuals that do move downriver of RM 106 remain there for less than a month in late spring after spawning. Third, the Southport Project site includes some, but not a large amount of the one to five meter deep weedy area backwaters preferred as feeding areas. Last, bivalve mollusks, the preferred food item for shortnose sturgeon, were determined to be present in low numbers in benthic macroinvertebrate sampling conducted in spring 2010. This makes the Southport Project site and immediate area relatively unattractive as feeding grounds. Thus, it is likely that the Southport Project will have no significant effect on shortnose sturgeon either directly or upon those habitats utilized by this species. (Normandeau, 2010).

No Atlantic sturgeon were collected by multiple collection gear at the Southport Project site during spring and summer of 2010 (Weston Solutions, Inc. 2010). The postulated, but not substantiated, spawning grounds of Atlantic sturgeon are thought to possibly occur either near the head of tide at Trenton, New Jersey (based upon telemetry studies and gonadal biopsies) and/or between Tinicum Island and Marcus Hook (based upon telemetry studies, gonadal

biopsies, and substrate characteristics). Nearly all previous collections of juveniles throughout the Delaware River have occurred either above RM 125 (Lazarri *et al.* 1986) or between RM 60 and 80 (Simpson and Fox 2007). Based upon the telemetry studies of Simpson and Fox (2007), it can be conservatively stated that adults would only be present in the river near the Southport Project site between the months of June and October, and that they likely would only be present in the channel areas, and moving quickly through the area on the way to upstream spawning areas or returning from them. Telemetry studies indicated that Atlantic sturgeon do not use shallow river margins for feeding, as do the shortnose sturgeon. Therefore, it is unlikely that any life stage of Atlantic sturgeon will enter the area of the Southport Project site. (Normandeau 2010).

Construction and dredging activities have been designed to minimize any short-term or long-term adverse effects to water quality. Likewise, it would be prudent to restrict dredging to months during which Atlantic sturgeon or shortnose sturgeon are not likely to be present in the project area, which would be November through May.

Dwarf Wedgemussel and Small-Whorled Pogonia

USFWS does not list Philadelphia County as a location in which the dwarf wedgemussel is known to occur (USFWS, 2010a). The small-whorled pegonia habitat type does not exist within the project site so it is unlikely that this species exists within the Southport Development Project site. Since neither of these species is likely to occur in or near the project site, adverse impacts are not likely.

Marine Mammals

The potential for the proposed project to adversely affect the endangered humpback whale, fin whale and north Atlantic right whale could occur from the increase in shipping traffic associated with the new terminal. The main threat to these species of marine mammals comes from ship strikes; however, the anticipated increase in vessel traffic resulting from the projected demand for containerized cargo going to East Coast ports would happen regardless of Southport being built. Furthermore, impacts from vessels approaching the Delaware Bay from the Atlantic Ocean are beyond the USACE “control and responsibility” and well beyond the area of the proposed Southport development. Even considering potential impacts to these species from increased

vessel traffic in Delaware Bay, those potential impacts will not be significant since protection measures are in place to reduce the likelihood of ship strikes.

Protection measures that are currently in place for protecting the north Atlantic right whale would also help protect other species of marine mammals. NOAA has seasonal vessel speed restrictions in place for the U.S. East Coast. These restrictions require vessels 65 feet or longer to travel at 10 knots or less in key right whale areas, which extends out to 20 nautical miles around major mid-Atlantic ports, which includes the Entrance to the Delaware Bay. The seasonal restrictions are in enforcement from November 1 through April 30, times when whales are known to be in the area. NOAA also calls for temporary voluntary speed limits during other times of the year when a group of three or more right whales is confirmed (NOAA, 2010j).

NOAA also utilizes the Right Whale Sighting Advisory System (RWSAS) which was designed to reduce collisions between ships and north Atlantic right whales by alerting mariners to the presence of the right whales. These reports are obtained from a variety of sources including aerial surveys, shipboard surveys, whale watch vessels, and opportunistic sources (Coast Guard, commercial ships, fishing vessels, and the general public (NOAA, 2010k).

Sea Turtles

The potential for the proposed project to adversely affect the federally threatened loggerhead, federally endangered Kemp's ridley, federally endangered leatherback, and federally endangered green sea turtles could occur from the increase in shipping traffic associated with the new terminal. The main threat to these species of sea turtles comes from entanglement in fishing gear and to a lesser extent, ship strikes. Protection measures that are currently in place for protecting the north Atlantic right whale would also help protect these sea turtles. NOAA has seasonal vessel speed restrictions in place for the U.S. East Coast. These restrictions require vessels 65 feet or longer to travel at 10 knots or less in key right whale areas, which extends out to 20 nautical miles around major mid-Atlantic ports, which includes the Entrance to the Delaware Bay. The seasonal restrictions are in enforcement from November 1 through April 30, times when whales are known to be in the area.

Bald Eagle

The bald eagle nest located in a wooded area on the southern portions of the parcel was last used for nesting during periods in the spring and summer of 2008, with confirmation that the pair fledged one eaglet (USFWS, 2010c). Since 2008, only one unconfirmed sighting of an eagle on the nest has occurred. Except for this one unconfirmed sighting, neither eagles nor evidence of nest-building activities were observed at the nest site from late January to mid-March in 2010 and during subsequent observations during nesting seasons including as recently as the spring-summer 2012 Mustin Housing Demolition. .

The nest has not been occupied by nesting eagles from 2008 – 2012 nesting seasons as described above. An application for removal of the inactive nest, as well as implementation of measures that would provide a "net benefit" to the bald eagle population, is currently pending with the USFWS. A supplement to the application for take of an abandoned bald eagle nest has been developed and is being provided to the appropriate resource agencies. It should be noted that routine monitoring of the nest has been conducted since the application was submitted, and no nesting activities have been observed. If the nest site is lost, it would not adversely impact or change the increased breeding in the area's bald eagle population. According to Normandeau (2010), the Navy Yard is not an important site for breeding, feeding, or sheltering. This was confirmed through additional observations by Normandeau through 2012. The majority of the foraging, roosting, and perching observations have been made on the New Jersey side of the Delaware. Refer to Subsection 4.3.21 and Appendix K for information on mitigation, coordinated with USFWS and Pennsylvania Game Commission, for potential impacts to federal and state-listed species.

Bog Turtle, Redbelly Turtle, Coastal Plain Leopard Frog and New Jersey Chorus Frog

HA determined that none of the investigated wetlands within the project site provide suitable habitat for bog turtle (see Appendix C); therefore, this species would not be affected by the construction of the terminal.

A habitat survey for the redbelly turtle was completed by Versar in May 2007 and one redbelly turtle was observed during the study basking on large drift logs along the northwestern shoreline of the man-made embayment immediately north of the proposed facility. HA also conducted

habitat surveys for the redbelly turtle in October 2009. The habitat survey determined that the Delaware River in the vicinity of the site provides suitable redbelly turtle habitat, but the upland areas and dry fields where nesting turtle habitat is available is unlikely because of the debris that lines the west bank of the river. Access to the site by nesting turtles is likely limited to the cove and stormwater channel (Appendix C). A Phase II redbelly turtle nesting habitat assessment was conducted by HA at the Southport site to satisfy a request from the PFBC (see Appendix D). The Phase II survey, completed on 8 July 2010 did not revealed the presence of turtle nesting on the Southport site (see Appendix D). Mitigation for the loss of redbelly turtle habitat would be provided in several ways. Refer to Subsection 4.3.21 and Appendix K for information on mitigation for potential impacts to federal and state-listed species, which are not anticipated to be significant.

A habitat survey for the southern leopard frog was completed by Versar in May 2007. Versar did not observe any southern leopard frogs within the project site. HA conducted habitat surveys for the southern coastal plain leopard frog, and New Jersey chorus frog in October 2009. The targeted frog species habitat survey conducted by HA indicated the potential for frog habitats to be extremely marginal, and none of the wetlands currently provide the typical combination of hydrology and vegetation that is considered suitable habitat for either species. The overall degraded conditions of the site, including the history of site disturbance and the current monoculture of common reed associated with these areas, limit the likelihood of these species occurring in the investigated wetlands (Appendix C). Impacts to these species are unlikely because they likely do not reside within or adjacent to the proposed facility based on the habitats observed.

Eastern Mudminnow

The eastern mudminnow, considered vulnerable in the State of Pennsylvania, was not observed at the site during a fish study conducted by Normandeau Associates, Inc., in October 2003 using electrofishing and seine and gill net techniques. Additional fish surveys that WESTON conducted in April and June 2010 to characterize the fish and benthic community in the vicinity of the project area did not encounter the eastern mudminnow (Appendix C).

Velvety Panic-Grass, Forked Rush, Bugleweed, Field Dodder, Walter's Barnyard Grass, and Multi-Flowered Mud Plantain

State-listed plant species known to occur within the project area include field dodder (proposed threatened), bugleweed (endangered), and velvety panic-grass (endangered). Species located in the vicinity of the project area were Walter's barnyard grass (endangered), multi-flowered mud plantain (endangered), and forked rush (endangered). A botanical survey conducted by Mr. Joseph Arsenault in October and November 2009 investigated all six of these species. Those species identified during the investigation included the four state-listed species: bugleweed, field dodder, forked rush, and velvet panicum (also known as velvety panic-grass). All of these species would be removed because their current location is within the design footprint of the proposed facility. DCNR has provided recommendations for mitigation to compensate for impacts to these protected species and these recommendations have been incorporated into the mitigation plan. Refer to Subsection 4.3.21 and Appendix K for information on mitigation for impacts to federal and state-listed species.

4.3.13 Recreation

4.3.13.1 Parks, Fishing, Boating, and Other Recreation Resources

The construction and operation of the Southport terminal is expected to have minimal impacts on recreation. Construction and operation of the terminal would have no impact to the surrounding parks and there would be no loss of frequently used recreational lands. Dredging of the Delaware River and placement of dredged material would have short-term impacts on recreation, including a temporary increase in turbidity, which can affect recreational fishing. Notification to fishermen would minimize the disturbance because recreational fishermen would likely avoid fishing in the vicinity of dredging. Dredging and operation of the terminal are not expected to have major impacts on boating. Temporary impacts may occur related to recreational boating and commercial activities at the Navy Yard because of the floating discharge sections of the pipeline; however, most of the pipe will be submerged and boaters have the ability to navigate around dredging operations and generally avoid these areas. Increased boat traffic to and from the container terminal during operations should have minimal impacts to recreation.

4.3.14 Cultural Resources

The Phase IA Cultural Resources Assessment conducted in January 2010 (see Appendix H) concluded that the proposed project site is considered to have no potential for containing significant historic archaeological remains. In addition, the proposed site's existing architecture and above-ground resources that are greater than 50 years of age, including the Mustin family housing, the Mustin Airfield, Pier 122, and Pier 124, do not meet the criteria to be eligible for listing on NRHP. The adjacent Seaplane Hangar, which is part of the Philadelphia Naval Shipyard Historic District, would not be adversely affected by the proposed action. Therefore, no additional investigations are recommended for the aforementioned resources (Berger, 2010).

4.3.15 Socioeconomics

The movement of containers via the proposed container terminal would provide significant contributions to the local and regional economies by generating business revenue to local and national firms providing vessel and cargo-handling services. These firms, in turn, provide employment and income to individuals, and pay taxes to state and local governments. The regional socioeconomic impacts of the construction and operation of the proposed Southport Development project follow five discrete pathways: (1) business revenue impacts, (2) employment impacts, (3) personal earnings impacts, (4) tax impacts, and (5) impacts during construction. These impacts are nonadditive. The following socioeconomic analysis was conducted by Econsult in June of 2010.

Business Revenue Impacts

Activity at the container terminal would generate business revenue for firms that provide handling and vessel services. This revenue would be dispersed throughout the economy through the hiring of employees, the purchase of goods and services, and the payment of taxes. The remainder is used to pay stockholders, retire debt, and make investments, or is held as retained earnings. The only portions of these revenue impacts that would remain in the local economy are those paid out in salaries, local purchases by individuals and business directly dependent on the seaport, contributions to state and local taxes, and lease payments and wharfage, dockage, and handling fees (Econsult, 2010).

It is anticipated that $871.0 million of business revenue to local service providers would be generated annually (Econsult, 2010).

Employment Impacts

Employment impacts from the construction and operation of the proposed Southport Development Project consist of direct, induced, and indirect employment. Direct employment generated by the movement of the containers via the terminal includes jobs with railroads and trucking companies, longshoremen, steamship agents, freight forwarders, stevedores, etc. Indirect employment created throughout the local economy comes from the spending of wages by the individuals directly employed by the activity at the container terminal. Indirect jobs are created locally due to the purchase of goods and services by firms including local office supply firms, maintenance and repair firms, parts and equipment suppliers, etc. (Econsult, 2010).

The Southport Development project is projected to generate nearly 18,073 direct, induced, and indirect jobs annually. It is estimated that 7,310 direct jobs would be generated, and these job holders would receive about $325.3 million of direct personal earnings for an average salary of approximately $44,500. It is assumed that the majority of these jobs would be held by Philadelphia-area residents. In the baseline study of the Economic Impacts of the Port of Philadelphia, approximately 65.1% of the direct job holders created by activity at the Port's public marine terminals reside in Philadelphia County, followed by 7.3% in Delaware County, 4.8% in Bucks County, and 10.8% in the State of New Jersey. An additional $1.0417 billion of local spending and consumption activity is anticipated to be generated, which would support 9,452 induced jobs. It is anticipated that $871.0 million of business revenue to local service providers would be generated annually with a 1,340,000 TEU throughput. It is also estimated that with a 1,340,000 TEU throughput, $52.3 million of local purchases would be made annually to support the terminal operations. These purchases will support an additional 1,311 indirect jobs annually in the Commonwealth of Pennsylvania (Econsult, 2010).

The breakdown of the direct jobs by job category shows that the largest growth would be with the local trucking industry, followed by the growth with distribution centers, warehousing and container repair and storage operations, and with members of the International Longshoremen's Association (ILA) (Econsult, 2010).

Personal Earnings Impacts

The personal earnings of employees (excluding benefits) due to handling the import and export containers would be spent throughout the regional economy for the purchase of goods and services. This, in turn, generates additional jobs in the community. It is estimated that $52.3 million of local purchases would be made annually to support the terminal operations (Econsult, 2010).

Tax Impacts

Federal, state, and local taxes would be paid by firms and individuals whose jobs are directly dependent upon and supported by activity at the container terminal. A total of more than $149.6 million of state and local tax revenue would be generated annually by the container terminal operations (Econsult, 2010).

Impacts During Construction

In addition to the annual impacts generated by the throughput of the terminal, a total of $533.1 million of local construction expenditures would be made to support the development of the terminal. It is anticipated that these expenditures would be made over a 24-month period. Using data from the U.S. Bureau of Economic Analysis, regional Input-Output Modeling System for the Commonwealth of Pennsylvania, it is estimated that the $533.1 million of purchases would support 11,387 direct, induced, and indirect jobs during the 24-month construction period, with a payroll of $418.2 million (Econsult, 2010).

4.3.15.1 Environmental Justice

The project site itself is currently uninhabited. Present land use in the area is predominantly undeveloped or light industrial. Since there are no residential neighborhoods adjacent to the project site, there would be no adverse environmental justice issues concerning the construction or operation of the container terminal. However, the new terminal would provide numerous socioeconomic benefits, through jobs and local revenue that may have a positive effect on nearby minority and lower income populations.

4.3.16 Transportation

4.3.16.1 Vehicle Traffic

During and following construction activities, both local and regional traffic would increase. The peak hour traffic volumes were analyzed to determine the future operating conditions with development of the Southport Development Project, in accordance with the standard techniques contained in the current *Highway Capacity Manual* (2000). In the surrounding area, PennDOT District 6-0, as well as many local municipalities, generally considers level-of-service (LOS) A through D acceptable operating conditions while LOS E represents conditions approaching capacity and LOS F indicates that traffic volumes have exceeded available capacity.

During the estimated 2-year construction period, a minor, temporary increase in local traffic is expected. Following construction activities and during operations of the terminal, both local and regional traffic would increase. The analysis results are summarized below for each study intersection. The detailed traffic analysis report is included as Appendix I of this document.

South Broad Street and Packer Avenue

This signalized intersection currently operates at acceptable conditions (LOS B overall and LOS C or better for all movements) during the weekday morning, weekday midday, and weekday afternoon peak hours. With the development of the proposed terminal, traffic signal improvements are needed to mitigate the impact of the development; with optimization of the traffic signal timings, this intersection will continue to operate acceptably in the future under with-development conditions, during all peak hours.

Eastbound 1-76 Ramp/Darien Street and Packer Avenue

This signalized intersection currently operates at acceptable conditions during all three peak hours (LOS C overall and LOS D or better for all movements). During the 2014 and 2024 future conditions, the 1-76 off-ramp left-turn movement would function with delay (LOS E or F) during the weekday afternoon peak hours. However, with optimization of the traffic signal timings, this intersection would operate acceptably in the future conditions during all three peak hours.

Pattison Avenue and Lawrence Street

This signalized intersection currently operates at acceptable conditions (LOS B or better overall and LOS D or better for all movements) during the weekday morning, weekday midday, and weekday afternoon peak hours. Traffic signal improvements are needed to mitigate the impact of the development of the terminal; therefore, with optimization of the traffic signal timings, this intersection would continue to operate acceptably in the future with development conditions during all peak hours.

Pattison Avenue and Front Street

Under existing conditions, this signalized intersection currently operates at highly acceptable conditions (LOS B or better overall and for all movements). During future conditions without and with the proposed development, the intersection would operate with acceptable LOS C or better conditions during all peak hours.

Front Street and Packer Avenue

Under existing and future without development conditions, this signalized intersection operates with delay (LOS E) on the southbound Front Street through movement. All other movements operate at LOS D or better and the overall intersection operates at LOS D or better during all peak hours. Optimization of the signal timings would improve this operation to LOS D or better for all movements in the future (2014 and 2024 with development conditions).

Front Street and Westbound 1-76 Off Ramp/Southbound 1-95 On Ramp

Under existing conditions, this signalized intersection currently operates at acceptable conditions and would continue to operate with acceptable conditions (LOS D or better) during future conditions without and with the proposed development.

Front Street and Southbound 1-95 Off Ramp/Northbound 1-95 On Ramp

This signalized intersection currently operates at acceptable conditions (LOS C overall and LOS D or better for all movements) during the weekday morning, weekday midday, and weekday afternoon peak hours. During future conditions, the northbound Front Street left-turn movement operates with delay (LOS E or F) during the weekday afternoon peak hour only. Optimization of

the signal timings would improve this operation to LOS D or better for all movements in the future (2014 and 2024 with development conditions).

Front Street and Oregon Avenue

This signalized intersection currently operates with overall delay (LOS E or F) during all peak hours and would continue to operate with delay during future conditions. Specifically, the eastbound Oregon Avenue approach and the northbound Front Street left-turn lane operate with heavy delay. However, the impact of the development can be mitigated with optimization of the traffic signal timings, with delay at this intersection being greatly reduced.

Columbus Boulevard and Oregon Avenue

This signalized intersection currently operates at overall highly acceptable LOS B during all peak hours, with all movements operating at LOS C or better. With optimization of the traffic signal timing to mitigate the impact of the development, all movements at the intersection would continue to operate at acceptable LOS D or better conditions during both 2014 and 2024 future conditions.

South Columbus Boulevard and Packer Avenue Marine Terminal

This unsignalized intersection currently operates at acceptable conditions during all three peak hours and would continue to operate acceptably in future without development conditions. During the 2014 and 2024 future with development conditions, it is recommended that Southport traffic be directed to utilize Oregon Avenue to travel between South Columbus Boulevard and South Delaware Avenue, instead of Packer Avenue. This would allow site traffic to utilize the traffic signal at the intersection of Oregon Avenue and Columbus Boulevard. With this recommendation, the intersection of South Columbus Boulevard and the Packer Avenue Marine Terminal Access would operate at acceptable LOS D or better operation during each of the three peak hours without further improvement.

South Delaware Avenue and Packer Avenue Marine Terminal

This unsignalized intersection operates at acceptable conditions during all three peak hours in existing and future without development conditions. During the future, with development conditions, it is again recommended that Southport traffic be directed to utilize Oregon Avenue to travel between South Columbus Boulevard and South Delaware Avenue, allowing motorists to

utilize the traffic signal at the intersection of Oregon Avenue and Columbus Boulevard. With this recommendation, the eastbound Packer Avenue approach, as well as the South Delaware Avenue approaches, would continue to operate at acceptable LOS D or better operation. The westbound Packer Avenue Marine terminal approach would operate at LOS F during the weekday morning peak hour, due primarily to the additional traffic on South Delaware Avenue. This delay would only be experienced by the relatively small number of vehicles exiting the Marine Terminal during this period, 55 vehicles, which is less than one per minute, during only the weekday morning peak hour. Since signalization of this intersection is not warranted according to the warrant criteria listed in the Manual on Uniform Traffic Control Devices (MUTCD), the only modification that would provide LOS D or better operating conditions on this approach is to restrict exiting movements to right-turn movements only. This would require vehicles exiting the Packer Avenue Terminal to turn right and utilize Oregon Avenue to travel to Columbus Boulevard. This increased activity at Oregon Avenue and Columbus Boulevard can be accommodated and still maintain acceptable LOS D or better operation.

However, given that heavy delay is only expected to be experienced during one peak hour, it is recommended that the intersection be monitored, as development in the area increases, including the potential Mustin Field development, and the turn restriction only be implemented if the actual delay becomes excessive.

4.3.16.2 Delaware River

Once the Southport terminal is fully operational and capable of an annual container throughput capacity of 1.3 million TEUs, it is expected to draw approximately 260 ship visits per year. Current annual vessel traffic to the Port of Philadelphia is approximately 3,006 vessels per year (Maritime Administration, 2009). This increase in traffic, which is less than 9%, is not considered significant. Furthermore, the ongoing navigation improvements to the main channel in the Delaware River will ensure the continued safe navigation to the terminals along the river and will provide increased efficiencies for arriving ships (e.g., reduction in lightering). Therefore, impacts to the local waterborne transportation network resulting from the additional ships that will call at Southport are not considered significant.

4.3.17 Noise

Noise impacts to the natural and human environment are expected to be localized and short-term, occurring during the construction of the container terminal, including dredging and dredged material placement. Minimal noise impacts are also expected during the operation of the container terminal. Present land use in the area is predominantly port related, light industrial, former military, or undeveloped. There are no environmentally sensitive areas such as schools, hospitals, and low-income areas near the proposed project site. No mitigation would be implemented.

Noise from construction would affect ambient levels in the Southport project area. Construction noise would range from approximately 70 dBA to 95 dBA at 50 ft from its source. Noise levels at a receptor would depend on the type of construction activity, noise levels generated by various pieces of equipment, distance between the noise source and receptor, and the presence of intervening objects such as walls or buildings, vegetation, and intervening topography (USACE, Galveston District, 2003).

The three primary noise generating activities associated with the construction of the container terminal are as follows: (1) excavation including the dredging of material from the Delaware River, (2) vegetation removal, grading, and moving of placed material over the site, and (3) construction of berths, terminal facilities, buildings, and the on-site access road.

Dredging activities would generate noise from a variety of equipment. The primary source of equipment noise would include the hydraulic cutterhead dredge, the associated pumps and generators, and tugboats used to position the dredge. Other equipment, such as tending boats and survey boats, do not contribute substantially to the noise associated with dredging activities.

Noise associated with dredging activities includes the operation of dredges. These activities can intermittently generate noise levels as high as 85 to 88 dBA (California Department of Water Resources, 2000). The loudest expected sounds of 88 dBA from dredging operations can be expected to be attenuated to levels approaching 55 dBA (with levels exceeding 65 dBA considered acceptable according to HUD Policy 24CFR Part 51) approximately 2,000 ft from the source. This distance can vary depending on environmental criteria identified above.

Other than noise impacts to terrestrial areas, there are also consequences for underwater noise, because underwater noise can impact fish and other marine animal behavior. Sound is important when hunting for prey, avoiding predators, or engaging in social interaction. A species can also suffer from acoustically induced stress in its own habitat. Changes in vocalization behavior, breathing and diving patterns, and active avoidance of noise sources by marine life have all been observed in response to anthropogenic noise. Since most fish and marine animals would vacate the area during construction, impacts would be minimal.

Major noise sources arising during operations would be from a variety of sources: container cranes to load and offload containers, gantry cranes and loaders to transfer containers to and from stacks and onto trucks, and miscellaneous vehicles and equipment to facilitate cargo movement. In addition to mechanical devices, movement of containers, equipment and backup beepers, and shipping and vehicular traffic to and from the facility also emit noise. Noise associated with the terminal complex is broadband in nature without any particular frequency being discernible (USACE, Galveston District, 2003).

No noise-sensitive areas (e.g., residences, schools, hospitals) fall within the noise impact zone.

4.3.18 Short-term Uses Versus Long-term Productivity

This subsection discusses the short-term adverse impacts caused by terminal development at Southport relative to the long-term maintenance and enhancement of productivity. Short-term impacts are primarily those that occur during the period of construction. Long-term productivity relates to the continuous beneficial impacts of the proposed project, such as enhanced efficiency and increases in permanent employment opportunities.

The long-term productivity of this area is in use for port and industrial developments, and the anticipated benefits from these developments outweigh any potential impacts from the federal action, particularly in light of the mitigation measures proposed to offset potential impacts.

4.3.19 Irreversible or Irretrievable Commitments of Resources

This subsection discusses natural, social, and economic resources that would be permanently committed as a result of the proposed project. Because these resources would be expended in a

way that could not be recovered once committed to the proposed project, their loss of availability for the other uses would be irreversible.

The following is a summary of the irreversible or irretrievable commitments of resources of the proposed project:

- Conversion of the proposed Southport location for the proposed project would constitute a commitment of this natural resource that would be difficult to reverse or retrieve.
- Construction of the proposed Southport terminal at the proposed location would require an irreversible and irretrievable commitment of financial resources. There may be an additional commitment of financial resources for improved surface transportation.
- Construction of the proposed Southport terminal would result in the loss of 3.75 acres of isolated, nontidal wetlands, permanent impacts to approximately 7 acres of intertidal and subtidal habitat, 1 acre of deep water, and approximately 100 acres of terrestrial habitat. Although these losses would be mitigated as stated in Subsection 4.3.21 and Appendix K, these resources would be permanently committed to the proposed project.
- An undetermined volume of fuel, as well as other types of energy resources, would be expended during the construction of the proposed terminal.
- Alteration of stormwater discharge patterns and introduction of dredging activities may result in temporary impacts to water quality.

Grading, excavation, filling, dredging, and disposal operations would result in changes to soils and sediments at the site and at the USACE Fort Mifflin CDF or other approved disposal facility.

4.3.20 Cumulative Effects

CEQ regulations for implementing NEPA define cumulative effects as:

> "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." (40 CFR part 1508.7)

Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time. Effects can include both direct effects, which are caused by an action

and occur at the same time and place as the action, and indirect effects, which are caused by an action and occur later in time and are farther removed in distance, but can still be considered to be reasonably foreseeable.

4.3.20.1 Past Actions

Past projects or actions that could, when added to the recommended plan, result in cumulative impacts include the following:

Closure and Subsequent Redevelopment of the Former Philadelphia Naval Shipyard – An EIS for the Disposal and Reuse of Naval Base Philadelphia was completed by the Navy in 1997 to evaluate impacts resulting from the BRAC closure and redevelopment of the property. The majority of the facility is now owned by the Philadelphia Industrial Development Corporation (PIDC), with a portion still owned and operated by the Navy. The mixed-used complex includes a variety of tenants in industrial, research space, and office space, including an active ship repair facility

Maintenance Dredging at the Philadelphia Navy Yard (Former Philadelphia Naval Shipyard) – Periodic maintenance dredging has been conducted in the past along the Delaware River for the private ship repair facility and in the Reserve Basin for the Navy's Inactive Ship Maintenance Facility. The dredged material has been disposed of at a variety of permitted disposal sites, including the Fort Mifflin CDF.

Expansion of the Philadelphia International Airport – Previous expansion of the airport included constructing the new Runway 8-26 for commuter aircraft using dredged material as fill and the extension of existing Runway 17-35.

Maintenance Dredging of the Delaware River Federal Navigation Channels – The deep-draft federal navigation channels have been dredged periodically to maintain the congressionally authorized dimensions (widths and depths). The dredged material has been placed at the Fort Mifflin CDF.

4.3.20.2 Present Actions

Present projects or actions that could, when added to the recommended plan, result in cumulative impacts include:

Ongoing Landside Operations at the Philadelphia Navy Yard – The construction and operation of the proposed Southport project should not adversely affect the ongoing operations at the Navy Yard. The Southport terminal would have dedicated access via a planned extension of South Columbus Boulevard, so the anticipated increase in local truck traffic would not utilize roads within the Navy Yard property. Construction of the terminal would not adversely impact historic or potentially historic properties within the Navy Yard. Development of the Southport site is consistent with the long term plans of the Commonwealth to construct a port in this location and would not conflict with plans for other adjacent areas.

Ongoing Operations at the Norfolk Southern (NS) Railyard – It is not anticipated that the adjacent NS railyard would be adversely impacted by the construction or operation of the Southport terminal. A stormwater conveyance channel on the NS property provides drainage for the immediate area (NS and east end of the Philadelphia Navy Yard). Approximately 1,000 ft of the channel that is on the Southport site would be relocated to maintain its function. The Southport terminal would utilize stormwater BMPs and have its own stormwater collection system.

Ongoing Operations at the Packer Avenue Marine Terminal – The existing traffic serving the Packer Avenue Marine terminal has been accounted for when projecting traffic impacts resulting from the Southport operation. Local intersection improvements would be implemented that would improve the LOS to acceptable levels.

Ongoing Operations at the Philadelphia International Airport – Airport operations combined with the planned operations at Southport are not expected to collectively result in significant impacts to the natural and man-made environment. The height of all structures (buildings and cranes) at Southport would be well within FAA guidelines and would not interfere with the safe operation of approaching aircraft to the airport. Impacts resulting from the construction of Southport would require mitigation, including the creation and/or enhancement of terrestrial and aquatic habitats. Although the mitigation areas may attract birds, these areas would not be within 5 miles of the Philadelphia International Airport, which is an FAA directive.

Deepening of the Federal Navigation Channels in the Delaware River – The deepening of the Federal navigation channel in the Delaware River is ongoing. Upon completion, the -45 ft MLLW depth may allow larger and deeper-draft ships to call on the Port of Philadelphia. It is

anticipated that Southport would attract an additional 260 ships per year to the Port of Philadelphia, regardless of whether the deepening project is completed and deeper-draft vessels call on the Port of Philadelphia.

4.3.20.3 Reasonably Foreseeable Future Actions

Future projects or actions that could, when added to the recommended plan, result in cumulative impacts include the following:

Continued Redevelopment of the Philadelphia Navy Yard – Continued redevelopment of the Navy Yard may result in additional impacts to the local environment; however, they are not anticipated to be significant, either individually or combined with impacts resulting from Southport, if they are consistent with the reuse plan as described in the Philadelphia Naval Base EIS of 1997.

Deepening of the Federal Navigation Channels in the Delaware River – The deepening of the federal navigation channel in the Delaware River is expected to continue into the immediate future. Upon completion, the -45 ft MLLW depth may allow larger and deeper-draft ships to call on the Port of Philadelphia.

Expansion of the Philadelphia International Airport – The impacts associated with the planned relocation of Runway 9-27, combined with the impacts from Southport are not expected to be significant since the current preferred alternative does not involve the taking of subaqueous lands.

Construction and Operation of the Paulsboro (NJ) Marine Terminal – Construction and operation of a new bulk/break-bulk terminal in Paulsboro, NJ, would result in impacts to the natural and man-made environment, including impacts to wetlands, subtidal/intertidal waters, traffic, and air quality. A NEPA document is being prepared by the Gloucester County Improvement Authority to evaluate these impacts. Although it is expected that some of the terminal operations would be relocated from another nearby terminal, the new terminal at Paulsboro may attract some additional ships and bring additional jobs to the Philadelphia area as well as Southern New Jersey.

The potential impacts resulting from implementation of Southport, when added to impacts from the aforementioned past, present, and reasonably foreseeable future actions, will not make Southport project's impacts significant. In large part, this is because any potential impact from Southport is fully mitigated, and the impacts from projects independent of and unrelated to Southport (most of which will be accompanied with their own mitigation plans) will not combine with impacts from the Southport project to alter the conclusions about impacts from Southport.

4.3.21 Mitigation

The mitigation process for the Southport Development Project has included significant efforts to avoid, minimize, and, when necessary, to propose compensation for unavoidable impacts from construction and operation activities associated with the proposed project. Sections 1 and 2 of this EA outline in detail the careful consideration given to selecting a suitable site for the proposed action. The design layout for the project site (preferred alternative) was selected following a comprehensive assessment to avoid and minimize environmental impacts from the proposed action. This would include obtaining and complying with the necessary federal, state, and local permits and approvals. This also includes restoring or replacing resources that would be lost from this proposed action (see Appendix K).

4.3.21.1 Surface Water

Activities associated with dredged material placement and construction of the proposed project would have both short-term and long-term impacts to surface water quality. However, adherence to standard erosion control measures and BMPs, such as installation of temporary silt fences and hay bales, use of turbidity curtains (if appropriate), and timely stabilization of disturbed areas, would mitigate and minimize these effects. A project-specific erosion and sediment control plan would be prepared, and all operations would comply with PADEP Draft Erosion and Sediment Control Best Management Practice (BMP) Manual (PADEP, 2009).

The project also has the potential for long-term effects. The project would result in an additional 73 acres of paved area at Southport and relocation of an existing stormwater channel that currently discharges into the slip area north of the proposed facility. Activities within the paved area would include horizontal transport of containers to and from the wharf, as well as to and from trucks. The increased amount of impervious surface would likely result in an increased volume and peak rate stormwater discharge to the Delaware River, which will have a negligible

effect on this tidal waterbody. Due to the proposed implementation of BMPs, the surface water quality effects are anticipated to be negligible in the vicinity of the facility.

An application for an NPDES permit to discharge stormwater associated with construction activities has been prepared and submitted to PADEP. A post-construction stormwater management plan has been developed for the proposed marine terminal that includes BMPs to provide water quality treatment from the proposed land uses. A large sand filter would be installed under the plinth and gravel area to filter stormwater infiltrating through the gravel prior to entering the groundwater table and eventual discharge to the river. A street-sweeping schedule is proposed for the paved areas that would be used for truck traffic. All runoff from the paved areas is proposed to be collected in an engineered conveyance system and passed through water quality structures that hydrodynamically separate solids from the stormwater. The combination of the above-described BMPs achieves the PADEP goal of 85% reduction in Total Suspended Solids (TSS) and Total Phosphorus (TP), as well as a 50% reduction in nitrates as required by the PADEP Pennsylvania Stormwater Best Management Practices (BMP) Manual (PADEP, 2009).

4.3.21.2 Transportation

During terminal operations both local and regional traffic would increase. This could result in impacts if mitigation is not implemented. Mitigation would include restricting Southport traffic from using Packer Avenue to travel between South Columbus Boulevard and South Delaware Avenue, requiring this traffic to utilize Oregon Avenue, and the traffic signal at Oregon Avenue and Columbus Boulevard, instead. Also, mitigation would include monitoring traffic conditions on the Packer Avenue Marine Terminal access approach and if delay becomes excessive, restricting the access approach to right-turn movements only, requiring Packer Avenue Marine Terminal traffic to also utilize Oregon Avenue instead of Packer Avenue. Traffic signals in the vicinity and surrounding the proposed site would need to have the timing adjusted in order to increase performance to obtain acceptable LOS D overall or better. Optimization of the traffic signal timings for the following intersections has been suggested:

- S. Broad Street and Packer Avenue
- Eastbound I-76 Ramp/Darien Street and Packer Avenue
- Pattison Avenue and Lawrence Street
- Front Street and Packer Avenue
- Front Street and Southbound 1-95 Off Ramp/Northbound I-95 On Ramp
- Front Street and Oregon Avenue

- Columbus Boulevard and Oregon Avenue

A traffic impact analysis is provided in Appendix I.

4.3.21.3 Wetlands/Waters and Sensitive Species and Habitats

Pursuant to federal and state regulatory programs and policies, compensatory mitigation is required to offset unavoidable impacts to wetlands and other waters of the United States, as well as documented sensitive species and habitats. Compensatory mitigation for the filling of wetlands and other waters, and disturbance of upland habitats for sensitive terrestrial species (vegetation, birds, etc.) is part of the Joint Permit approval process. A mitigation plan to compensate for the loss of wetlands, waters, and sensitive habitats is required to be submitted in connection with the Joint Permit application (refer to Appendix K). The determination of compensatory mitigation requirements was made following significant efforts to avoid and minimize impacts to wetlands and other waters (see Section 2). The mitigation plan is sufficient to offset any otherwise unavoidable impacts to wetlands, waters, and sensitive habitats.

Habitats and regulated areas within the Southport Development Project footprint requiring mitigation include the following:

- Nontidal freshwater wetlands—primarily dominated by common reed.
- Intertidal wetlands, mudflat and subtidal habitat with some SAV.
- Tidally influenced stormwater channel.
- Deep-water habitat.
- Upland fields (state-listed plant species).
- Other possibilities include sensitive habitats for the bald eagle nest, redbelly turtle breeding habitat, etc.

Sections 3 and 4 of this EA have provided detailed information regarding these environmental resources.

Table 4-3 summarizes impacts to regulated wetlands and other waters from the Southport Development Project and proposed mitigation. Consultation with federal and state agencies has provided the mitigation framework needed to compensate for unavoidable impacts to these valuable resources as well as other sensitive habitats and biota.

Compensatory mitigation ratios and other requirements for the loss/filling of designated wetland/water areas and impacts to sensitive biota have been initially determined (based on preliminary discussions with federal and state regulatory and resource agencies) as follows:

USFWS and PGC – DGS has worked closely with the USFWS and the Pennsylvania Game Commission in connection with the inactive bald eagle nest located on the Southport site. DGS has prepared and submitted an application to the USFWS, with notification to PGC, for removal of the bald eagle nest, as well as implementation of measures that would provide a "net benefit" to the bald eagle population. This application is currently pending (USFWS, 2010c). A supplement to the application for take of an abandoned bald eagle nest has been developed and is being provided to the appropriate resource agencies. It should be noted that routine monitoring of the nest has been conducted since the application was submitted, and no nesting activities have been observed.

PFBC – One redbelly turtle has been observed in the intertidal areas at the north end of the Southport site and the approved mitigation would need to include redbelly habitat. This can include suitable intertidal habitat as well as additional features such as basking logs and nesting habitat. A turtle nesting survey conducted during summer 2010 has provided no evidence of the use of uplands for nesting by redbelly turtles at this time (Appendix D). Mitigation for the loss of redbelly turtle habitat would be provided in several ways. The existing stormwater channel would be relocated and constructed to allow for the continued use by redbelly turtle and access to upgradient areas. Compensation for the loss of intertidal habitat for redbelly turtle would be incorporated into the proposed mitigation in JM area (refer to Appendix K).

Fish and macrobenthic surveys have been conducted at the Southport site and adjacent areas. No state-listed species have been identified during these surveys.

The loss and alteration of fish habitat will be mitigated in a number of ways. First, the open-water area under the wharves would provide habitat for fish, including species that inhabit shaded, deeper-water areas (e.g., catfish) and species that utilize open-water areas higher in the water column as well as the pilings. Second, the presence of striped bass breeding habitat along the southern and eastern shore of the Southport site is a concern to PFBC. Construction of the rock revetment and stabilization of the bank along the southern shoreline would be performed in such a way and with similar rubble materials that recolonization would occur and the area would

eventually return to a productive foraging area for striped bass. Third, a variety of fish habitats, primarily intertidal and subtidal, would be provided from the proposed mitigation in the area of JM (Appendix K). The PFBC has indicated that the selected mitigation site should adequately replace lost habitat and support similar fish species.

The loss and alteration of benthic habitat will be mitigated in several ways. First, construction of the rock revetment and stabilization of the bank along the southern shoreline would result in impacts, though temporary, to this habitat. The rock revetment would be constructed in such a way and with similar rubble materials that recolonization by benthic invertebrates would occur and the area would eventually return to a productive benthic habitat and foraging area for fish. Second, the area under the wharves would provide a combination of benthic habitat (though generally deeper and receiving less light than the existing benthic areas in the proposed Southport Project footprint) and aufwuchs or periphyton habitat on the portion of pilings below the high water line). Third, the proposed mitigation in the area of JM would provide additional compensation for the loss of benthic habitat through the proposed construction and enhancement of intertidal and subtidal (including SAV) habitats.

DCNR – Four state-listed plant species have been identified and mapped on the Southport project site. DCNR has provided input regarding mitigation for impacting these species (Appendix G). The DCNR recommendation is to collect and preserve available seed from the on-site species for use at the approved mitigation site. Suitable habitat for these species would need to be provided at the mitigation site.

NMFS – NMFS prefers that all filled wetlands and tidal and deep-water areas be mitigated for, at a minimum, a 1:1 replacement-to-loss ratio. Mitigation for the loss of SAV areas would be required at a higher ratio (to be determined). The selected mitigation site and plan should provide suitable habitat for the impacted (or closely related) fish species. Mitigation for impacts to federally protected species (bald eagle, short-nosed sturgeon, and Atlantic sturgeon) would be coordinated with the appropriate federal agency (see above). NMFS acknowledges the existence of short-nosed sturgeon and Atlantic sturgeon in the Delaware River although they were not inventoried on the Southport site during the investigations. The development of the mitigation plan for the Southport Project (refer to Appendix K) would include consultation with NMFS to incorporate habitat for sturgeon in the design.

USACE –USACE has identified acceptable mitigation for impacts to waters of the United States (Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act) from the Southport project. This can include the following:

- Open water (1:1) Water depths greater than 6.6 ft (NAVD88) below MLLW
- Subtidal Water depths between MLLW and 6.6 ft (NAVD88) below MLLW
- Vegetated tidal (1:1)
- Mudflat (1:1)
- SAV (1:1)
- Tidal stormwater channel (1:1)
- Nontidal emergent (common reed dominated) (1:1)

Compensation for other forms of mitigation, including enhancement and preservation, would be negotiated during the permit review process. Compensation for the filling of nontidal, isolated wetlands can include enhancements or the creation of desirable upland buffers in the selected mitigation site. Mitigation for impacts to federally protected species (bald eagle, short-nosed sturgeon, and Atlantic sturgeon) would be coordinated with the appropriate federal agency (see above).

PADEP – PADEP has identified acceptable mitigation for impacts to waters of the Commonwealth (Chapter 105). The mitigation requirements are similar to the USACE guidance (see above) with the following additional considerations. Impacts to documented redbelly turtle habitat shall be at a minimum 1:1 creation-to-loss ratio with additional mitigation required, which can consist of basking platforms, nesting areas, and other enhancements to the mitigation site. Impacts to other state-listed species and sensitive habitats need to be mitigated. The determination of suitable mitigation shall be coordinated with the applicable Pennsylvania resource agency (see above).

The search for suitable mitigation sites has been comprehensive and thorough and is summarized in the Mitigation Report presented in Appendix K. The preferred site consists of a former marina (Jack's Marina or JM; Appendix K). Some mitigation is also proposed at the Southport Project site. Details regarding the proposed mitigation are provided in the Mitigation Report presented in Appendix K.

Appendix K summarizes the avoidance and minimization at the Southport site and mitigation at the, JM site. Avoidance and minimization at the Southport site consists of relocating the existing

tidal stormwater channel to a location parallel to the existing footprint. Similar habitat would be provided to compensate for this loss. In addition, avoidance and minimization of impacts to open water habitat is accomplished through the proposed construction of wharf structures on pilings, providing open water habitat within the project footprint (Figures 2-13 and 2-14). A combination of tidal, subtidal and deepwater habitat will remain along the southern edge of the project footprint following construction. The remaining mitigation would be provided at JM. Appendix K provides information on the size and kind of mitigation by area as well as figures and conceptual designs for the proposed mitigation. The proposed mitigation at JM is conceptual at this time, incorporating comments from the USACE received during site visits conducted both before and after the JPA submittal. Comprehensive surveys of these areas to obtain data on soils and sediment characteristics, topography and bathymetry, wetlands and other waters, and biota were completed in the fall of 2010 and are included in Appendix K. Regulatory and resource agencies have been consulted regarding mitigation alternatives and recommended data collection needs at these sites.

SECTION 4

TABLES

Table 4-1
Expected Emissions per Construction Year

	Emissions (tons/yr)						
	VOC	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_{2e} (metric tons)**
Proposed Action Construction	32	16	68	16	6.5	0.92	7,524
Percent of Regional Emissions	0.010%	0.001%	0.021%	0.014%	0.019%	0.00047%	b
No Action	0	0	0	0	0	0	b
Percent of Regional Emissions	0	0	0	0	0	0	b
2002 Philadelphia 18 County Nonattainment area[a]	325,070	1,738,144	321,782	114,876	33,833	194,480	b

% = percent
CO = carbon monoxide
CO_{2e} = carbon dioxide equivalent
NO_x = nitrogen oxides
$PM_{2.5}$ = particulate matter equal or less than 2.5 micrometers in diameter
PM_{10} = particulate matter equal or less than 10 micrometers in diameter
SO_2 = sulfur dioxide
tpy = tons per year
VOC = volatile organic compound
Notes:
[a] Source USEPA AirData; Emissions from an extract of USEPA's National Emission Inventory (NEI). Data for year 2002 were extracted from the NEI final version August 2008. NEI emissions database developed by the USEPA, 2002, is the latest year of emissions available. http://www.epa.gov.air/data/geosel.\html
[b] Greenhouse gases have not been quantified for Philadelphia County.

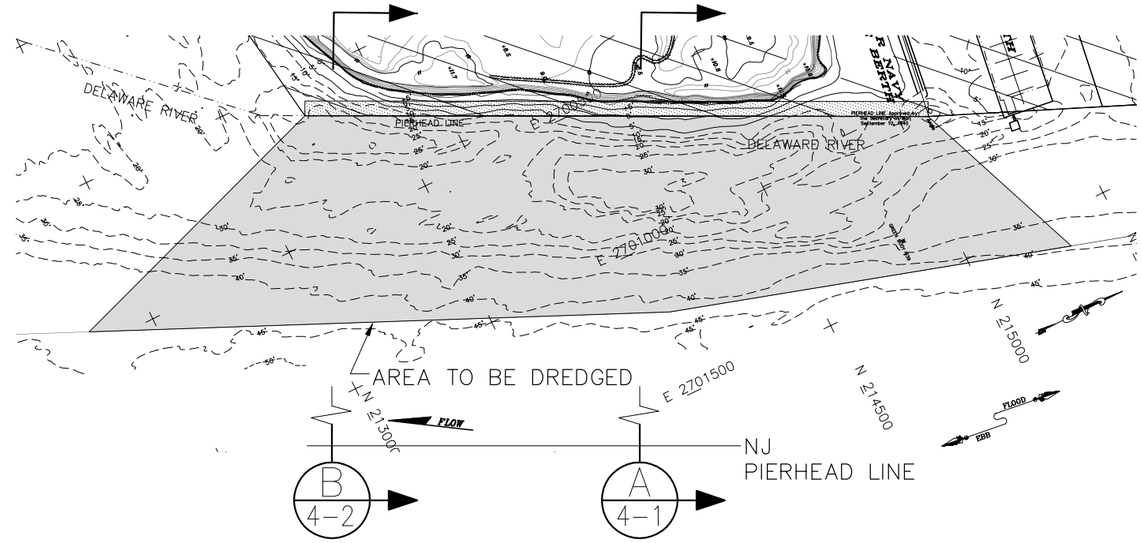
Table 4-2
Comparison of Emissions to De Minimis Thresholds[a]

Pollutants	Proposed Action Construction Emissions (tpy)	De minimis Threshold (tpy)
VOC (ozone precursor)	32	50
NO_x (ozone precursor)	68	100
$PM_{2.5}$	6.5	100
SO_2 ($PM_{2.5}$ precursor)	0.92	100
NO_x ($PM_{2.5}$ precursor)	68	100
NH_3 ($PM_{2.5}$ precursor)	Not Quantified	100

NO_x=nitrogen oxides
$PM_{2.5}$=particulate matter equal or less than 2.5 micrometers in diameter
PM_{10}=particulate matter equal or less than 10 micrometers in diameter
SO_x=sulfur oxides
tpy - tons per year
VOC=volatile organic compound
NH_3 – ammonia
Notes:
[a]Construction activities were assumed to take place over a 2-year period.

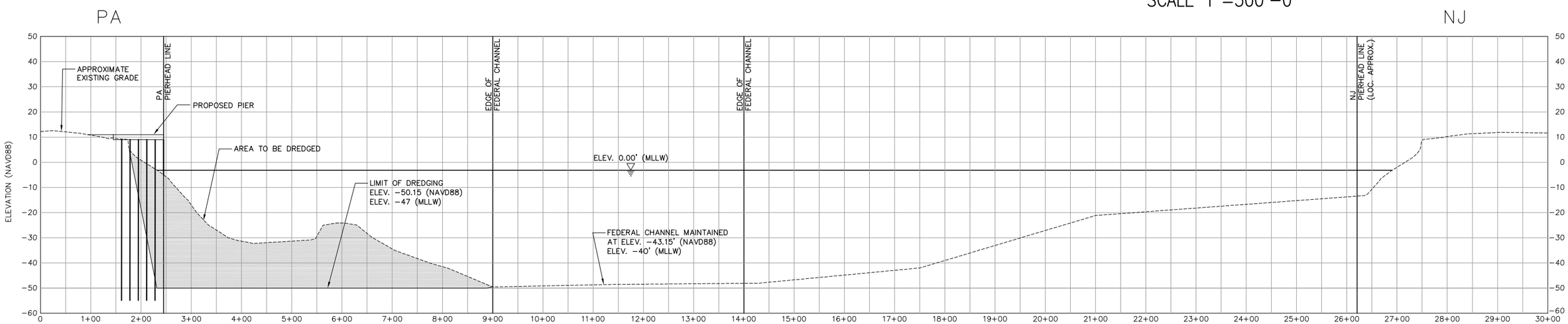
SECTION 4

FIGURES



PLAN INSET

SCALE 1"=500'-0"



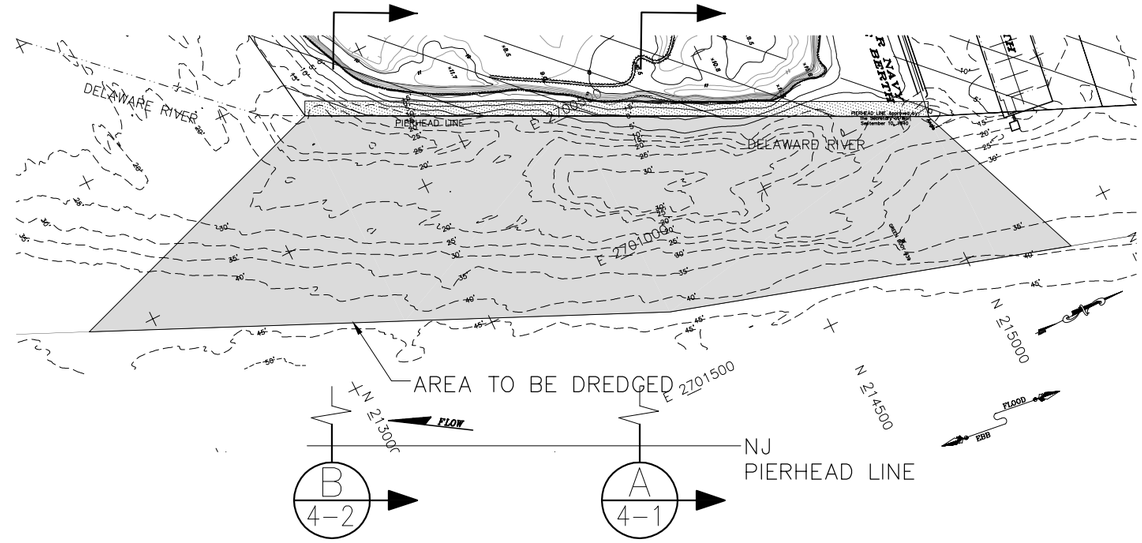
SECTION A

HORIZONTAL SCALE 1"=200'-0"
VERTICAL SCALE 1"=40'-0"

0 100 200 400 600 800 Feet

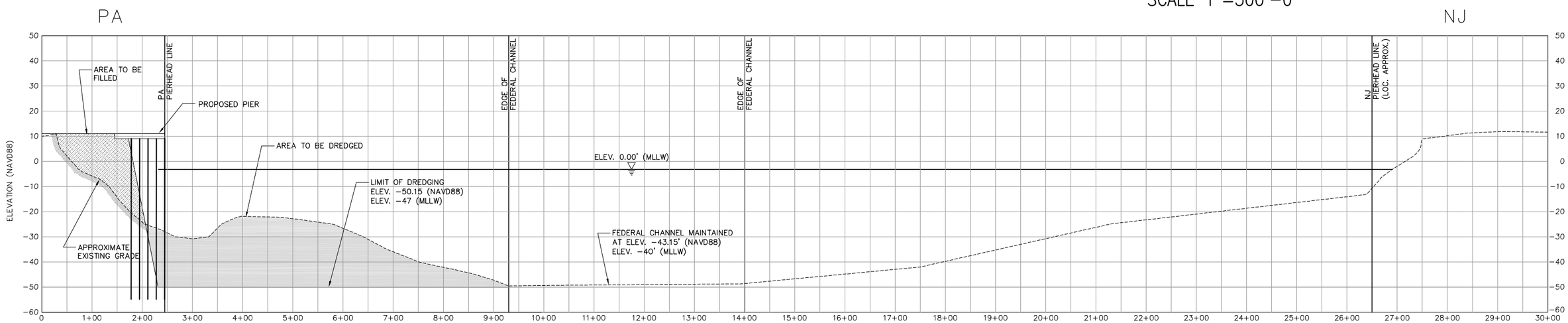
Figure 4-1
Cross Section "A" of Dredge Template and Delaware River
South Development Project
Philadelphia, Pennsylvania

G:\Acadproj\12769006003 PRPA Southport\PIDC\NavyYardEastWetlands.dwg



PLAN INSET

SCALE 1"=500'-0"



SECTION B

HORIZONTAL SCALE 1"=200'-0"
VERTICAL SCALE 1"=40'-0"

G:\Acadproj\12769006003 PRPA Southport\PIDC\NavyYardEastWetlands.dwg

0 100 200 400 600 800 Feet

Figure 4-2
Cross Section "B" of Dredge Template and Delaware River
Southport Development Project
Philadelphia, Pennsylvania

5. LIST OF PREPARERS

The Southport Development Project EA was prepared by WESTON® for the Commonwealth, acting though the DGS, and PRPA. WESTON was assisted in the preparation of the EA by McMahon Associates, Inc.; The Louis Berger Group, Inc.; Herpetological Associates, Inc.; and Joseph R. Arsenault. The following table presents an alphabetical list of the persons involved in developing this EA.

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6. PUBLIC REVIEW PROCESS

Public review of the proposed action is part of the permit application as prescribed by 33 CFR Part 325. The public notice is the primary method of advising all interested parties of the proposed activity for which a permit is sought and of soliciting comments and information necessary to evaluate the probable impact on the public interest. The notice includes sufficient information to give a clear understanding of the nature and magnitude of the activity.

Public notices will be distributed by the Philadelphia District, USACE, and PADEP.

It is presumed that all interested parties and agencies will wish to respond to public notices; therefore, a lack of response will be interpreted as meaning that there is no objection to the proposed project.

A copy of the public notice with the list of the addresses where public notice was sent will be included in this section, upon completion. As well, consultation letters with agencies such as the USFWS, NMFS, and SHPO will be included in this section, as received.

PUBLIC NOTICE

STATE HISTORIC PRESERVATION OFFICE CONSULTATION

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APPENDIX A

SEDIMENT CHARACTERIZATION REPORT

FINAL
SEDIMENT CHARACTERIZATION REPORT

SOUTHPORT TERMINAL
PHILADELPHIA, PENNSYLVANIA

Prepared for

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DEPARTMENT OF GENERAL SERVICES
200 South Broad Street
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AND

PHILADELPHIA REGIONAL PORT AUTHORITY
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July 2010

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APPENDIX C.1 – Bulk Sediment and Physical Results

AAL Report Nos. 1003118, 1003119, 1003121, 1003166, 1003167, 1003168, 1003216, 1003217, 1003225, 1004020, 1004021, 1004022, 1004080, 1004081, and 1004082.

APPENDIX C.2 – Total and Dissolved Elutriate Results

AAL Report Nos. 1003122, 1003169, 1003226, 1004023, and 1004083 and 1003124, 1003170, 1003227, 1004024, and 1004084.

APPENDIX C.3 – Site Water and Rinsate Blank Results

AAL Report Nos. 1003148, 1003171, 1004012, 1004025, and 1004085.

APPENDIX C.4 – Quality Assurance and Quality Control Summary

NOTE THAT THE ENTIRETY OF APPENDIX C IS PROVIDED ON THE ENCLOSED CD

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LIST OF ACRONYMS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AAL	American Analytical Laboratories, LLC
CDF	confined disposal facility
cy	cubic yards
DRBC	Delaware River Basin Commission
GPS	global positioning system
MDL	method detection limit
mg/kg	milligram per kilogram
MLLW	mean lower low water
MSC	medium specific concentrations
MS	matrix spike
MSD	matrix spike duplicate
NJDEP	New Jersey Department of Environmental Protection
PADEP	Pennsylvania Department of Environmental Protection
PADEP WQC	Pennsylvania Department of Environmental Protection Water Quality Criteria
PCB	polychlorinated biphenyl
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SCR	sediment characterization report
SQO	stream quality objectives
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1 Introduction

The Commonwealth of Pennsylvania proposes to construct a new container terminal in Philadelphia, PA. The location of the proposed Southport Terminal (Southport) is along the Delaware River, south of the Walt Whitman Bridge at the east end of the former Philadelphia Navy Yard (see Figure 1). The proposed conceptual design for this site includes the construction of two container vessel berths and access channel. Following construction of the berthing areas, the area must be dredged to create adequate draft for the vessels that will utilize the berthing areas.

The berthing areas initially will be dredged to -42' mean lower low water (MLLW) (-40'+2' allowable overdredge). Eventually, the berth may be dredged to -47' MLLW (-45'+2' allowable overdredge) to take advantage of potential future infrastructure developments. Consequently, sampling of the proposed Southport berthing area was performed in order to characterize the material to -42' MLLW for disposal of dredged material, and also to -47' MLLW for purposes of the Pennsylvania Obstruction and Encroachment Permit/U.S. Army Corps of Engineers (USACE) Section 10/ Section 404 Permit (Joint Permit) for the Southport project. Note that the sampling of sediments to -42' MLLW depth was focused on obtaining a 401 Water Quality Certificate (WQC) for dredging and disposal of the initial dredging project and therefore, a higher sampling frequency was used for these sediments. The current depths as determined from a September 2009 hydrographic survey at the berthing areas range from 0' to -45' MLLW.

WESTON chose the core locations based on the September 2009 hydrographic survey (see Figure 2) of the dock areas performed by Hydrographic Surveys, Inc. (Sewell, NJ). As detailed in the 2010 approved Sampling and Analysis Plan (SAP; WESTON 2010), a volume of approximately 848,000 cy must be dredged if the area is dredged to -42' MLLW and additionally approximately 298,000 cy of material if the area is dredged to the -47' MLLW depth. The core locations were chosen based on this information and subsequently approved by the Pennsylvania Department of Environmental Protection (PADEP). The details of the SAP were discussed via email with PADEP prior to sample collection.

In addition, 160,000 cy of material will be dredged at the shoreline edge of the berthing area to support construction of a revetment to stabilize the reconfigured shoreline resulting from the wharf construction. Following the submittal of the 2010 SAP, design changes were made to the pier structure at the Southport site. Specifically, the pier structure was changed from a sheet-piled structure to a pile supported wharf and rip-rap revetment. This was done in part for environmental reasons to reduce the amount of open water impacted by the project. This design change resulted in an increase in volume of material to be dredged by approximately 160,000 cy. In order to ensure that all potential dredge material was characterized during the March-April 2010 sampling event, additional samples were collected along and on the shoreline of the eastern edge of the Southport site. These additional samples are discussed in more detail in Section 2 of this Sediment Characterization Report.

Pending receipt of a WQC, the Commonwealth of Pennsylvania plans to dispose of material at the USACE Fort Mifflin Confined Disposal Facility (CDF) located in Philadelphia, Pennsylvania, or another permitted confined disposal facility along the Delaware River. For example, White's Rehandling Basin, located in Logan Township, New Jersey, may be used as an alternate disposal site in the event the USACE facility cannot accept all or some of the material, and if White's Basin is available.

Hydraulic dredging will be the method of dredging if the Fort Mifflin CDF facility is to be used for disposal of this dredged material. Sediment would be pumped directly from the dredge to their facility. Open clamshell dredging will be used if White's Rehandling Basin is the chosen disposal location. If disposal is to occur at White's Rehandling Basin, sediment would be transported by scow, bottom-dumped into the subaqueous disposal pit at the Basin, and then hydraulically moved to an upland disposal site. Although the use of White's Rehandling Basin is not anticipated, the sediment characterization detailed in this report was conducted to accommodate both PADEP and New Jersey Department of Environmental Protection (NJDEP) requirements.

Sixty-two (62) sediment cores were collected to characterize the approximately 1,306,000 cy that could be dredged at the Southport site including the 160,000 cy for construction of the revetment, the 848,000 cy to -42' MLLW, and the additional 298,000 cy for potential dredging from -42' to -47'. The following Sediment Characterization Report (SCR) details the results of the analyses performed on these samples.

2 March-April 2010 Sediment Sampling Event

Sixty-two (62) sediment cores were collected from March 9 through April 9, 2010 by Weston Solutions, Inc. (WESTON) from the locations listed in Tables 1 and 2, and processed into sixty-five (65) sediment samples. This includes fifty-two (52) coring locations outlined by WESTON and approved by PADEP in the January 2010 SAP (WESTON, 2010), and an additional ten (10) cores (five via vibracore and five via a land based drill rig) to characterize the additional 160,000 cy of material to be dredged/excavated during construction of the wharf and revetment. Samples were collected through the use of WESTON's vibracore rig and split spoon sampling from barge and truck mounted drill rigs, as detailed below:

Sampling protocol from 2010 SAP:

- Forty (40) of the total fifty-two (52) core locations were collected via vibracore to sediment depths ranging from 2' to 12'. All forty (40) of these vibracore samples were composited into pairs for a total of **twenty (20) analytical composite samples (Composites A through T)**, as can be seen in Table 2.

- The remaining twelve (12) core locations were collected in areas where the bottom of the dredge template and sediment thicknesses were greater than the 12' sediment thickness range of the vibracore (existing depth to target template depth). Sediments from these sampling locations were collected using both the vibracore and split

spoon. The SAP stated that the first 12' of each core would be collected using WESTON's vibracore boat with the remaining length of core being obtained using a drill rig equipped with 3" diameter split spoons. This method resulted in the collection of **twenty-eight (28) samples**.

As can be seen in Table 1 and in the core log located in Appendix B, the core lengths were adjusted based on conditions found in the field. In two (2) sample locations vibracore samples were not required based on the existing depth but were collected and combined with the split spoon sample to ensure that adequate volume was collected. In several other locations the vibracore length required based on the existing depth of sediment could not be obtained with the vibracore boat, thus the start depth of the adjacent split spoon sample was increased to accommodate for this shortage, and in other locations the split spoon sample was collected deeper than the dredge target depth due to a miscalculation. The results of these samples provide valuable information on the concentrations of parameters in the deep sediments at the Southport site.

- **Seven (7) samples** were collected from the depth in between -42' and -47' MLLW (see Table 1). These samples characterized the material in between the dredge depth that is currently proposed for the site, and a possible future -47' dredge depth.

Additional Samples above the 2010 SAP to Support Revised Design:

- **Five (5) additional vibracore and five (5) additional land boring samples** were approved by PADEP and collected along the eastern shoreline (in water and on land) of the Southport site in order to characterize the material that will need to be removed from that area during construction of the revetment. This revetment, which will reduce the amount of open water impacted at the site, was the result of a change in design that followed the submittal of the January 2010 SAP. The water-side samples were collected via vibracore as deep as possible. Note that this area is extremely rocky and that the vibracore was unable to penetrate to the full 12' in some locations (see Appendix B). The land-side samples were collected via a truck mounted drill rig to depths ranging from 8' to 13' (see Appendix B). Note that the top two feet of the land-side cores were comprised mainly of vegetation and rocky material and were therefore excluded from the sample.

The resulting sampling collection frequency is 1:20,836 for the 1,146,000 cy of material that would be removed to -47' MLLW (55 samples), 1:17,600 for the 848,000 cy of material that would be removed from the surface to -42' MLLW (48 samples), 1:42,571 for the 298,000 cy of material that exists from -42' to -47' MLLW (7 samples), and 1:16,000 for the 160,000 cy of material that must be removed during construction of the revetment. Overall, the core collection frequency is 1 core collected per 21,064 cy, based on the collection of sixty-two (62) cores.

Refer to the map in Figure 2 for the location where each sediment core was collected. Tables 1 and 2 also list the compositing scenario proposed in the sampling plan and includes any modifications.

A core log was prepared by WESTON for each core, and is provided in Appendix B. The core logs list the precise collection coordinates as recorded by GPS, the depth of each core, and a physical description of the core. No strata greater than two feet in length were encountered within any core; hence core sub-sampling was not performed. The compositing scenario proposed in the approved sampling plan was followed.

After core collection, logging, and analysis for volatiles using a MiniRae, each core was homogenized, composited when necessary and stored in sealed glass jars by WESTON field personnel. Note that prior to homogenization, WESTON collected discrete samples from each core specifically for volatile organic compounds and physical analyses per the approved SAP. Samples were stored at 4°C and transported to American Analytical Laboratories, LLC (AAL) of Farmingdale, NY for analysis. Cores were analyzed for the PADEP required physical and chemical parameters for bulk sediments, total elutriates, and dissolved elutriates. QA/QC samples including field duplicates, matrix spike/matrix spike duplicates, rinsate blanks, and a surface water blank were also prepared and analyzed.

Table 1. Deep Sampling Locations for March-April 2010 Sediment Sampling Event

Location Number	Actual Sample Depth (MLLW)	Recovered Core Length (ft)*	Type	Sample Label	Elutriate Sample
SS-1	31.3’	12’	Vibracore	SS-1A	
	37’	5’	Split Spoon	SS-1B	
	42’	5’	Split Spoon	SS-1C	
SS-2	28.3’	12’	Vibracore	SS-2A	
	42’	13.7’	Split Spoon	SS-2B	
	47’	5’	Split Spoon	SS-2C	E-6
SS-3	32’	6.8’	Vibracore	SS-3A	
	33.3’	5’	Split Spoon	SS-3B	
	38.3’	5’	Split Spoon	SS-3C	
	43.3’	5’	Split Spoon	SS-3D	E-7
SS-4	30’	11.7’	Vibracore	SS-4A	E-1 (24 and 72 hour)
	39.2’	6’	Split Spoon	SS-4B	
	45.2’	6’	Split Spoon	SS-4C	
SS-5	42.4’	8’	Vibracore	SS-5A	E-13 (and PCB Congener
	41’	8’	Split Spoon	SS-5B	
SS-6	37’	11.5’	Vibracore	SS-6A	E-2
	42’	5’	Split Spoon	SS-6B	
	47’	5’	Split Spoon	SS-6C	E-8
SS-7	32’	10.7’	Vibracore	SS-7A	E-2
	45.2’	10’	Split Spoon	SS-7B	
	50.2’	5’	Split Spoon	SS-7C	E-9
SS-8	21’	2.5’	Vibracore	SS-8A	
	34.5’	13’	Split Spoon	SS-8B	
	42.5’	8’	Split Spoon	SS-8C	
SS-9	35.5’	5’	Vibracore	SS-9A	
	37.5’	6.5’	Split Spoon	SS-9B	
	42.5’	5’	Split Spoon	SS-9C	E-10
SS-10	33.5’	5.5’	Vibracore	SS-10A	E-15
	34.5’	7’	Split Spoon	SS-10B	
SS-11	29.5’	12’	Vibracore	SS-11A	E-1
	47’	12.5’	Split Spoon	SS-11B	
	52’	5’	Split Spoon	SS-11C	E-11
SS-12	21.3’	3’	Vibracore	SS-12A	
	40.7’	17.7’	Split Spoon	SS-12B	
	45.7’	5’	Split Spoon	SS-12C	E-12

Table 2. Shallow Sampling Locations for March-April 2010 Sediment Sampling Event

Location Number	Actual Sample Depth (MLLW)	Discrete/Composite	Recovered Core Length (ft)*	Type	Sample Label	Elutriate Sample
1	42’	Composite with Core 2	4’	Vibracore	Comp-A	E-3
2	42’	Composite with Core 1	7’	Vibracore	Comp-A	
3	32’	Composite with Core 4	10’	Vibracore	Comp-B	
4	31’	Composite with Core 3	6’	Vibracore	Comp-B	
5	30.1’	Composite with Core 6	10’	Vibracore	Comp-C	
6	30’	Composite with Core 5	8’	Vibracore	Comp-C	
7	42’	Composite with Core 8	9.5’	Vibracore	Comp-D	
8	42’	Composite with Core 7	10.5’	Vibracore	Comp-D	
9	32’	Composite with Core 10	9.2’	Vibracore	Comp-E	E-14
10	33’	Composite with Core 9	11.6’	Vibracore	Comp-E	
11	30’	Composite with Core 12	10’	Vibracore	Comp-F	
12	29’	Composite with Core 11	8’	Vibracore	Comp-F	
13	32’	Composite with Core 14	8.3’	Vibracore	Comp-G	
14	27.9’	Composite with Core 13	10’	Vibracore	Comp-G	
15	42’	Composite with Core 16	3.2’	Vibracore	Comp-H	E-16 (24 and 72 hours)
16	42’	Composite with Core 15	6’	Vibracore	Comp-H	
17	24’	Composite with Core 18	6’	Vibracore	Comp-I	
18	31’	Composite with Core 17	12’	Vibracore	Comp-I	
19	42’	Composite with Core 20	8.5’	Vibracore	Comp-J	E-18
20	42’	Composite with Core 19	11.5’	Vibracore	Comp-J	
21	42’	Composite with Core 22	2’	Vibracore	Comp-K	E-4 (24 and 72 hours)
22	42’	Composite with Core 21	2.5’	Vibracore	Comp-K	
23	42’	Composite with Core 24	7.5’	Vibracore	Comp-L	
24	42’	Composite with Core 23	6.5’	Vibracore	Comp-L	
25	37’	Composite with Core 26	9.7’	Vibracore	Comp-M	
26	35.3’	Composite with Core 25	10’	Vibracore	Comp-M	
27	18.5’	Composite with Core 28	4’	Vibracore	Comp-N	E-17
28	24’	Composite with Core 27	4’	Vibracore	Comp-N	
29	42’	Composite with Core 30	10’	Vibracore	Comp-O	E-19
30	42’	Composite with Core 29	7’	Vibracore	Comp-O	
31	21’	Composite with Core 32	7’	Vibracore	Comp-P	
32	24.5’	Composite with Core 31	7’	Vibracore	Comp-P	
33	34.8’	Composite with Core 34	8’	Vibracore	Comp-Q	E-5
34	23.5’	Composite with Core 33	8’	Vibracore	Comp-Q	
35	42’	Composite with Core 36	2.3’	Vibracore	Comp-R	
36	42’	Composite with Core 35	2.5’	Vibracore	Comp-R	
37	42’	Composite with Core 38	7’	Vibracore	Comp-S	
38	42’	Composite with Core 37	5.5’	Vibracore	Comp-S	
39	24.2’	Composite with Core 40	4’	Vibracore	Comp-T	
40	28.4’	Composite with Core 39	4.5’	Vibracore	Comp-T	

Location Number	Actual Sample Depth (MLLW)	Discrete/Composite	Recovered Core Length (ft)*	Type	Sample Label	Elutriate Sample
41	NA	Discrete	12’	Vibracore	Core 41	Core 41
42	NA	Discrete	12’	Vibracore	Core 42	Core 42
43	NA	Discrete	10’	Vibracore	Core 43	Core 43
44	NA	Discrete	12’	Vibracore	Core 44	Core 44
45	NA	Discrete	12’	Vibracore	Core 45	Core 45
46	NA	Discrete	13’**	Vibracore	Core 46	Core 46
47	NA	Discrete	8’**	Vibracore	Core 47	Core 47
48	NA	Discrete	13’**	Vibracore	Core 48	Core 48
49	NA	Discrete	13’**	Vibracore	Core 49	Core 49
50	NA	Discrete	11’**	Vibracore	Core 50	Core 50

* Includes some consolidation of samples from collection to processing
** The top 2ft of soil were excluded from the sample as discussed in Section 2

3 Analytical Results and Screening of Sediment Samples

AAL analyzed each of the samples submitted for the PADEP required chemical and physical parameters. Physical analyses included grain size, percent moisture, and total organic carbon (TOC). Bulk sediments were chemically analyzed for the following parameters: volatile organic compounds (VOC), semivolatile organic compounds (SVOCs), pesticides (plus lindane and methoxychlor), polychlorinated biphenyl (PCB) Aroclors, metals, total petroleum hydrocarbons (TPH), pH, sulfide, cyanide, hexavalent and trivalent chromium, radioactivity, PCB congeners, grain size, TOC and percent moisture.

Modified total and dissolved elutriate samples were prepared from each sediment sample, and tested for the following parameters: SVOCs, pesticides (plus lindane and methoxychlor), PCB Aroclors, PCB Congeners (one sample), metals, pH, cyanide, hexavalent and trivalent chromium, TOC and TSS. Per PADEP (see Appendix A), the frequency of elutriate samples were decreased from the amount proposed on the 2010 SAP. The elutriate compositing scenario is detailed in Tables 1 and 2.

Table 3 lists the analytical methods used in each analysis. Note that the PCB Congener, radioactivity, grain size, and TOC samples were subcontracted to Summit Environmental Technologies, Inc. Appendix C contains the analytical data packages.

Table 3. Analytical Parameters and Methods

Test Parameter	Analytical Method
BULK SEDIMENT PARAMETERS	
Grain Size	ASTM
TCL Volatile Organic Compounds	EPA Method 8260B
TCL Semivolatile Organic Compounds	EPA Method 8270C
PCB (Aroclors)	EPA Method 8082
TCL Pesticides (plus lindane and methoxychlor)	EPA Method 8081A
TAL Metals	EPA Method 6010B/7471
TPH	EPA Method 8015
pH	SW 9045C
Sulfide	SW 9034
Cyanide, total	SW9012
Hexavalent and Trivalent Chromium	SW7196A/SW6010
Total Organic Carbon	USACE Method (USACE, 1992)
% Moisture	ASTM D2216
Radioactivity	9300 series
PCB Congeners	1668A
TOTAL AND DISSOLVED ELUTRIATE PARAMETERS	
Modified Elutriate Preparation	USACE Method (USACE, 1985)
TCL Semivolatile Organic Compounds	EPA Method 8270C

Test Parameter	Analytical Method
TCL PCBs (Aroclors)	EPA Method 608/8082
TCL Pesticides (plus lindane and methoxychlor)	EPA Method 8081A
TAL Metals	EPA Method 200.7/245.1
Cyanide, total	E335.4
Total Organic Carbon	EPA Method 415.1/SM5310
Total Suspended Solids	SM 2540D
Hexavalent and Trivalent Chromium	SM 3500 D/6010B
pH	SM 4500 H B
PCB Congeners	1668A

TCL = Target Compound List
TAL = Target Analyte List

3.1 Physical Characterization of Sediments

The results for the grain size analysis, TOC concentrations, percent solids, percent moisture and pH on each individual core sample are provided in Table 4.

Grain Size: Grain size was classified using the ASTM Method on all split spoon samples and all individual cores collected at the Southport site. Southport sediments were predominantly comprised of clay, sand, and silt with some concentrations of gravel. The grain size analysis indicated that the average clay concentration was 51%, the average sand concentration was 36%, the average silt concentration was 12%, and the average gravel concentration was ~1.0%.

Total Organic Carbon (TOC): Sediments at the Southport site contained TOC concentrations ranging from 0.59% to 5.06%, as summarized in Table 4. Note that only the individual cores and split spoon samples were analyzed for TOC.

pH: The pH level of sediments at the Southport site ranged from 5.30-7.56, as summarized in Table 4. Note that only the split spoon and Composite samples were analyzed for pH.

3.2 Chemical Characterization of Bulk Sediments

Results from the bulk sediment analysis were compared to Pennsylvania Clean Fill Criteria and PADEP Act 2 Residential and Non-Residential Medium Specific Concentrations (MSCs). Tables 5a and 5b provide a summary of detected concentrations for the bulk sediments collected from the Southport site. Note that sixty-five (65) bulk sediment samples plus four (4) field duplicate samples were collected and analyzed.

Table 6 provides results from analysis of Toxicity Characteristic Leaching Procedure (TCLP) concentrations at the Southport site. Results were compared to Resource Conservation and Recovery Act (RCRA) criteria.

Volatile Organic Compounds: Twenty (20) VOCs were detected in various samples at the Southport site, as summarized in Table 5a. One (1) of the detected VOC's, methylene chloride, exceeded the PA Clean Fill Criteria [0.076 milligrams per kilogram (mg/kg)] for three (3) of the samples, at concentrations of 0.085 mg/kg, 0.088 mg/kg, and 0.094 mg/kg, as summarized in Table 5a.

Semivolatile Organic Compounds: Sixty (60) SVOCs were detected in some or all of the sediment samples collected at the Southport site, as summarized in Table 5b. The following SVOCs exceeded available criteria: benzo(a)pyrene exceeded the PADEP Residential MSC and Clean Fill Criteria (2.5 mg/kg), at a concentration of 4.0 mg/kg, in one (1) of the sixty-nine (69) samples (includes duplicates), 2-Nitroanoline exceeded the PADEP Clean Fill Criteria (0.033 mg/kg), at a concentration of 0.086 mg/kg, in one (1) of the sixty-nine (69) samples, 3-nitroaniline exceeded the PADEP Clean Fill Criteria (0.038 mg/kg), at a concentration of 0.041 mg/kg in one (1) of the sixty-nine (69) samples, bis(2-chloroethyl)ether exceeded the PADEP Clean Fill Criteria (0.0039 mg/kg), at a concentration of 0.027 mg/kg in one (1) of the sixty-nine (69) samples, N-Nitrosodi-n-propylamine exceeded the PADEP Clean Fill Criteria (0.0013 mg/kg) in three (3) of the sixty-nine (69) samples at concentrations of 0.017 mg/kg, 0.1 mg/kg, and 0.39 mg/kg, 2,4-Dinitrotoluene exceeded the PADEP Clean Fill Criteria (0.05 mg/kg), at a concentration of 0.53 mg/kg, in one (1) of the sixty-nine (69) samples, and 4-Nitroaniline exceeded the PADEP Clean Fill Criteria (0.031 mg/kg), in three (3) of the sixty-nine (69) samples at concentrations of 0.035 mg/kg, 0.036 mg/kg, and 0.37 mg/kg.

Pesticides: Twelve (12) pesticides were detected in some or all of the sediment samples collected from Southport site, as summarized in Table 5b. None of the pesticides were present in concentrations that exceeded the available PADEP Residential and Non-Residential MSC or PADEP Clean Fill Criteria.

PCBs: Two (2) PCB Aroclors were detected in some or all of the sediment samples collected at the Southport site, as indicated in Table 5b. Note that all concentrations were detected below available PADEP Residential and Non-Residential MSC and PADEP Clean Fill Criteria.

PCBs (Congeners): Six (6) PCB Congener bulk sediment samples were prepared from six (6) of the twelve (12) split spoon core locations by compositing the material collected down to -42' MLLW into one (1) sample per core. Specifically, PCB Congener sample P-SS-1 was a composite from location SS-1, P-SS-3 was a composite of location SS-3, P-SS-5 was a composite from location SS-5, P-SS-7 was a composite from location SS-7, P-SS-9 was a composite from location SS-9, and P-SS-11 was a composite from location SS-11. These samples were analyzed by Summit Environmental Technologies (Cuyahoga Falls, Ohio). The PCB Congener results from the sampling event were summed in order to calculate the total PCBs results since there are no PADEP regulatory criteria for PCB Congeners (see Table 7a). The total PCBs concentrations in the six (6) samples collected during this event ranged from 0.3 micrograms per kilogram (µg/kg) to 439.78 µg/kg. Note that in the past, the PADEP has accepted 200 µg/kg as a criterion for PCB Congeners. This was based on Delaware River Basin Commission sampling for PCB Congeners conducted in the Delaware River. Note that

the sample result for P-SS-5, which was collected from the SS-5 location detailed on Figure 2, was higher than this level.

Total Petroleum Hydrocarbons: Total petroleum hydrocarbons were detected in twenty-six (26) sediment samples collected at the Southport site. Table 5b summarizes these results and indicates the limit of quantitation. Note that PA criteria have not been developed to evaluate total petroleum hydrocarbons at this time.

Inorganic Chemicals (Metals, Cyanide, and Sulfide): Twenty-six (26) metals plus cyanide were detected in samples collected at the Southport site, as summarized in Table 5b. One (1) of the detected metals, arsenic exceeded the PADEP Residential MSC and the Clean Fill Criteria (12 mg/kg) in seventeen (17) of the sixty-nine (69) samples at concentrations ranging from 13 mg/kg to 48.1 mg/kg. Note that the detected concentrations of arsenic are similar to maintenance dredge material in the Delaware River.

Note that no PADEP MSC's or Clean Fill Criteria have been developed for calcium, total chromium, magnesium, potassium, or sodium, so detected concentrations of these substances could not be compared to screening criteria. Calcium concentrations ranged from 500 mg/kg to 10,800 mg/kg. Total chromium concentrations ranged from 8.73 mg/kg to 181 mg/kg. Magnesium concentrations ranged from 1,180 mg/kg to 7,880 mg/kg. Potassium concentrations ranged from 477 mg/kg to 3,600 mg/kg. Sodium concentrations ranged from 44.7 mg/kg to 378 mg/kg.

TCLP: As stated in the SAP, with the exception of the VOC sample, which was sampled following the VOC sample protocol (one per core/sample), the TCLP analyses were performed on each bulk sediment composite sample (composites A through T), on one (1) sample from each of the twelve (12) split spoon cores, and from each of the additional ten (10) cores. Note that the material from each split spoon core down to the initial dredge depth (-42' MLLW) was composited into one (1) sample per core.

Note that SVOCs, herbicides, and pesticides were not detected in the TCLP samples collected at the Southport site, as summarized in Table 6; however, one (1) VOC and seven (7) inorganic analytes were detected at concentrations below the Resource Conservation and Recovery Act (RCRA) criteria.

Radiological Results – Radiological data for gross alpha, gross beta, and total radium are provided in Table 8. Based on a regulatory analysis previously conducted for sediment samples collected in the Delaware River, the only applicable regulatory limit governing soils is the criterion in 40CFR192, which stipulates that soils may have a combined Radium-226 and Radium-228 activity equal to or less than 15 pCi/g above background levels. All total radium levels are less than the 15 pCi/g level. Using the criterion in 40CFR192, Delaware River sediment soils at the Southport site area are not considered to be contaminated.

3.3 Chemical Characterization of Elutriate Samples

Per direction from PADEP, the frequency of elutriate sampling was reduced from the frequency originally proposed in the SAP submitted in January 2010 (see Appendix A). Tables 1 and 2 demonstrate at which locations elutriate samples were collected. The results from these total elutriate and dissolved elutriate samples were compared to Pennsylvania Department of Environmental Protection acute and chronic Water Quality Criteria (PADEP WQC) and Delaware River Basin Commission (DRBC) acute and chronic Stream Quality Objectives (SQOs) for the protection of aquatic life.

Where appropriate, aquatic water quality criteria were corrected for hardness and pH, using the average hardness for freshwater in the Delaware River of 74 mg/kg and a pH of 7.0 (as provided by the Delaware River Basin Commission). Table 9 summarizes the results of the total elutriate analysis. Table 10 summarizes the results of the dissolved elutriate analysis.

Semivolatile Organic Compounds: Total and dissolved elutriates samples were analyzed for Target Compound List (TCL) SVOCs. Results from these analyses are discussed separately below, and are summarized in Tables 9 and 10. No acute or chronic DRBC SQOs have been developed for any of the detected SVOCs. A comparison of detected SVOC concentrations with PADEP WQC is presented here.

SVOCs in Total Elutriates – Twenty-six (26) SVOCs were detected in at least one (1) total elutriate sample generated from sediments collected at the Southport site, with the following SVOC detections exceeding PADEP WQC: acenaphthene exceeded the PADEP chronic WQC (17 µg/L) in five (5) samples, benzo(a)anthracene exceeded the PADEP acute and chronic WQC (0.5 µg/L and 0.1 µg/L, respectively) in nineteen (19) samples, fluoranthene exceeded the PADEP chronic WQC (40 µg/L) in one (1) sample, and phenanthrene exceeded the acute PADEP WQC (5 µg/L) in nine (9) samples and the PADEP chronic WQC (1 µg/L) in eighteen (18) samples. These results are summarized in Table 9. In addition, three (3) samples were re-analyzed via the SIM method in order to achieve a lower method of detection limit (MDL) for benzo(a)anthracene since AAL's standard MDL is higher than the PADEP WQC. Note that not all samples were re-analyzed only a representative number of samples and that the samples that were re-analyzed contained no detections of SVOCs.

SVOCs in Dissolved Elutriates – Twenty-five (25) SVOCs were detected in some or all of the dissolved elutriate sample, with the following SVOC detections exceeding PADEP WQC: acenaphthene exceeded PADEP chronic WQC (17 µg/L) in one (1) sample, benzo(a) anthracene exceeded the PADEP acute and chronic WQC (0.5 µg/L and 0.1 µg/L, respectively) in nine (9) samples, and phenanthrene exceeded the PADEP acute WQC (5 µg/L) in five (5) samples and the PADEP chronic WQC (1 µg/L) in ten (10) samples. As with the total elutriate samples, three (3) samples E-2, E-16 (72 hour), and E-17 were re-analyzed via the SIM method. Note that only one (1) sample, E-16 (72 hour), had a detection for benzo(a)anthracene. This detection, 0.65 µg/L, exceeded the PADEP acute WQC of 0.5 µg/L.

Pesticides: Total and dissolved elutriate samples were analyzed for TCL pesticides. Eight (8) pesticides were detected in some or all of the total elutriate samples with the following pesticide detections exceeding applicable criteria: 4,4-DDD exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in five (5) samples. Dieldrin exceeded the DRBC chronic SQO (0.0019 µg/L) in three (3) samples and the PADEP chronic WQC (0.056 µg/L) in one (1) sample. 4,4-DDE exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in fifteen (15) samples, the DRBC acute SQO (0.55 µg/L) in four (4) samples, and the PADEP acute WQC (1.1 µg/L) in three (3) samples. Endrin exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.0023 µg/L and 0.036 µg/L, respectively) in seven (7) samples and the DRBC acute SQO and the PADEP acute WQC (0.09 µg/L and 0.086 µg/L, respectively) in six (6) samples. Heptachlor epoxide exceeded the PADEP chronic WQC (0.0038 µg/L) in two (2) samples

Nine (9) pesticides were detected in some or all of the dissolved elutriate samples. 4,4-DDD exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in two (2) samples. 4,4-DDE exceeded the DRBC chronic SQO and the PADEP chronic WQC (0.001 µg/L) in twelve (12) samples and the DRBC acute SQO and the PADEP acute WQC (0.55 µg/L and 1.1 µg/L, respectively) in one (1) sample. Endrin exceeded the DRBC chronic SQO (0.0023 µg/L) in eight (8) samples, the PADEP chronic WQC (0.036 µg/L) in two (2) samples, and the DRBC acute SQO and the PADEP acute WQC (0.09 µg/L and 0.086 µg/L, respectively) in one (1) sample. Heptachlor epoxide exceeded the PADEP chronic WQC (0.0038 µg/L) in six (6) samples. 4,4-DDT exceeded the DRBC chronic SQO and the PADED chronic WQC (0.001 µg/L) in one (1) sample. Dieldrin exceeded the DRBC chronic SQO (0.0019 µg/L) in one (1) sample. Note that no criteria have been developed to evaluate endosulfan sulfate, hexachlorobenzene and delta-BHC at this time.

PCBs: One (1) PCB Aroclor (Aroclor 1260) was detected in four (4) of the total elutriate samples; all four (4) samples exceeded the PADEP chronic WQC and the DRBC chronic SQO. One (1) PCB Aroclor (Aroclor 1260) was detected in four (4) of the dissolved elutriate samples; all four (4) samples exceeded the PADEP chronic WQC and the DRBC chronic SQO, with one (1) sample exceeding the PADEP acute WQC and the DRBC acute SQO as indicated in Tables 9 and 10, respectively.

In addition, one (1) total and one (1) dissolved elutriate sample, E-13 (see Table 7b) underwent PCB Congener analysis per direction from PADEP and the DRBC (see Appendix A). As with the PCB Congener sample, all PCB Congeners were summed in order to obtain a concentration of total PCBs in the sample. The total PCB detections for the total and dissolved E-13 elutriate sample were 5.6 µg/L and 0.243 µg/L, respectively.

Inorganics (Metals & Cyanide): Total and dissolved elutriates were analyzed for metals and cyanide. Note that many metals have no defined DRBC SQOs or PA WQC, including calcium, chromium, iron, manganese, magnesium, potassium, sodium, and tin. The following metals have no defined DRBC SQOs, but do have PADEP WQC: antimony, barium, and vanadium.

Metals/Cyanide in Total Elutriates – Twenty-three (23) metals, plus cyanide, were detected in total elutriate samples. Thirteen (13) of these inorganic analytes (aluminum, arsenic, barium, cadmium, chromium trivalent, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc) were detected in concentrations that exceeded acute and/or chronic DRBC SQOs or PADEP WQC, as discussed in more detail below.

Aluminum – All thirty-three (33) total elutriate samples exceeded the DRBC acute SQO and the DRBC chronic SQO for aluminum (750 µg/L and 87 µg/L, respectively) at concentrations ranging from 21,000 µg/L to 648,000 µg/L. In addition, all thirty-three (33) of the total elutriate samples exceeded the PADEP acute WQC for aluminum (750 µg/L).

Arsenic - Ten (10) of the thirty-three (33) total elutriate samples exceeded the DRBC acute SQO (360 µg/L) at concentrations ranging from 434 µg/L to 782 µg/L and thirteen (13) samples exceeded the DRBC chronic SQO (190 µg/L) for arsenic at concentrations ranging from 244 µg/L to 782 µg/L. In addition, eleven (11) of the thirty-three (33) total elutriate samples exceeded the PADEP acute WQC for arsenic (340 µg/L) at concentrations ranging from 349 µg/L to 782 µg/L. Thirteen (13) of the thirty-three (33) total elutriate samples exceeded the PADEP chronic WQC for arsenic (150 µg/L) at concentrations ranging from 244 µg/L to 782 µg/L. The remaining samples met all applicable criteria.

Barium - Four (4) of the thirty-three (33) total elutriate samples exceeded the PADEP chronic WQC for barium (4,100 µg/L) at concentrations ranging from 4,250 µg/L to 4,980 µg/L. The remaining samples met all applicable criteria.

Cadmium - Eighteen (18) of the thirty-three (33) total elutriate samples exceeded the DRBC acute SQO and the DRBC chronic SQO for cadmium (2.79 µg/L and 0.9 µg/L, respectively), and the PADEP acute and chronic WQC for cadmium (1.57 µg/L and 0.217µg/L, respectively), at concentrations ranging from 6.7 µg/L to 297 µg/L. The remaining samples were non-detect for cadmium.

Chromium - Fourteen (14) of the thirty-three (33) total elutriate samples exceeded the DRBC acute SQO and thirty-two (32) samples exceeded the DRBC chronic SQO for trivalent chromium (1,357 µg/L and 161.7 µg/L, respectively) at concentrations ranging from 187 µg/L to 6,010 µg/L. In addition, twenty-seven (27) of the thirty-three (33) total elutriate samples exceeded the PADEP acute WQC for trivalent chromium (445 µg/L), and all of the thirty-three (33) total elutriate samples exceeded the PADEP chronic WQC for chromium trivalent (57.9 µg/L) at concentrations ranging from 187 µg/L to 6,010 µg/L. The remaining samples met all applicable criteria.

Note that hexavalent chromium was not detected in total elutriate samples collected from the Southport site.

Copper – All thirty-three (33) total elutriate samples exceeded the DRBC acute SQO and the DRBC chronic SQO for copper (13.35 µg/L and 9.14 µg/L, respectively) and the PADEP acute and chronic WQC for copper (10.5 µg/L and 7.2 µg/L, respectively) at concentrations ranging from 86 µg/L to 4,550 µg/L.

Lead - All thirty-three (33) total elutriate samples exceeded the DRBC acute SQO and the DRBC chronic SQO for lead (48 µg/L and 16 µg/L, respectively). In addition, thirty-two (32) of the total elutriate samples exceeded the PADEP acute WQC for lead (55.6 µg/L) at concentrations ranging from 109 µg/L to 6,020 µg/L, with the remaining total elutriate sample exceeding the PADEP chronic WQC (2.17 µg/L) at a concentration of 55 µg/L.

Nickel - Twenty-eight (28) of the thirty-three (33) total elutriate samples exceeded the DRBC chronic SQO for nickel (122.2 µg/L) at concentrations ranging from 147 µg/L to 752 µg/L. In addition, twenty (20) of the thirty-three (33) total elutriate samples exceeded the PADEP acute WQC for nickel (364 µg/L) at concentrations ranging from 375 µg/L to 752 µg/L, and thirty-two (32) of the thirty-three total elutriate samples exceeded the PADEP chronic WQC for nickel (40.4 µg/L) at concentrations ranging from 52 µg/L to 752 µg/L. The remaining sample met all applicable criteria.

Selenium - Eleven (11) of the thirty-three (33) total elutriate samples exceeded the DRBC acute SQO, and fifteen (15) of the thirty-three (33) total elutriate samples exceed the DRBC chronic SQO for selenium (20 µg/L and 5 µg/L, respectively) at concentrations ranging from 11.9 µg/L to 43.4 µg/L. In addition, fifteen (15) of the thirty-three (33) total elutriate samples exceeded the PADEP chronic WQC for selenium (4.99 µg/L) at concentrations ranging from 11.9 µg/L to 43.4 µg/L. The remaining samples were non-detect for selenium.

Silver - Fourteen (14) of the thirty-three (33) total elutriate samples exceeded the DRBC acute SQO silver (2.42 µg/L) and the PADEP acute WQC for silver (2.42 µg/L) at concentrations ranging from 18.2 µg/L to 111 µg/L. The remaining samples were non-detect for silver.

Thallium - Seven (7) of the thirty-three (33) total elutriate samples exceeded the PADEP chronic WQC for thallium (13 µg/L) at concentrations ranging from 14.5 µg/L to 53.3 µg/L. The remaining samples met all applicable criteria.

Vanadium - Twenty-one (21) of the thirty-three (33) total elutriate samples exceeded the PADEP acute WQC and thirty-one (31) of the thirty-three (33) total elutriate samples exceeded the PADEP chronic WQC for vanadium (510 µg/L and 100 µg/L, respectively) at concentrations ranging from 102 µg/L to 2,920 µg/L. The remaining samples met all applicable criteria.

Zinc – All thirty-three (33) total elutriate samples exceeded the DRBC acute SQO and the DRBC chronic SQO for zinc (90.7 µg/L and 82.1 µg/L, respectively), and the

PADEP acute and chronic WQC for zinc (93 µg/L and 93 µg/L, respectively) at concentrations ranging from 526 µg/L to 15,400 µg/L.

Cyanide – None of the thirty-three (33) total elutriate samples exceeded any of the DRBC or PADEP limits.

Metals/Cyanide in Dissolved Elutriates – Eighteen (18) metals plus cyanide were detected in some or all dissolved elutriate samples. Five (5) of these inorganic analytes (aluminum, chromium trivalent, copper, lead, and zinc) were detected in concentrations that exceeded the acute and/or chronic DRBC SQOs or the PADEP WQC, as discussed in more detail below.

Aluminum – Fifteen (15) of the thirty-three (33) dissolved elutriate samples exceeded the DRBC acute SQO, and PADEP acute WQC at concentrations ranging from 776 µg/L to 14,700 µg/L. In addition, eighteen (18) of the dissolved elutriate samples only exceeded the DRBC chronic SQO (87 µg/L) at concentrations ranging from 335 µg/L to 721 µg/L.

Copper - Eleven (11) of the thirty-three (33) dissolved elutriate samples exceeded the DRBC acute SQO, and eighteen (18) of the thirty-three (33) dissolved elutriate samples exceed the DRBC chronic SQO for copper (13.35 µg/L and 9.14 µg/L, respectively) at concentrations ranging from 9.14 µg/L to 391 µg/L. In addition, sixteen (16) of the thirty-three (33) dissolved elutriate samples exceeded the PADEP acute WQC and twenty (20) of the thirty-three (33) dissolved elutriate samples exceeded the PADEP chronic WQC for copper (10.5 µg/L and 7.2 µg/L, respectively). The remaining samples were non-detect.

Chromium - One (1) of the thirty-three (33) dissolved elutriate samples exceeded the DRBC chronic SQO and three (3) of the thirty-three (33) dissolved elutriate samples exceed the PADEP chronic WQC for chromium trivalent (161.7 µg/L and 57.9 µg/L, respectively) at concentrations ranging from 69.1 µg/L to 325 µg/L. The remaining samples met all applicable criteria.

Note that hexavalent chromium was not detected in dissolved elutriate samples collected from the Southport site.

Lead - Five (5) of the thirty-three (33) dissolved elutriate samples exceeded the DRBC acute SQO and eleven (11) of the thirty-three (33) dissolved elutriate samples exceed the DRBC chronic SQO for lead (48 µg/L and 16 µg/L, respectively) at concentrations ranging from 23.8 µg/L to 444 µg/L. In addition, four (4) of the thirty-three (33) dissolved elutriate samples exceeded the PADEP acute WQC, and eighteen (18) of the thirty-three (33) dissolved elutriate samples exceeded the PADEP chronic WQC for lead (55.6 µg/L and 2.17 µg/L, respectively). The remaining samples were non-detect for lead.

Zinc - Twenty-nine (29) of the thirty-three (33) dissolved elutriate samples exceeded the DRBC acute SQO and thirty (30) of the thirty-three (33) dissolved elutriate

samples exceed the DRBC chronic SQO for zinc (90.7 µg/L and 82.1 µg/L, respectively) at concentrations ranging from 89.1 µg/L to 1,560 µg/L. In addition, twenty-eight (28) of the thirty-three (33) dissolved elutriate samples exceeded the acute PADEP WQC and the chronic PADEP WQC for zinc (93 µg/L and 93 µg/L, respectively). The remaining samples met all applicable criteria.

Cyanide – None of the thirty-three (33) dissolved elutriate samples exceeded any of the DRBC SQO or PADEP WQC limits for cyanide.

In general, the concentrations of the detected metals decreased after the suspended particulate matter was removed (i.e. total elutriate concentrations were generally higher than dissolved elutriate concentrations), as can be seen in Tables 9 and 10. The difference in metal concentrations between dissolved and total elutriate samples indicates that the metals are largely associated with the suspended particulate material and not in the water matrix. This is an indication the contaminants in the sediments will not leach into ground or surface water upon when decanted and stored in the upland CDF.

TOC: TOC concentrations in the total elutriate samples ranged from 5 mg/L to 59.9 mg/L, as summarized in Table 9. TOC concentrations in the dissolved elutriate samples ranged from 3.7 mg/L to 37.6 mg/L, as summarized in Table 10.

TSS: TSS concentrations in the total elutriate samples ranged from 320 mg/L to 19,500 mg/L, as indicated in Table 9. TSS concentrations in the dissolved elutriate samples ranged from 3 mg/L to 52 mg/L, as indicated in Table 10.

3.4 Characterization of Site Water and Rinsate Blanks

Surface Water Blank – One (1) surface water sample from the Delaware River was also collected and sampled since Delaware River water is used to prepare the elutriate samples. The results from this surface water analysis are also presented in Table 11a. Detected concentrations were compared to acute and chronic DRBC SQOs and PADEP WQC. All detected concentrations of VOCs and inorganic analytes met available criteria. Note that SVOCs, pesticides, or PCB Aroclors were not detected in the Southport site water sample.

Rinsate Blank – Three (3) rinsate blanks were collected during the course of the Southport project. The results of these samples are presented in Table 11b. These samples were analyzed for VOCs, SVOCs (and SIM PAHs), pesticides (plus lindane and methoxychlor), PCB Aroclors, metals, TSS, and TOC. As with the site water, detected concentrations were compared to acute and chronic DRBC SQOs and PADEP WQC. All detected concentrations met available criteria.

4 Summary

Based on the sampling results described above, these sediments do not present a disposal concern if disposed in a non-residential setting. Concentrations of VOCs, SVOCs, pesticides, metals, and cyanide in bulk sediments and elutriates do not threaten human health or the environment, if disposed/reused in a non-residential setting. Dredged sediments from the Southport site would be disposed in one of the CDFs discussed in Section 1.

The major findings of this sediment characterization are as follows:

- The sediments to be dredged at the Southport site are predominantly comprised of clay, sand, and silt with some concentrations of gravel.

- Exceedences were found in surficial sediment samples and not in the deep samples indicating that the sediments containing concentrations of parameters that exceeded criteria were deposited recently at the site and similar to maintenance dredge material in this reach of the Delaware River.

  Low levels of VOCs, SVOCs, pesticides, PCBs, metals, and cyanide were detected in bulk sediments collected at the Southport site. However, no compounds were detected in bulk sediments in concentrations that exceeded the PADEP MSC or Clean Fill Criteria with eight (8) exceptions. Seven (7) SVOCs, benzo(a)pyrene, 2-Nitroanoline, 3-nitroaniline, Bis(2-chloroethyl)ether, N-Nitrosodi-n-propylamine, 2,4-Dinitrotoluene, and 4-Nitroaniline exceeded the PADEP Residential MSC and/or the Clean Fill Criteria in one to three samples, and one (1) metal, arsenic exceeded the PADEP Residential MSC and Clean Fill Criteria in seventeen (17) of the sixty-nine (69) samples (sixty-five samples plus four duplicate samples), as detailed on Tables 5a and 5b and in Section 3. Note that all detected concentrations that exceeded criteria did not exceed the non-residential PADEP criteria and that all CDFs along the Delaware River are located in non-residential settings.

- All TCLP sample results were below the applicable RCRA criteria, indicating that sediments at the Southport site are not hazardous.

- Low levels of SVOCs were detected in the total and dissolved elutriate samples. Comparisons of SVOC concentrations were made with the acute and chronic PADEP WQC because acute or chronic DRBC SQOs have not been developed for any of the detected substances. Four (4) SVOCs, acenaphthene, benzo(a)anthracene, fluoranthene, and phenanthrene exceeded the acute and/or chronic PADEP WQC in the total elutriate samples and acenaphthene, benzo(a)anthracene, and phenanthrene exceeded the acute and/or chronic PADEP WQC in the dissolved elutriate samples as detailed in Tables 9 and 10 and Section 3.

- Low levels of pesticides were detected in the total and dissolved elutriate samples which is generally typical of Delaware River sediments. Note that four (4) pesticides, 4,4-DDE, endrin, heptachlor epoxide, and 4,4-DDD, in the total elutriate sample, and

six (6) pesticides, 4,4-DDD, 4,4-DDE, endrin, heptachlor epoxide, 4,4-DDT, and dieldrin in the dissolved elutriate samples exceeded the acute and/or chronic DRBC SQO and PADEP WQC in one (1) to fifteen (15) samples as detailed in Tables 9 and 10 and Section 3.

- One (1) PCB Aroclor (1260) was detected in four (4) total elutriate and four (4) dissolved elutriate samples. Note that all detected concentrations exceeded the chronic DRBC SQO and PADEP WQC as detailed in Tables 9 and 10 and Section 3.0.

- The concentrations of thirteen (13) metals in total elutriate and five (5) metals in dissolved elutriate samples exceeded DRBC acute and chronic SQO and/or PADEP WQC (see Tables 9 and 10). Note that only five (5) metals exceeded criteria in both the total and dissolved elutriate samples (i.e. aluminum, trivalent chromium, copper, lead, and zinc) with the average detected concentration of each parameter significantly decreasing in the dissolved fraction. For example, the average lead detection in the total elutriate sample was calculated at 1,767 µg/L, with the calculated average in the dissolved fraction being 59.9 µg/L. The significant decreases in concentrations indicate that the detected metals are associated with the particulate matter in the sample.

- All samples were processed within holding times and according to method specifications, with the exception of the pH analysis which was conducted at the laboratory per the method detailed in the January 2010 SAP.

- Three (3) additional elutriate samples were collected and analyzed for both the 24 and 72 hour settling times (all other elutriate samples were allowed to settle for 24 hours only). This additional method was discussed with PADEP prior to sample collection (see Appendix A), and affected the preparation of three (3) elutriate samples, E-1, E-4, and E-16 in order to allow the samples to settle for 24 and 72 hours. This procedure was followed in order to simulate the concentrations of analytes that would be present at both the 24 and 72 hour retention times. Quantifying both the 24 and 72 hour elutriate is practical and valuable since retention times vary depending on a number of physical and operational factors within a CDF. See Figure 3 for representative photos of the elutriate settling process.

5 References

DRBC (Delaware River Basin Commission). 2008. Administrative Manual – Part III. *Water Quality Regulations*. West Trenton, NJ. September 12, 2008.

PADEP (Pennsylvania Department of Environmental Protection). 2001. Residential and Non-Residential PA Act 2 Medium-Specific Concentrations for Surface and Subsurface Soils (PADEP, 2001).

USACE (U.S. Army Corp of Engineers). 1985. Interim Guidance for Predicting Quality of Effluent Discharged from Confined Dredge Material Disposal Areas – Test Procedures. *Environmental Effects of Dredging Technical Notes*. EEDP-04-2. June, 1985.

WESTON (Weston Solutions, Inc.). 2010. *Sampling and Analysis Plan, Sediment Characterization, Southport Terminal*. Prepared for the Pennsylvania Department of General Services and the Philadelphia Regional Port Authority. January 2010.

TABLES

Table 4
Summary of Physical Parameters in Bulk Sediments
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	SS-1A 1003118-07 03/10/2010	SS-1B 1003118-08 03/10/2010	SS-1C 1003118-09 03/10/2010	SS-1C DUP 1003118-10 03/10/2010	SS-2A 1003118-11 03/10/2010	SS-2B 1003118-12 03/10/2010	SS-2C 1003118-13 03/10/2010	SS-3A 1003118-14 03/10/2010	SS-3B 1003166-15 03/17/2010	SS-3C 1003166-16 03/17/2010	SS-3D 1003166-17 03/17/2010	SS-4A 1003118-01 03/09/2010	SS-4B 1003118-02 03/09/2010	SS-4C 1003118-03 03/09/2010
Grain Size Analysis														
% Rock	0	0	0	0	0	0	0	0	1.9	2.2	0	0	0	3.0
% Sand	4.8	65.6	80	53.8	4.8	23.5	66.7	30.4	28.3	54.4	12	15.4	67.6	85.3
% Silt	23.8	17.2	15	15.4	33.3	29.4	14.8	34.7	17.0	13.0	25.9	23.1	17.7	3.0
% Clay	71.4	17.2	5	30.8	61.9	47.1	18.5	34.8	52.8	30.4	62.1	61.5	14.7	8.8
Miscellaneous Parameters														
pH	7.09 H	7.11 H	7.12 H	7.31 H	7.14 H	7.09 H	7.12 H	7.18 H	7.41 H	7.23 H	7.48 H	7.21 H	7.17 H	7.15 H
% Solid	63.2	64.1	72.4	72.3	63.8	63.1	66.6	60.3	66.9	64.2	69.1	61.9	71.3	72.1
% Moisture	36.8	35.9	27.6	27.7	36.2	36.9	33.4	39.7	33.1	35.8	30.9	38.1	28.7	27.9
% TOC	1.35	0.91	2.00	1.76	1.44	1.73	0.93	2.50	1.25	1.52	1.20	1.44	0.84	0.93

Parameters	SS-5A 1003118-22 03/11/2010	SS-5B 1003118-23 03/11/2010	SS-6A 1003118-24 03/11/2010	SS-6B 1003118-25 03/11/2010	SS-6C 1003118-26 03/11/2010	SS-6C DUP 1003118-29 03/11/2010	SS-7A 1003118-17 03/10/2010	SS-7B 1003118-20 03/10/2010	SS-7C 1003118-21 03/10/2010	SS-8A 1003166-06 03/16/2010	SS-8B 1003118-27 03/11/2010	SS-8C 1003118-28 03/11/2010	SS-9A 1003166-07 03/16/2010	SS-9B 1003166-04 03/15/2010
Grain Size Analysis														
% Rock	0	0	0	0	0	0	0	0	0	4.5	0	0	0	0
% Sand	45.0	68.8	29.4	38.0	47.4	44.4	22.2	70.0	66.6	27.3	17.4	20.8	29.2	88.9
% Silt	5.0	6.2	59.0	8.0	15.8	14.9	22.2	10.0	16.7	27.3	34.8	29.2	20.8	5.6
% Clay	50.0	25.0	64.7	54.0	36.8	40.7	55.6	20.0	16.7	40.9	47.8	50.0	50.0	5.6
Miscellaneous Parameters														
pH	6.93 H	7.08 H	7.00 H	7.02 H	7.12 H	7.05 H	7.16 H	7.27 H	7.35 H	7.28 H	7.10 H	7.31 H	7.12 H	7.12 H
% Solid	58.7	61.2	53.7	57.2	65.8	66.3	60.9	64.8	69.2	72.9	66.1	65.9	63.2	69.7
% Moisture	41.3	38.8	46.3	42.8	34.2	33.7	39.1	35.2	30.8	27.1	33.9	34.1	36.8	30.3
% TOC	2.37	2.15	2.11	2.50	1.88	1.43	1.94	1.50	1.94	1.24	1.46	1.22	1.91	1.41

Parameters	SS-9C 1003166-05 03/15/2010	SS-10A 1003166-08 03/16/2010	SS-10B 1003166-03 03/15/2010	SS-11A 1003118-04 03/09/2010	SS-11B 1003118-05 03/09/2010	SS-11C 1003118-06 03/09/2010	SS-12A 1003166-09 03/16/2010	SS-12B 1003166-01 03/15/2010	SS-12C 1003166-02 03/15/2010	Comp A 1004080-08 04/06/2010	Comp B 1004080-09 04/06/2010	Comp-C 1003118-30 03/11/2010	Comp-D 1003118-31 03/11/2010	Comp E 1004080-10 04/06/2010
Grain Size Analysis														
% Rock	0	0	0	0	0	31.8	0	0	0	NA	NA	NA	NA	NA
% Sand	50.0	54.6	87.5	6.7	27.8	59.1	66.7	15.5	91.3	NA	NA	NA	NA	NA
% Silt	18.2	13.6	8.3	26.6	11.1	9.1	22.2	15.5	8.6	NA	NA	NA	NA	NA
% Clay	31.8	31.8	4.2	66.7	61.1	0	11.1	69.0	0	NA	NA	NA	NA	NA
Miscellaneous Parameters														
pH	7.37 H	6.84 H	7.31 H	7.05 H	6.96 H	7.11 H	6.97 H	7.20 H	7.56 H	6.75 H	6.80 H	7.15 H	7.18 H	6.80 H
% Solid	80.6	57.6	75.9	59.2	66.1	77.6	69	63.6	82.3	63.5	62.2	63.3	73.8	59.3
% Moisture	19.4	42.4	24.1	40.8	33.9	22.4	31.0	36.4	17.7	36.5	37.8	36.7	26.2	40.7
% TOC	0.83	1.72	0.61	1.62	1.65	0.79	2.15	1.65	0.59	NA	NA	NA	NA	NA

Parameters	Comp F 1004080-13 04/05/2010	Comp G 1004080-14 04/06/2010	Comp H 1004080-15 04/07/2010	Comp I 1004080-16 04/07/2010	Comp I DUP 1004080-17 04/07/2010	Comp J 1004080-18 04/07/2010	Comp K 1003166-10 03/17/2010	Comp L 1003166-13 03/17/2010	Comp M 1004080-19 04/07/2010	Comp N 1003216-04 03/24/2010	Comp O 1004080-20 04/07/2010	Comp P 1003216-05 03/24/2010	Comp Q 1003166-14 03/17/2010	Comp R 1003216-01 03/18/2010
Grain Size Analysis														
% Rock	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Silt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Clay	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous Parameters														
pH	6.70 H	6.80 H	6.60 H	6.65 H	6.75 H	6.70 H	6.94 H	6.98 H	6.75 H	6.55 H	6.60 H	6.45 H	6.94 H	6.70 H
% Solid	58.8	57.5	61.0	58.6	58.0	50.8	62.5	60.2	58.7	61.0	61.6	54.3	57.7	67.7
% Moisture	41.2	42.5	39.0	41.4	42.0	49.2	37.5	39.8	41.3	39.0	38.4	45.7	42.3	32.3
% TOC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4
Summary of Physical Parameters in Bulk Sediments
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	Comp S 1003216-02 03/18/2010	Comp T 1003216-03 03/18/2010	Core 1 1004081-08 04/06/2010	Core 2 1004081-09 04/06/2010	Core 3 1004081-10 04/06/2010	Core 4 1004081-11 04/06/2010	Core-5 1003119-32 03/10/2010	Core 6 1003119-29 03/11/2010	Core 7 1003119-30 03/11/2010	Core 8 1003119-31 03/11/2010	Core 9 1004081-12 04/06/2010	Core 10 1004081-15 04/06/2010	Core 11 1004081-16 04/05/2010	Core 12 1004081-17 04/05/2010
Grain Size Analysis														
% Rock	NA	NA	0	0	0	0	0	0	0	0	0	0	0	0
% Sand	NA	NA	7.7	16	19.6	8	8.8	29.5	36.0	8.0	13.7	16	8	27.5
% Silt	NA	NA	15.8	6	3.9	8	40.3	18.2	12.0	22.0	7.9	2	2	1.9
% Clay	NA	NA	76.5	78	76.5	84	50.9	52.3	52.0	70.0	78.4	82	90	70.6
Miscellaneous Parameters														
pH	6.65 H	6.45 H	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Solid	66.8	60.4	55.3	64.5	59.7	59.6	62.8	59.2	63.7	64.7	61.2	59.3	57.7	58.5
% Moisture	33.2	39.6	44.7	35.5	40.3	40.4	37.2	40.8	36.3	35.3	38.8	40.7	42.3	41.5
% TOC	NA	NA	0.62	1.18	3.45	1.23	1.31	1.66	1.48	1.60	5.06	1.66	1.29	2.65

Parameters	Core 13 1004081-18 04/06/2010	Core 14 1004081-19 04/05/2010	Core 15 1004081-20 04/07/2010	Core 16 1004081-21 04/07/2010	Core 17 1004081-22 04/07/2010	Core 17 DUP 1004081-23 04/07/2010	Core 18 1004081-24 04/07/2010	Core 19 1004081-25 04/07/2010	Core 20 1004081-26 04/07/2010	Core 21 1003167-15 03/16/2010	Core 22 1003167-06 03/17/2010	Core 23 1003167-07 03/17/2010	Core 24 1003167-08 03/17/2010	Core 25 1004081-27 04/07/2010
Grain Size Analysis														
% Rock	0	0	0	0	0	0	0	0	0	2.2	0	0	0	0
% Sand	15.7	8	38.8	26	8	12.2	18	20.4	25.6	34.8	25.5	25.5	34.0	26
% Silt	1.9	4	8.2	4	2	2.1	2	2.1	1.9	15.2	23.4	23.4	19.2	2
% Clay	82.4	88	53	70	90	85.7	80	77.5	72.5	47.8	51.1	51.1	46.8	72
Miscellaneous Parameters														
pH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Solid	57.2	65.1	67.3	64.1	55.1	55.1	56.5	50.9	54.1	53.3	57.4	63.4	55.2	61.2
% Moisture	42.8	34.9	32.7	35.9	44.9	44.9	43.5	49.1	45.9	46.7	42.6	36.6	44.8	38.8
% TOC	1.25	1.55	1.89	1.69	1.39	1.28	1.47	1.38	2.23	1.88	1.97	1.88	1.76	2.39

Parameters	Core 26 1004081-28 04/07/2010	Core 27 1003217-07 03/18/2010	Core 28 1003217-09 03/24/2010	Core 29 1004081-29 04/07/2010	Core 30 1004081-30 04/07/2010	Core 31 1003217-10 03/24/2010	Core 32 1003217-11 03/24/2010	Core 33 1003167-09 03/17/2010	Core 34 1003167-10 03/17/2010	Core 35 1003217-01 03/18/2010	Core 36 1003217-02 03/18/2010	Core 37 1003217-03 03/18/2010	Core 38 1003217-04 03/18/2010	Core 39 1003217-05 03/18/2010
Grain Size Analysis														
% Rock	0	0	0	0	0	0	0	2.2	2.0	0	0	0	0	0
% Sand	34	44.9	36.2	26.5	28.6	31.3	27.1	37.8	15.7	50	43.9	36	24.6	80.4
% Silt	6	10.2	6.4	10.2	4.1	8.3	4.2	24.4	21.5	2	15.8	8	17.5	2
% Clay	60	44.9	57.4	63.3	67.3	60.4	68.7	35.6	60.8	48	40.3	56	57.9	17.6
Miscellaneous Parameters														
pH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Solid	69.7	57.6	53.0	67.0	74.2	57.9	55.1	64.3	48.7	65.6	32.2	65.3	58.6	60.8
% Moisture	30.3	42.4	47.0	33.0	25.8	42.1	44.9	35.7	51.3	34.4	67.8	34.7	41.4	39.2
% TOC	2.11	1.13	1.96	2.13	2.39	1.09	2.13	1.92	2.02	1.24	1.31	1.58	1.73	1.97

Table 4
Summary of Physical Parameters in Bulk Sediments
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	Core 39 DUP 1003217-08 03/18/2010	Core 40 1003217-06 03/18/2010	Core 41 1004080-01 04/06/2010	Core 42 1004080-02 04/06/2010	Core 43 1004080-03 04/06/2010	Core 44 1004080-04 04/06/2010	Core 45 1004080-05 04/07/2010	Core 46 1004020-01 03/31/2010	Core 47 1004020-02 03/31/2010	Core 47 DUP 1004020-03 03/31/2010	Core 48 1004020-04 03/31/2010	Core 49 1004020-05 04/01/2010	Core 50 1004020-06 04/01/2010
Grain Size Analysis													
% Rock	3.8	0	0	0	0	0	0	0	0	0	30.6	0	0
% Sand	56.6	22.9	22	19.6	20	16	26	64.6	47.9	54.2	51.0	66.7	74.5
% Silt	5.7	2.1	4	3.9	4	0	2	4.2	4.2	0	0	3.7	2.0
% Clay	33.9	75	74	76.5	76	84	72	31.2	47.9	45.8	18.4	29.6	23.5
Miscellaneous Parameters													
pH	NA	NA	6.65 H	6.85 H	6.80 H	6.80 H	6.70 H	6.50 H	5.30 H	6.05 H	5.35 H	6.90 H	6.85 H
% Solid	64.7	52.4	51.5	49.1	56.6	58.1	60.9	78.5	66.5	58.9	77.8	82.5	64.3
% Moisture	35.3	47.6	48.5	50.9	43.4	41.9	39.1	21.5	33.5	41.1	22.2	17.5	35.7
% TOC	2.99	2.41	2.56	2.81	2.47	1.68	1.44	1.29	2.68	2.72	1.25	0.74	1.01

Notes:
H= Holding time exceeded
NA= Not Analyzed
TOC = Total Organic Carbon
SS = Split Spoon
Comp = Composite

Table 5a
Sediment Volatile Organic Compound Sampling Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	SS-1A 1003119-07 03/10/2010 mg/kg	SS-1B 1003119-08 03/10/2010 mg/kg	SS-1C 1003119-09 03/10/2010 mg/kg	SS-1C DUP 1003119-10 03/10/2010 mg/kg	SS-2A 1003119-11 03/10/2010 mg/kg	SS-2B 1003119-12 03/10/2010 mg/kg	SS-2C 1003119-13 03/10/2010 mg/kg	SS-3A 1003119-14 03/10/2010 mg/kg	SS-3B 1003167-18 03/17/2010 mg/kg	SS-3C 1003167-19 03/17/2010 mg/kg	SS-3D 1003167-20 03/17/2010 mg/kg	SS-4A 1003119-01 03/09/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.019
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.011
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.076	680	3,500	4,000	0.02 BC	0.021 BC	0.023 BC	0.017 BC	0.02 BC	0.02 BC	0.021 BC	0.021 BC	0.027 B	0.024 B	0.022 B	0.021 BC
Naphthalene	25	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.24 C
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.033
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0022 J
o-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Diethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.27 J
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0077 J
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0064 J
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	SS-4B 1003119-02 03/09/2010 mg/kg	SS-4C 1003119-03 03/09/2010 mg/kg	SS-5A 1003119-22 03/11/2010 mg/kg	SS-5B 1003119-23 03/11/2010 mg/kg	SS-6A 1003119-24 03/11/2010 mg/kg	SS-6B 1003119-25 03/11/2010 mg/kg	SS-6C 1003119-26 03/11/2010 mg/kg	SS-6C DUP 1003119-32 03/11/2010 mg/kg	SS-7A 1003119-17 03/10/2010 mg/kg	SS-7B 1003119-20 03/10/2010 mg/kg	SS-7C 1003119-21 03/10/2010 mg/kg	SS-8A 1003167-11 03/16/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	ND	0.071	0.016	0.013	0.0097	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	0.04	0.0031 J	0.0031 J	0.0021 J	ND	ND	ND	0.00079 J	ND	ND
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	0.02	0.0016 J	0.0015 J	0.0016 J	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	0.015	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	0.0056 J	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	0.16	ND	0.16	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	0.0039 J	0.0031 J	0.0073 J	0.0038 J	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	0.0016 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	0.011	0.0012 J	0.0016 J	0.0013 J	ND	ND	ND	ND	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	0.0022 J	ND	0.0015 J	0.00094 J	ND	ND	ND	ND	ND	ND
Methylene chloride	0.076	680	3,500	4,000	0.022 BC	0.018 BC	0.047 BC	0.021 BC	0.022 BC	0.026 BC	0.021 B	0.018 BC	0.019 BC	0.019 BC	0.021 BC	0.016 BC
Naphthalene	25	4,400	56,000	190,000	ND	ND	0.046 C	0.045 C	0.005 JC	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	0.028	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	0.0041 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	ND	0.0055 J	0.0037 J	0.0025 J	0.003 J	0.00083 J	ND	ND	ND	ND	ND
p-Diethylbenzene	NA	NA	NA	NA	ND	ND	0.068	0.0061 J	0.0038 J	0.0044 J	0.00099 J	ND	ND	ND	ND	ND
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	0.0047 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	0.0021 J	ND	0.0011 J	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	0.0013 J	0.00085 J	0.001 J	ND	ND	ND	ND	ND	ND	ND

Table 5a
Sediment Volatile Organic Compound Sampling Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	SS-8B 1003119-27 03/11/2010 mg/kg	SS-8C 1003119-28 03/11/2010 mg/kg	SS-9A 1003167-12 03/16/2010 mg/kg	SS-9B 1003167-04 03/15/2010 mg/kg	SS-9C 1003167-05 03/15/2010 mg/kg	SS-10A 1003167-13 03/16/2010 mg/kg	SS-10B 1003167-03 03/15/2010 mg/kg	SS-11A 1003119-04 03/09/2010 mg/kg	SS-11B 1003119-05 03/09/2010 mg/kg	SS-11C 1003119-06 03/09/2010 mg/kg	SS-12A 1003167-14 03/16/2010 mg/kg	SS-12B 1003167-01 03/15/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.076	680	3,500	4,000	0.021 BC	0.041 BC	0.023 BC	0.018 BC	0.022 BC	0.016 B	0.02 BC	0.019 BC	0.021 BC	0.018 BC	0.014 B	0.024 BC
Naphthalene	25	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Diethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	SS-12C 1003167-02 03/15/2010 mg/kg	Core 1 1004081-08 04/06/2010 mg/kg	Core 2 1004081-09 04/06/2010 mg/kg	Core 3 1004081-10 04/06/2010 mg/kg	Core 4 1004081-11 04/06/2010 mg/kg	Core-5 1003119-33 03/10/2010 mg/kg	Core 6 1003119-29 03/11/2010 mg/kg	Core 7 1003119-30 03/11/2010 mg/kg	Core 8 1003119-31 03/11/2010 mg/kg	Core 9 1004081-12 04/06/2010 mg/kg	Core 10 1004081-15 04/06/2010 mg/kg	Core 11 1004081-16 04/05/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	0.0038 J	ND	ND	ND	ND
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.076	680	3,500	4,000	0.022 BC	0.016 B	0.0099 B	0.018 B	0.0044 BJ	0.016 B	0.029 BC	0.027 BC	0.018 B	0.016 B	0.0099 B	0.0071 BJ
Naphthalene	25	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	0.0012 J	ND	ND	ND	ND
p-Diethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	0.001 J	ND	ND	ND	ND
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 5a
Sediment Volatile Organic Compound Sampling Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	Core 12 1004081-17 04/05/2010 mg/kg	Core 13 1004081-18 04/06/2010 mg/kg	Core 14 1004081-19 04/05/2010 mg/kg	Core 15 1004081-20 04/07/2010 mg/kg	Core 16 1004081-21 04/07/2010 mg/kg	Core 17 1004081-22 04/07/2010 mg/kg	Core 17 DUP 1004081-23 04/07/2010 mg/kg	Core 18 1004081-24 04/07/2010 mg/kg	Core 19 1004081-25 04/07/2010 mg/kg	Core 20 1004081-26 04/07/2010 mg/kg	Core 21 1003167-15 03/16/2010 mg/kg	Core 22 1003167-06 03/17/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.015	0.0053 J	0.0044 J
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0057 J	0.0012 J	ND
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0036 J	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006 J	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0015 J	ND	ND
Methylene chloride	0.076	680	3,500	4,000	0.0063 BJ	0.013 B	0.0033 BJ	0.0095 B	0.0073 BJ	0.0085 BJ	0.0067 BJ	0.01 B	0.0091 BJ	0.0098 B	0.018 B	0.026 BC
Naphthalene	25	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0089 C
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0011 J	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0048 J	0.0013 J	ND
p-Diethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0071 J	0.0011 J	ND
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0024 J	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0023 J	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0014 J
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001 J

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	Core 23 1003167-07 03/17/2010 mg/kg	Core 24 1003167-08 03/17/2010 mg/kg	Core 25 1004081-27 04/07/2010 mg/kg	Core 26 1004081-28 04/07/2010 mg/kg	Core 27 1003217-07 03/18/2010 mg/kg	Core 28 1003217-09 03/24/2010 mg/kg	Core 29 1004081-29 04/07/2010 mg/kg	Core 30 1004081-30 04/07/2010 mg/kg	Core 31 1003217-10 03/24/2010 mg/kg	Core 32 1003217-11 03/24/2010 mg/kg	Core 33 1003167-09 03/17/2010 mg/kg	Core 34 1003167-10 03/17/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	0.0075 J	0.025	0.0037 J	ND	0.0085 J	ND	ND	ND	0.014	0.0037 J	0.0056
1,2,4-Trimethylbenzene	9	110	320	360	ND	0.0066 J	ND	0.0016 J	ND	0.0021 J	ND	ND	ND	0.0024 J	ND	0.0018 J
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	0.0021 J	ND	ND	ND	ND	ND	ND	ND	0.00097 J	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00066 J	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	0.0032 J	0.0044 J	ND	ND	ND	ND	ND	ND	0.0013 J	ND	0.005 J
m,p-Xylene [a]	990	8,000	10,000	10,000	0.001 J	0.0019 J	ND	ND	ND	0.0012 J	ND	ND	ND	0.00061 J	ND	0.0011 J
Methylene chloride	0.076	680	3,500	4,000	0.021 BC	0.033 BC	0.0037 BJ	0.0077 B	0.0076 BJ	0.0089 BJ	0.0057 BJ	0.0063 BJ	0.0076 BJ	0.0087 BJ	0.017 B	0.021 BC
Naphthalene	25	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0018 J	ND	ND
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	0.0098	ND	ND	ND	0.0021 J	ND	ND	ND	0.0025 J	ND	0.0011 J
p-Diethylbenzene	NA	NA	NA	NA	ND	0.0035 J	0.014	0.0019 J	ND	0.0012 J	ND	ND	ND	0.0031 J	ND	0.0026 J
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00072 J	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	0.0021 J	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	0.00091 J	ND	ND	ND	ND	0.00084 J	ND	ND

Table 5a
Sediment Volatile Organic Compound Sampling Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	Core 35 1003217-01 03/18/2010 mg/kg	Core 36 1003217-02 03/18/2010 mg/kg	Core 37 1003217-03 03/18/2010 mg/kg	Core 38 1003217-04 03/18/2010 mg/kg	Core 39 1003217-05 03/18/2010 mg/kg	Core 39 DUP 1003217-08 03/18/2010 mg/kg	Core 40 1003217-06 03/18/2010 mg/kg	Core 41 1004081-01 04/06/2010 mg/kg	Core 42 1004081-02 04/06/2010 mg/kg	Core 43 1004081-03 04/06/2010 mg/kg	Core 44 1004081-04 04/06/2010 mg/kg	Core 45 1004081-05 04/07/2010 mg/kg
Volatile Organic Compounds																
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.0069 J	0.0039 J	ND	0.031	ND	ND
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0084	ND	ND
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0042 J	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0027 J	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001 J	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.0011 J	ND	0.0032 J	0.0055 J	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0022 J	ND	ND
Methylene chloride	0.076	680	3,500	4,000	ND	ND	ND	ND	0.0087 B	0.01 B	0.0068 BJ	0.0073 BJ	0.008 BJ	0.014 B	0.0067 BJ	0.0069 BJ
Naphthalene	25	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017 J	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND	0.0019 J	ND	0.0021 J	0.0036 J	ND	ND
p-Diethylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.017	ND	ND	0.013	ND	ND
p-Ethyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0028 J	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	0.001 J	ND	ND	0.002 J	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001 J	ND	ND

Parameters	PADEP Clean Fill Criteria mg/kg	PADEP Residential MSC mg/kg	PADEP Non-Residential Surface Soil MSC mg/kg	PADEP Non-Residential Sub-Surface Soil MSC mg/kg	Core 46 1004021-01 03/31/2010 mg/kg	Core 47 1004021-02 03/31/2010 mg/kg	Core 47 DUP 1004021-03 03/31/2010 mg/kg	Core 48 1004021-04 03/31/2010 mg/kg	Core 49 1004021-05 04/01/2010 mg/kg	Core 50 1004021-06 04/01/2010 mg/kg
Volatile Organic Compounds										
1,2,4,5-Tetramethylbenzene	NA	NA	NA	NA	0.006 J	0.019	0.02	ND	ND	0.0037 J
1,2,4-Trimethylbenzene	9	110	320	360	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.8	110	320	360	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
Acetone	41	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND
Carbon disulfide	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND
Ethylbenzene	46	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
m,p-Xylene [a]	990	8,000	10,000	10,000	ND	ND	ND	ND	ND	ND
Methylene chloride	0.076	680	3,500	4,000	0.064	**0.085**	**0.094**	0.065	0.07	**0.088**
Naphthalene	25	4,400	56,000	190,000	0.003 J	0.0025 J	ND	ND	ND	ND
n-Butylbenzene	950	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND
n-Propylbenzene	290	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND
o-Xylene [a]	990	8,000	10,000	10,000	ND	0.0044 J	0.0048 J	ND	ND	ND
p-Diethylbenzene	NA	NA	NA	NA	0.0012 J	0.002 J	0.0042 J	ND	ND	ND
p-Ethyltoluene	NA	NA	NA	NA	0.00085 J	0.0013 J	0.0015 J	ND	ND	ND
sec-Butylbenzene	350	8,800	10,000	10,000	0.0013 J	0.002 J	0.0024 J	ND	ND	ND
tert-Butylbenzene	270	8,800	10,000	10,000	ND	ND	ND	ND	ND	ND
Toluene	44	7,600	10,000	10,000	ND	ND	ND	ND	ND	ND

Notes:
B = Analyte detected in the associated Method Blank
C= Callbration exceeded
J= Analyte detected below quantitation limit
mg/kg= milligrams per kilogram
MSC= Maximum Specific Criteria
NA= No regulatory standard
ND= Analyte not detected
PADEP= Pennsylvania Department of Environmental Protection
a = Criteria for total xylenes.
Red Text = Detected concentration exceeds the PADEP clean fill criteria
= Detected concentration exceeds the PADEP residential MSC
= Detected concentration exceeds the PADEP non-residential surface soil MSC
= Detected concentration exceeds the PADEP non-residential sub-surface soil MSC

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	SS-1A 1003118-07 03/10/2010 mg/kg	SS-1B 1003118-08 03/10/2010 mg/kg	SS-1C 1003118-09 03/10/2010 mg/kg	SS-1C DUP 1003118-10 03/10/2010 mg/kg	SS-2A 1003118-11 03/10/2010 mg/kg	SS-2B 1003118-12 03/10/2010 mg/kg	SS-2C 1003118-13 03/10/2010 mg/kg	SS-3A 1003118-14 03/10/2010 mg/kg	SS-3B 1003166-15 03/17/2010 mg/kg	SS-3C 1003166-16 03/17/2010 mg/kg	SS-3D 1003166-17 03/17/2010 mg/kg	SS-4A 1003118-01 03/09/2010 mg/kg	SS-4B 1003118-02 03/09/2010 mg/kg	SS-4C 1003118-03 03/09/2010 mg/kg
Polychlorinated Biphenyls																		
	---	---	---	---	PCBs not detected at or above the applicable method detection limit in these samples.													
Pesticides																		
4,4´-DDT	53	53	230	190,000	ND	ND	ND	0.00013	0.00041	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	130	1,300	17,000	190,000	ND	ND	0.0004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	70	1,300	17,000	190,000	ND	ND	0.00015	0.00018	0.00012	0.0002	0.00009 J	ND	ND	ND	ND	ND	0.000052 J	ND
Endrin	5.5	66	840	190,000	0.0036	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds																		
Anthracene	350	66,000	190,000	190,000	ND	ND	ND	ND	ND	0.03 J	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	25	25	110	190,000	ND	ND	ND	ND	0.019 J	0.1	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	2.5	2.5	11	190,000	ND	ND	ND	ND	ND	0.078	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	25	25	110	190,000	ND	ND	ND	ND	ND	0.062 J	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	180	13,000	170,000	190,000	ND	ND	ND	ND	ND	0.026 J	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	250	250	1,100	190,000	ND	ND	ND	ND	ND	0.06 J	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	130	1,300	5,700	10,000	0.015 J	1.6	0.46	0.33	ND	0.37	0.22	ND	0.19	0.086	0.13	0.024 J	0.14	0.36
Butyl benzyl phthalate	10,000	10,000	10,000	10,000	0.016 JB	0.033 JB	0.019 JB	ND	0.027 JB	0.009 JB	0.02 JB	0.017 JB	ND	ND	ND	0.032 JB	0.032 JB	0.033 JB
Chrysene	230	2,500	11,000	190,000	ND	ND	ND	ND	0.013 J	0.097	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	160	10,000	10,000	10,000	ND	0.0085 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	1,500	10,000	10,000	10,000	ND	0.03 J	0.011 J	0.0074 J	ND	ND	ND	ND	ND	ND	ND	0.028 J	ND	ND
Fluoranthene	3,200	8,800	110,000	190,000	ND	ND	ND	ND	0.025 J	0.099	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	25	25	110	190,000	ND	ND	ND	ND	ND	0.036 J	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	10,000	66,000	190,000	190,000	ND	ND	ND	ND	0.013 J	0.054 J	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	2,200	6,600	84,000	190,000	ND	ND	ND	ND	0.019 J	0.13	ND	ND	ND	ND	ND	ND	ND	ND
Inorganic Analytes																		
Aluminum	NA	190,000	190,000	190,000	6,530	5,220	4,710	4,330	6,550	7,420	6,160	7,340	7,120	8,140	5,010	7,940	4,790	6,160
Antimony	27	88	1,100	190,000	ND	ND	ND	ND	ND	ND	ND	ND	0.302 J	0.323 J	ND	0.358 J	ND	ND
Arsenic	12	12	53	190,000	3.33	2.66	2.6	2.45	3.34	4.3	3.26	4.42	3.92	4.1	2.4	4.04	2.44	3.2
Barium	8,200	15,000	190,000	190,000	54.6	39	36	32.2	55.7	58.4	44.8	65.9	57.7	65.7	37.1	62.7	32.8	42.7
Cadmium	38	47	210	190,000	ND	ND	ND	ND	ND	0.397 J	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	NA	NA	NA	NA	1,970	1,340	1,240	1,080	1,990	2,240	1,540	2,150	1,880	2,300	1,160	2,250	1,080	1,270
Chromium, Total	NA	NA	NA	NA	19.9	14.7	13.6	12.3	20	22.1	16.7	23.2	20.9	23.7	13.5	23	12.5	17
Chromium, Hexavalent	94	94	420	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.366 J	ND	ND	ND	ND
Chromium, Trivalent	190,000	190,000	190,000	190,000	19.9	14.7	13.6	12.3	20	22.1	16.7	23.2	20.9	23.3	13.5	23	12.5	17
Copper	8,200	8,200	100,000	190,000	5.06	3.8	3.51	3.25	5.14	6.86	4.25	6.5	5.57	6.08	3.66	5.73	3.04	4.56
Iron	NA	66,000	190,000	190,000	16,400	13,100	12,900	12,900	17,500	18,400	16,500	20,600	19,300	22,500	12,500	19,400	13,400	16,000
Lead	450	500	1,000	190,000	5.34	4.2	4.07	3.79	5.84	8.01	4.88	6.42	5.65	6.14	4.22	5.92	3.86	4.87
Magnesium	NA	NA	NA	NA	3,040	2,250	2,090	1,900	2,990	3,200	2,590	3,350	2,970	3,450	2,070	3,240	1,920	2,460
Manganese	31,000	31,000	190,000	190,000	422	321	371	336	504	570	429	580	455	597	313	466	348	460
Mercury	10	66	840	190,000	ND	ND	ND	ND	ND	0.0156	ND	ND	0.0154	0.0157	0.0118	ND	ND	ND
Nickel	650	4,400	56,000	190,000	11.8	9.37	8.84	8.17	11.8	13.8	10.8	13.8	12.4	13.7	9.53	13	8.72	10.8
Potassium	NA	NA	NA	NA	1,120	908	817	739	1,150	1,330	1,110	1,270	1,320	1,540	840	1,500	866	1,250
Selenium	26	1,100	14,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	0.589 J	0.693 J	ND	0.356 J	ND	ND
Sodium	NA	NA	NA	NA	121	101	87.4	74.8	130	140	115	141	119	132	82.7	144	79.9	95.9
Thallium	14	15	200	190,000	0.501 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.03	ND	ND
Tin	240	130,000	190,000	190,000	7.88	5.82	5.4	4.84	8.08	13.7	6.47	8.92	10.4	11.3	6.8	9.01	4.89	6.77
Vanadium	1,500	1,500	20,000	190,000	17.6	13.5	12.7	11.5	18	20.1	15.9	20.5	19.1	21.9	12.1	21.2	11.8	17.2
Zinc	12,000	66,000	190,000	190,000	33.9	28.4	25.7	24.2	35	44.1	31.4	38.1	36.3	40.2	29.8	37.3	27.3	31.9
Miscellaneous																		
Cyanide	200 [c]	4,400	56,000	190,000	0.168	ND	ND	ND	ND	ND	ND	ND	0.164	0.224	ND	ND	ND	ND
Total DRO TPH	NA	NA	NA	NA	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfide	---	---	---	---	Sulfide not detected at or above the method detection for these samples.													

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	SS-5A 1003118-22 03/11/2010 mg/kg	SS-5B 1003118-23 03/11/2010 mg/kg	SS-6A 1003118-24 03/11/2010 mg/kg	SS-6B 1003118-25 03/11/2010 mg/kg	SS-6C 1003118-26 03/11/2010 mg/kg	SS-6C DUP 1003118-29 03/11/2010 mg/kg	SS-7A 1003118-17 03/10/2010 mg/kg	SS-7B 1003118-20 03/10/2010 mg/kg	SS-7C 1003118-21 03/10/2010 mg/kg	SS-8A 1003166-06 03/16/2010 mg/kg	SS-8B 1003118-27 03/11/2010 mg/kg	SS-8C 1003118-28 03/11/2010 mg/kg	SS-9A 1003166-07 03/16/2010 mg/kg	SS-9B 1003166-04 03/15/2010 mg/kg
Polychlorinated Biphenyls																		
Aroclor 1260	30	30	130	190,000	ND	0.23	0.27	0.27	0.27	0.27	ND	ND	ND	ND	ND	ND	0.21	ND
Pesticides																		
4,4´-DDD	6.8	75	330	190,000	0.018	0.016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4´-DDE	41	53	230	190,000	0.56	0.31	0.38	0.22	0.13	0.13	ND	ND	ND	ND	0.00016	ND	0.25	0.0052
4,4´-DDT	53	53	230	190,000	ND	ND	ND	ND	0.054	0.06	ND	ND	ND	ND	ND	ND	ND	0.0018 C
alpha-BHC	0.046	2.8	13	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0026
delta-BHC	11	130	1,700	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0004	ND	ND
Endosulfan sulfate	70	1,300	17,000	190,000	0.0041	0.0062	0.006	0.0097	0.0066	0.0093	ND	ND	ND	ND	ND	ND	0.0067	0.0013
Endrin	5.5	66	840	190,000	ND	ND	ND	0.017	0.0041	0.012	ND	ND	ND	ND	ND	ND	0.0096	0.00089
Heptachlor epoxide	1.1	2	8.7	190,000	ND	ND	0.0019	0.02	0.011	0.0092	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	91	1,300	10,000	10,000	ND	ND	ND	ND	0.0015 C	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds																		
2-Methylnaphthalene	2,900	4,400	10,000	10,000	9.2	0.13	0.1	0.095	0.075	0.11	ND	ND	ND	ND	ND	ND	0.041 J	0.053 J
3+4-Methylphenol	37	1,100	14,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.053 J
4-Nitroaniline	0.031	13	160	190,000	0.37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	4.1	1,800	22,000	190,000	ND	ND	ND	ND	ND	ND	0.05 J	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	2,700	13,000	170,000	190,000	9.2	0.52	0.15	0.12	0.089	0.11	ND	ND	ND	ND	ND	ND	0.051 J	0.052 J
Acenaphthylene	2,500	13,000	170,000	190,000	ND	ND	ND	ND	0.027 J	0.039 J	ND	ND	ND	ND	ND	ND	0.032 J	ND
Anthracene	350	66,000	190,000	190,000	18	1.3	0.19	0.15	0.094	0.2	ND	ND	ND	ND	ND	ND	0.069	0.052 J
Benzo(a)anthracene	25	25	110	190,000	5.4	1.4	0.59	0.45	0.28	0.38	ND	ND	ND	ND	ND	ND	0.2	0.13
Benzo(a)pyrene	2.5	2.5	11	190,000	4.0	0.96	0.55	0.43	0.26	0.38	ND	ND	ND	ND	ND	ND	0.21	0.13
Benzo(b)fluoranthene	25	25	110	190,000	4.4	1.2	0.61	0.53	0.33	0.36	ND	ND	ND	ND	ND	ND	0.21	0.13
Benzo(g,h,i)perylene	180	13,000	170,000	190,000	1.6	0.49	0.37	0.3	0.19	0.27	ND	ND	ND	ND	ND	ND	0.15	0.09
Benzo(k)fluoranthene	250	250	1,100	190,000	3.5	0.81	0.48	0.34	0.18	0.37	ND	ND	ND	ND	ND	ND	0.2	0.077
Bis(2-ethylhexyl)phthalate	130	1,300	5,700	10,000	5.5	5.1	5.9	5.1	3.9	4.7	0.055 J	0.22	0.2	ND	0.097	0.1	3.9	0.53
Butyl benzyl phthalate	10,000	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	0.2 B	ND	0.023 JB	ND	ND	ND	ND	ND
Caprolactam	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	ND
Carbazole	21	900	4,000	190,000	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	230	2,500	11,000	190,000	7	1.9	0.78	0.56	0.4	0.56	ND	ND	ND	ND	ND	ND	0.25	0.15
Dibenzo(a,h)anthracene	2.5	2.5	11	190,000	0.66	0.2	0.13	0.079	0.063	0.098	ND	ND	ND	ND	ND	ND	0.083	0.037 J
Dibenzofuran	NA	NA	NA	NA	5.6	0.28	0.11	0.08	0.046 J	0.072	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	0.012 J	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	1,500	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	0.01 J	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	3,200	8,800	110,000	190,000	17	2.4	1	0.72	0.44	0.63	ND	ND	ND	ND	ND	ND	0.41	0.29
Fluorene	3,000	8,800	110,000	190,000	9.5	0.6	0.16	0.14	0.088	0.15	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	25	25	110	190,000	1.8	0.64	0.41	0.32	0.2	0.27	ND	ND	ND	ND	ND	ND	0.14	0.082
Naphthalene	25	4,400	56,000	190,000	1.4	0.18	0.14	0.13	0.11	0.17	ND	ND	ND	ND	ND	ND	0.055 J	0.057 J
Phenanthrene	10,000	66,000	190,000	190,000	38	2.6	0.77	0.58	0.38	0.57	ND	ND	ND	ND	ND	ND	0.26	0.17
Pyrene	2,200	6,600	84,000	190,000	16	3.1	1.4	1.1	0.65	0.89	ND	ND	ND	ND	ND	ND	0.43	0.31
Inorganic Analytes																		
Aluminum	NA	190,000	190,000	190,000	11,100	7,990	16,500	16,900	16,700	7,640	7,220	6,240	4,450	5,030	5,720	6,050	14,700	5,530
Antimony	27	88	1,100	190,000	0.627 J	0.537 J	0.789 J	0.458 J	0.27 J	0.361 J	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	12	12	53	190,000	19.5	11.8	19.7	13.3	10.7	9.86	3.89	3.15	2.27	3.06	3.02	3.25	14	5.62
Barium	8,200	15,000	190,000	190,000	137	101	131	135	107	86.3	59.6	54.1	34.2	40.5	47.7	51.3	111	50
Beryllium	320	440	5,600	190,000	0.472 J	0.375 J	0.727	0.264 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	38	47	210	190,000	5.33	4.13	5.74	5.16	3.11	2.9	0.254 J	0.981	ND	ND	0.285 J	0.39 J	4.75	1.99
Calcium	NA	NA	NA	NA	2,640	1,990	2,240	2,090	1,820	1,590	2,060	1,710	1,020	1,250	1,520	1,550	2,170	1,080
Chromium, Total	NA	NA	NA	NA	135	86.3	137	107	73.9	64	22.1	18.2	12.2	14	16.4	17.6	89.2	39.8
Chromium, Hexavalent	94	94	420	190,000	1.21	4.87	10.7	2.36	0.931	1.03	1.2	7.14	7.99	ND	1.4	ND	ND	1.48
Chromium, Trivalent	190,000	190,000	190,000	190,000	134	81.4	126	105	72.9	62.9	20.9	11	4.17	14	15	17.6	89.2	38.3
Copper	8,200	8,200	100,000	190,000	114	80.3	118	103	70.2	64.3	5.32	4.87	3.31	4.09	4.24	4.82	95.8	43.5
Iron	NA	66,000	190,000	190,000	30,700	25,800	31,600	31,800	27,700	21,200	20,100	15,500	13,500	13,700	16,700	15,600	24,000	12,500
Lead	450	500	1,000	190,000	141	173	137	111	69	66	6	5	4	4	5	5	98	46
Magnesium	NA	NA	NA	NA	3,680	2,680	3,230	3,580	3,640	2,850	3,080	2,650	1,850	2,140	2,390	2,560	3,130	1,820
Manganese	31,000	31,000	190,000	190,000	462	371	408	404	404	387	491	482	418	310	425	405	386	302
Mercury	10	66	840	190,000	0.496	0.349	0.383	0.398	0.266	0.232	ND	ND	ND	0.0138	ND	ND	0.327	0.0937
Nickel	650	4,400	56,000	190,000	30.6	23.7	29.9	28.5	23.5	20.6	12.5	11.3	8.85	9.38	10.1	11	27.1	13.1
Potassium	NA	NA	NA	NA	2,250	1,620	2,050	2,830	2,840	1,860	1,320	1,110	723	883	1,050	1,020	2,150	782
Selenium	26	1,100	14,000	190,000	0.817 J	0.582 J	0.751 J	0.608 J	0.55 J	0.435 J	ND	ND	ND	ND	ND	0.318 J	1.1	0.834
Silver	84	1,100	14,000	190,000	2.42	1.35	2.19	1.9	1.16	1.04	ND	ND	ND	ND	ND	ND	1.68	0.567
Sodium	NA	NA	NA	NA	225	154	195	191	160	133	130	106	77.2	91.6	104	114	172	89.5
Thallium	14	15	200	190,000	0.517 J	ND	0.964	1.19	1.22	ND	0.526 J	ND	ND	ND	ND	ND	ND	ND
Tin	240	130,000	190,000	190,000	66.1	41.2	65.8	49.7	33.2	29.3	8.66	7.31	4.79	5.96	6.57	7.05	44.3	20.2
Vanadium	1,500	1,500	20,000	190,000	72.7	49.3	90.3	64.6	45.2	34.4	19.4	16.7	11	12.5	15.5	15.8	40.8	13.7
Zinc	12,000	66,000	190,000	190,000	420	358	422	390	288	274	36.4	34.2	26.5	28.8	30.9	32.5	361	187
Miscellaneous																		
Cyanide	200 [c]	4,400	56,000	190,000	0.637	0.464	0.669	0.654	0.192	0.208	ND	ND	ND	0.140	ND	0.566	0.428	0.320
Total DRO TPH	NA	NA	NA	NA	77 J	ND	ND	ND	40 J	ND	ND	ND	ND	ND	ND	ND	53 J	ND
Sulfide	---	---	---	---	Sulfide not detected at or above the method detection for these samples.													

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	SS-9C 1003166-05 03/15/2010 mg/kg	SS-10A 1003166-08 03/16/2010 mg/kg	SS-10B 1003166-03 03/15/2010 mg/kg	SS-11A 1003118-04 03/09/2010 mg/kg	SS-11B 1003118-05 03/09/2010 mg/kg	SS-11C 1003118-06 03/09/2010 mg/kg	SS-12A 1003166-09 03/16/2010 mg/kg	SS-12B 1003166-01 03/15/2010 mg/kg	SS-12C 1003166-02 03/15/2010 mg/kg	Comp A 1004080-08 04/06/2010 mg/kg	Comp B 1004080-09 04/06/2010 mg/kg	Comp-C 1003118-30 03/11/2010 mg/kg	Comp-D 1003118-31 03/11/2010 mg/kg	Comp E 1004080-10 04/06/2010 mg/kg
Polychlorinated Biphenyls																		
					PCBs not detected at or above the applicable method detection limit in these samples.													
Pesticides																		
4,4´-DDE	41	53	230	190,000	ND	0.013	ND	ND	ND	ND	0.0042	ND	ND	ND	ND	ND	ND	ND
4,4´-DDT	53	53	230	190,000	ND	ND	0.000054 JC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00029
delta-BHC	11	130	1,700	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00024	ND
Endosulfan sulfate	70	1,300	17,000	190,000	ND	0.0011	ND	0.00016	0.00011	ND	0.00079	ND	ND	ND	ND	ND	ND	ND
Endrin	5.5	66	840	190,000	ND	0.0026	ND	ND	0.000039 J	ND	0.0019	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds																		
1,2-Dichlorobenzene	59	3,800	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0068 J	ND
2-Methylnaphthalene	2,900	4,400	10,000	10,000	ND	0.019 J	ND	ND	ND	ND	0.047 J	ND	ND	ND	ND	ND	ND	ND
3+4-Methylphenol	37	1,100	10,000	10,000	ND	ND	ND	ND	ND	ND	0.052 J	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenylether	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.015 J	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	2,700	13,000	170,000	190,000	ND	0.041 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	2,500	13,000	170,000	190,000	ND	0.021 J	ND	ND	ND	ND	0.026 J	ND	ND	ND	ND	ND	ND	ND
Anthracene	350	66,000	190,000	190,000	0.007 J	0.08	ND	ND	ND	ND	0.11	ND	ND	ND	ND	ND	0.008 J	ND
Benzo(a)anthracene	25	25	110	190,000	0.017 J	0.3	ND	ND	ND	ND	0.35	ND	ND	ND	ND	ND	0.021 J	ND
Benzo(a)pyrene	2.5	2.5	11	190,000	ND	0.31	ND	ND	ND	ND	0.35	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	25	25	110	190,000	ND	0.33	ND	ND	ND	ND	0.32	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	180	13,000	170,000	190,000	ND	0.25	ND	ND	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	250	250	1,100	190,000	ND	0.32	ND	ND	ND	ND	0.29	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	130	1,300	5,700	10,000	0.11	0.45	0.15	0.026 J	0.35	0.1	ND	0.28	0.12	0.065	0.049 J	0.59	0.1	0.13
Butyl benzyl phthalate	10,000	10,000	10,000	10,000	ND	0.083	ND	0.049 JB	0.044 JB	0.032 BJ	ND	ND	ND	0.075	ND	ND	ND	ND
Carbazole	21	900	4,000	190,000	ND	0.023 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	230	2,500	11,000	190,000	0.022 J	0.38	ND	ND	ND	ND	0.41	ND	ND	ND	ND	ND	0.024 J	ND
Dibenzo(a,h)anthracene	2.5	2.5	11	190,000	ND	0.094	ND	ND	ND	ND	0.062	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	NA	NA	NA	NA	ND	0.02 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	160	10,000	10,000	10,000	ND	ND	ND	0.012 J	0.011 J	0.0083 J	ND	ND	ND	0.024 J	0.012 J	ND	ND	ND
Di-n-butyl phthalate	1,500	10,000	10,000	10,000	0.01 J	0.029 J	ND	ND	0.0076 J	ND	ND	ND	ND	0.016 J	0.032 J	ND	ND	0.052 J
Fluoranthene	3,200	8,800	110,000	190,000	0.02 J	0.53	ND	ND	ND	ND	0.57	ND	ND	ND	ND	ND	0.029 J	ND
Fluorene	3,000	8,800	110,000	190,000	ND	0.037 J	ND	ND	ND	ND	0.052 J	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	25	25	110	190,000	ND	0.24	ND	ND	ND	ND	0.23	ND	ND	ND	ND	ND	ND	ND
Naphthalene	25	4,400	56,000	190,000	ND	0.023 J	ND	ND	ND	ND	0.079	ND	ND	ND	ND	ND	0.01 J	ND
Phenanthrene	10,000	66,000	190,000	190,000	0.013 J	0.29	ND	ND	ND	ND	0.39	ND	ND	ND	ND	ND	0.024 J	ND
Pyrene	2,200	6,600	84,000	190,000	0.028 J	0.52	ND	ND	ND	ND	0.65	ND	ND	ND	ND	ND	0.05 J	ND
Inorganic Analytes																		
Aluminum	NA	190,000	190,000	190,000	3,410	7,470	2,970	8,820	12,700	4,230	5,860	7,000	3,290	6,990	8,210	6,880	4,710	12,300
Antimony	27	88	1,100	190,000	ND	0.551 J	ND	ND	0.331 J	ND	ND	ND	ND	ND	ND	ND	ND	2.36
Arsenic	12	12	53	190,000	1.9	5.76	1.71	3.78	4.86	2.31	11.8	4.06	1.66	3.33	3.81	4.13	2.96	4.31
Barium	8,200	15,000	190,000	190,000	23.1	84.3	20	65.2	64.5	30.7	79.3	62	22.2	50.7	60.4	58.5	36.1	68.2
Cadmium	38	47	210	190,000	ND	1.4	ND	ND	ND	ND	2.85	ND	ND	ND	ND	ND	0.373 J	ND
Calcium	NA	NA	NA	NA	608	2,220	500	2,330	2,430	880	1,200	2,240	659	1,780	2,160	1,900	896	2,370
Chromium, Total	NA	NA	NA	NA	8.88	28.9	7.39	25.6	27.1	12.6	49	21.4	8.73	20.8	24.1	21.7	16.5	26.2
Chromium, Hexavalent	94	94	420	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.21	0.377 J	ND
Chromium, Trivalent	190,000	190,000	190,000	190,000	8.88	28.9	7.39	25.6	27.1	12.6	49	21.4	8.73	20.8	24.1	19.5	16.2	26.2
Copper	8,200	8,200	100,000	190,000	2.69	38.2	2	5.8	6.4	3.46	53.3	5.61	2.17	4.35	5.76	5.22	8.38	6.18
Iron	NA	66,000	190,000	190,000	9,560	21,800	8,340	19,700	20,600	11,600	15,700	22,000	9,320	15,700	18,600	16,600	13,200	21,500
Lead	450	500	1,000	190,000	3.31	40.9	2.81	6.09	6.62	3.94	72.1	6.21	3.15	4.93	5.92	5.53	10.2	6.44
Magnesium	NA	NA	NA	NA	1,390	2,740	1,180	3,610	3,870	1,870	2,050	3,050	1,320	2,730	3,230	2,960	1,880	3,610
Manganese	31,000	31,000	190,000	190,000	189	766	200	495	539	331	275	769	253	419	487	432	345	580
Mercury	10	66	840	190,000	ND	0.134	ND	ND	ND	ND	0.347	0.0262	ND	ND	ND	ND	0.0175	0.0147
Nickel	650	4,400	56,000	190,000	6.6	18.6	6.15	13.8	14.7	8.69	16	12.8	6.57	12.1	13.6	12.3	9.09	15
Potassium	NA	NA	NA	NA	560	1,260	477	1,730	1,800	706	944	1,290	536	1,310	1,570	1,240	830	1,740
Selenium	26	1,100	14,000	190,000	ND	1.01	ND	ND	ND	ND	0.63 J	0.95	0.266 J	0.429 J	0.558 J	ND	ND	0.472 J
Silver	84	1,100	14,000	190,000	ND	0.576 J	ND	ND	ND	ND	0.435 J	ND	ND	ND	ND	ND	ND	ND
Sodium	NA	NA	NA	NA	55	132	44.7	150	164	76	118	120	49.4	158	179	121	67.4	188
Thallium	14	15	200	190,000	ND	ND	ND	1.29	0.714 J	ND	ND	ND	ND	ND	ND	0.602 J	ND	ND
Tin	240	130,000	190,000	190,000	3.84	14.2	3.17	10.2	10.7	4.9	27.1	9.13	3.86	8.35	9.94	8.7	7.09	11.2
Vanadium	1,500	1,500	20,000	190,000	7.73	22.9	6.79	24.4	26.2	12.3	15.9	19.4	7.8	18	21.2	19.5	11.6	23.8
Zinc	12,000	66,000	190,000	190,000	23.3	235	21.1	38.5	41	26.6	300	37.7	21.9	34.7	38.7	34.6	50.4	43.9
Miscellaneous																		
Cyanide	200 [c]	4,400	56,000	190,000	ND	0.326	ND	ND	ND	ND	0.581	0.182	ND	ND	ND	ND	ND	3.49
Total DRO TPH	NA	NA	NA	NA	ND	ND	ND	ND	47 J	ND	63 J	ND	ND	ND	ND	ND	ND	ND
Sulfide	---	---	---	---	Sulfide not detected at or above the method detection for these samples.													

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	Comp F 1004080-13 04/05/2010 mg/kg	Comp G 1004080-14 04/06/2010 mg/kg	Comp H 1004080-15 04/07/2010 mg/kg	Comp I 1004080-16 04/07/2010 mg/kg	Comp I DUP 1004080-17 04/07/2010 mg/kg	Comp J 1004080-18 04/07/2010 mg/kg	Comp K 1003166-10 03/17/2010 mg/kg	Comp L 1003166-13 03/17/2010 mg/kg	Comp M 1004080-19 04/07/2010 mg/kg	Comp N 1003216-04 03/24/2010 mg/kg	Comp O 1004080-20 04/07/2010 mg/kg	Comp P 1003216-05 03/24/2010 mg/kg	Comp Q 1003166-14 03/17/2010 mg/kg	Comp R 1003216-01 03/18/2010 mg/kg
Polychlorinated Biphenyls																		
Aroclor 1016	15	15	200	10,000	ND	ND	ND	ND	ND	12	ND	ND	1.0	ND	ND	ND	ND	ND
Aroclor 1260	30	30	130	190,000	ND	ND	0.017	ND	ND	8.5	0.063	0.084	0.79	0.087	0.036	0.12	ND	ND
Pesticides																		
4,4´-DDD	6.8	75	330	190,000	ND	ND	ND	ND	0.00021	ND	ND	ND	ND	0.036	ND	0.057	ND	0.007
4,4´-DDE	41	53	230	190,000	ND	ND	0.0099	ND	ND	0.9	0.025	0.33	0.37	0.14	0.035	0.42	0.066	0.017
4,4´-DDT	53	53	230	190,000	ND	0.00049	ND	ND	0.00036	ND	ND	ND	ND	ND	0.0095	ND	ND	0.0063
Endosulfan sulfate	70	1,300	17,000	190,000	ND	ND	0.0017	ND	ND	0.024	0.0013	0.0088	0.013	0.0047	0.0032	0.02	0.0011	ND
Endrin	5.5	66	840	190,000	ND	ND	ND	ND	0.00077	ND	0.0078	ND	ND	0.0079	ND	ND	0.0029	ND
Semivolatile Organic Compounds																		
1,2,4-Trichlorobenzene	27	2,200	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 J	ND	ND
1,4-Dichlorobenzene	10 [d]	750 [d]	3300 [d]	190000 [d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.023 J	ND	ND
2,4,5-Trichlorophenol	2,300	22,000	190,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 J	ND	0.048 J	ND	ND
2,4,6-Trichlorophenol	3.1	66	840	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025 J	ND	0.057 J	ND	ND
2,4-Dichlorophenol	1	660	8,400	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.011 J	ND	ND
2,4-Dimethylphenol	32	4,400	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.023 J	ND	0.083	ND	ND
2,4-Dinitrotoluene	0.05	58	260	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025 J	ND	0.037 J	ND	ND
2,6-Dinitrotoluene	1.1	220	2,800	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06 J	ND	0.089	ND	0.011 J
2-Chloronaphthalene	6,200	18,000	190,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014 J	ND	ND
2-Methylnaphthalene	2,900	4,400	10,000	10,000	ND	ND	0.17	ND	ND	0.43	0.065	0.52	0.51	0.019 J	0.4	0.08	0.19	0.016 J
2-Nitroaniline	0.033	13	160	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.015 J	ND	**0.086**	ND	0.025 J
2-Nitrophenol	5.9	1,800	22,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.029 J	ND	0.043 J	ND	ND
3,3´-Dichlorobenzidine	8.3	40	180	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.038 J	ND	ND	ND	ND
3+4-Methylphenol	37	1,100	10,000	10,000	ND	ND	0.27	ND	ND	0.45	0.071	ND	0.23	0.044 J	0.7	0.18	0.18	0.013 J
3-Nitroaniline	0.038	13	160	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.033 J	ND	**0.041 J**	ND	ND
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37 C	ND	0.44 C	ND	ND
4-Bromophenyl phenylether	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.018 J	ND	0.015 J	0.049 J	ND
4-Chloro-3-methylphenol	NA	1,100	14,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.045 J	ND	0.14	ND	0.014 J
4-Chloroaniline	19	880	11,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	ND	ND
4-Chlorophenyl phenylether	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.013 J	ND	0.04 J	ND	ND
4-Nitroaniline	0.031	13	160	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.018 J	ND	ND	ND	ND
4-Nitrophenol	4.1	1,800	22,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.42	ND	0.78	ND	0.07 J
Acenaphthene	2,700	13,000	170,000	190,000	ND	ND	0.12	ND	ND	1.7	0.059 J	1.5	0.9	0.089	0.2	0.094	0.69	0.032 J
Acenaphthylene	2,500	13,000	170,000	190,000	ND	ND	0.041 J	ND	ND	0.14	0.037 J	0.052 J	0.073	ND	0.091	0.072 J	ND	0.023 J
Anthracene	350	66,000	190,000	190,000	ND	ND	0.19	ND	ND	2.4	0.1	3	1.6	0.14	0.35	0.16	0.37	0.19
Azobenzene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.042 J	ND	0.024 J	ND	ND
Benzo(a)anthracene	25	25	110	190,000	ND	ND	0.35	ND	ND	2.1	0.37	1	1	0.078	0.83	0.6	0.64	0.4
Benzo(a)pyrene	2.5	2.5	11	190,000	ND	ND	0.3	ND	ND	1.3	0.4	0.78	0.69	0.73	0.67	0.46	0.57	0.32
Benzo(b)fluoranthene	25	25	110	190,000	ND	ND	0.3	ND	ND	1.5	0.4	0.92	0.87	0.9	0.72	0.53	0.61	0.28
Benzo(g,h,i)perylene	180	13,000	170,000	190,000	ND	ND	0.22	ND	ND	0.69	0.27	0.37	0.42	0.19	0.39	0.3	0.33	0.21
Benzo(k)fluoranthene	250	250	1,100	190,000	ND	ND	0.31	ND	ND	1.2	0.31	0.54	0.61	0.53	0.48	0.48	0.43	0.27
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01 J	ND	0.021 J	ND	ND
Bis(2-chloroethyl)ether	0.0039	0.96	5	5.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.027 J**	ND	ND
Bis(2-ethylhexyl)phthalate	130	1,300	5,700	10,000	0.084	0.094	0.76	0.058 J	0.068 J	9.4	0.57	17	5.6	0.01 J	1.3	9.9	2.8	0.9
Butyl benzyl phthalate	10,000	10,000	10,000	10,000	0.047 J	0.049 J	ND	ND	0.053 J	ND	ND	ND	ND	0.019 J	ND	0.099	ND	0.065
Caprolactam	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.1	2.1	ND	ND	ND	ND	1.5	ND
Carbazole	21	900	4,000	190,000	ND	ND	ND	ND	ND	0.16	0.032 J	0.3	0.12	ND	ND	0.046 J	0.061 J	0.047 J
Chrysene	230	2,500	11,000	190,000	ND	ND	0.42	ND	ND	2.8	0.44	1.6	1.3	0.01 J	0.99	0.71	0.76	0.51
Dibenzo(a,h)anthracene	2.5	2.5	11	190,000	ND	ND	0.077	ND	ND	0.32	0.063	0.17	0.1	0.11	0.11	0.1	0.12	0.061
Dibenzofuran	NA	NA	NA	NA	ND	ND	0.073	ND	ND	0.93	0.037 J	1	0.52	ND	0.19	0.068 J	0.15	0.015 J
Diethyl phthalate	160	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.042 J	ND	0.013 J	ND	0.013 J
Dimethyl phthalate	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.012 J	ND	ND
Di-n-butyl phthalate	1,500	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0082 J	ND	0.06 J	ND	0.02 J
Di-n-octyl phthalate	NA	4,400	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	6.2	ND	0.01 J	ND	0.019 J	ND	0.021 J
Fluoranthene	3,200	8,800	110,000	190,000	0.018	ND	0.72	ND	ND	4.7	0.63	3.3	2.9	0.83	1.6	0.87	1.6	0.57
Fluorene	3,000	8,800	110,000	190,000	ND	ND	0.16	ND	ND	1.7	0.084	1.8	0.95	0.1	0.33	0.13	0.51	0.038 J
Hexachlorobenzene	0.96	11	50	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.11	ND	0.18	ND	0.018 J
Hexachloroethane	0.056	220	2,800	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.016 J	ND	ND	ND	0.014 J
Indeno(1,2,3-c,d)pyrene	25	25	110	190,000	ND	ND	0.25	ND	ND	0.67	0.31	0.41	0.39	0.51	0.42	0.33	0.35	0.25
Isophorone	1.9	10,000	10,000	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.059 J	ND	0.011 J
Naphthalene	25	4,400	56,000	190,000	ND	ND	0.27	ND	ND	0.59	0.11	0.23	0.32	0.079	0.63	0.11	0.26	0.024 J
Nitrobenzene	0.79	110	1,400	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0097 J
N-Nitrosodi-n-propylamine	0.0013	2.6	11	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.1**	ND	**0.39**	ND	**0.017 J**
N-Nitrosodiphenylamine	20	3,700	16,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.35	ND	0.017 J
Pentachlorophenol	5	150	660	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.27	ND	0.38	ND	ND
Phenanthrene	10,000	66,000	190,000	190,000	0.013 J	ND	0.64	ND	ND	5.9	0.36	6.9	4.2	0.38	1.2	0.48	2.0	0.28
Phenol	66	130,000	190,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025 J	ND	ND
Pyrene	2,200	6,600	84,000	190,000	0.028 J	ND	0.82	ND	ND	5.2	0.65	2.8	3.0	1.0	1.8	1.3	1.4	0.63

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	Comp F 1004080-13 04/05/2010 mg/kg	Comp G 1004080-14 04/06/2010 mg/kg	Comp H 1004080-15 04/07/2010 mg/kg	Comp I 1004080-16 04/07/2010 mg/kg	Comp I DUP 1004080-17 04/07/2010 mg/kg	Comp J 1004080-18 04/07/2010 mg/kg	Comp K 1003166-10 03/17/2010 mg/kg	Comp L 1003166-13 03/17/2010 mg/kg	Comp M 1004080-19 04/07/2010 mg/kg	Comp N 1003216-04 03/24/2010 mg/kg	Comp O 1004080-20 04/07/2010 mg/kg	Comp P 1003216-05 03/24/2010 mg/kg	Comp Q 1003166-14 03/17/2010 mg/kg	Comp R 1003216-01 03/18/2010 mg/kg
Inorganic Analytes																		
Aluminum	NA	190,000	190,000	190,000	11,600	8,370	11,700	12,200	14,800	18,300	6,880	13,800	16,000	7,930	14,300	826	13,700	5,050
Antimony	27	88	1,100	190,000	ND	ND	ND	ND	ND	0.593 J	0.326 J	0.969	0.691 J	ND	ND	0.443 J	ND	ND
Arsenic	12	12	53	190,000	4.19	3.94	9.84	3.84	4.12	25.2	13.5	18.1	19.8	8.02	15	13	15.4	3.22
Barium	8,200	15,000	190,000	190,000	73	66.6	102	68.5	73.4	157	82.3	110	134	75.2	115	100	128	49.6
Beryllium	320	440	5,600	190,000	ND	ND	ND	ND	ND	0.529 J	ND	ND	0.82	ND	ND	0.572 J	ND	ND
Cadmium	38	47	210	190,000	ND	ND	1.83	ND	ND	5.64	2.71	7.1	5.14	2.09	4	4.48	3.78	0.635
Calcium	NA	NA	NA	NA	2,410	2,230	1,940	2,360	2,540	2,790	1,600	2,090	2,150	1,550	1,760	2,000	2,140	1,270
Chromium, Total	NA	NA	NA	NA	27.9	24.5	49.4	25.5	27.5	146	55.2	105	120	45.8	73.6	81.4	81	17
Chromium, Hexavalent	94	94	420	190,000	ND	ND	2.11	1.36	1.37	ND	ND	ND	ND	ND	ND	3.96	ND	ND
Chromium, Trivalent	190,000	190,000	190,000	190,000	27.9	24.5	47.3	24.1	26.1	146	55.2	105	120	45.8	73.6	77.4	81	17
Cobalt	8.1	4,400	56,000	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.332 J	ND
Copper	8,200	8,200	100,000	190,000	6.8	5.56	40.8	5.77	6.2	131	55.9	101	111	51.1	78.4	81.3	88.9	20.9
Iron	NA	66,000	190,000	190,000	20,000	19,200	22,400	20,800	24,800	34,000	12.8	25,500	29,700	22,500	25,700	28,100	24,700	1,590
Lead	450	500	1,000	190,000	8.35	6.01	54.6	6.16	6.67	161	71.8	138	134	58	105	86.8	108	21.8
Magnesium	NA	NA	NA	NA	3,680	3,450	3,170	3,540	3,770	3,970	2,410	3,160	3,320	2,880	2,590	2,720	3,010	2,000
Manganese	31,000	31,000	190,000	190,000	564	550	564	534	579	499	295	421	393	312	384	403	468	379
Mercury	10	66	840	190,000	0.0348	0.0155	0.221	0.0193	0.0161	0.696	0.411	0.651	0.441	0.0923	0.391	0.261	0.425	0.21
Nickel	650	4,400	56,000	190,000	15.5	14.3	18.1	14.3	15.4	35.6	18.4	25.7	31.4	21.1	21.2	25.5	22.9	11.9
Potassium	NA	NA	NA	NA	1,830	1,770	1,630	1,650	1,770	2,430	1,330	1,770	2,230	2,280	1,420	1,900	1,500	1,050
Selenium	26	1,100	14,000	190,000	0.537 J	0.416 J	0.736 J	0.439 J	0.615 J	1.48	0.688 J	1.22	1.16	0.744	0.938	0.749 J	1.09	0.522 J
Silver	84	1,100	14,000	190,000	ND	ND	0.381 J	ND	ND	2.28	0.514 J	1.36	1.95	0.651	0.838	1.6	1.24	0.138 J
Sodium	NA	NA	NA	NA	196	179	198	193	203	282	131	164	248	120	181	151	170	80.3
Tin	240	130,000	190,000	190,000	11.2	9.79	22.5	10.1	11	70.5	33.8	56.6	56.9	22	36.8	40	45	7.73
Vanadium	1,500	1,500	20,000	190,000	24.7	22.1	24.9	23.5	25.2	75.1	22.8	46.1	72.4	34.6	24.9	57.4	31.5	14.1
Zinc	12,000	66,000	190,000	190,000	44.9	40.2	213	41.7	45.2	525	288	512	434	252	396	349	393	115
Miscellaneous																		
Cyanide	200 [c]	4,400	56,000	190,000	0.126 J	0.129 J	0.265	0.169 J	0.183	0.939	0.605	1.03	0.589	0.272	0.734	0.633	0.692	0.275
Total DRO TPH	NA	NA	NA	NA	ND	ND	120	55 J	ND	130	70 J	80	110	160	ND	170	45 J	99
Sulfide	---	---	---	---	Sulfide not detected at or above the method detection for these samples.													

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	Comp S 1003216-02 03/18/2010 mg/kg	Comp T 1003216-03 03/18/2010 mg/kg	Core 41 1004080-01 04/06/2010 mg/kg	Core 42 1004080-02 04/06/2010 mg/kg	Core 43 1004080-03 04/06/2010 mg/kg	Core 44 1004080-04 04/06/2010 mg/kg	Core 45 1004080-05 04/07/2010 mg/kg	Core 46 1004020-01 03/31/2010 mg/kg	Core 47 1004020-02 03/31/2010 mg/kg	Core 47 DUP 1004020-03 03/31/2010 mg/kg	Core 48 1004020-04 03/31/2010 mg/kg	Core 49 1004020-05 04/01/2010 mg/kg	Core 50 1004020-06 04/01/2010 mg/kg
Polychlorinated Biphenyls																	
Aroclor 1016	15	15	200	10,000	ND	ND	1.8	2.2	1.4	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	30	30	130	190,000	0.034	0.097	0.45	1.2	0.75	ND	ND	0.027	0.31	0.1	0.058	0.016	0.017
Pesticides																	
4,4´-DDD	6.8	75	330	190,000	0.0045	0.034	ND	ND	ND	ND	ND	0.0068	ND	0.075	0.03	0.0076	0.0039
4,4´-DDE	41	53	230	190,000	0.012	0.21	0.62	0.9	0.46	ND	ND	0.0042	0.46	0.23	0.038	0.028	0.0092
4,4´-DDT	53	53	230	190,000	0.0088	ND	ND	ND	ND	ND	ND	ND	ND	0.041	0.024	0.0078	0.0027
alpha-BHC	0.046	2.8	13	190,000	ND	ND	ND	ND	ND	ND	ND	0.00021	ND	ND	ND	ND	ND
Dieldrin	0.11	1.1	5	10,000	ND	ND	ND	ND	ND	ND	ND	0.0018	0.066	0.018	0.026	ND	0.0013
Endosulfan sulfate	70	1,300	17,000	190,000	0.0016	0.0073	0.01	0.015	0.011	ND	ND	0.0006	ND	0.0056	0.0026	0.0012	0.00057
Endrin	5.5	66	840	190,000	ND	0.015	ND	ND	ND	ND	ND	0.00013	ND	ND	ND	ND	ND
Heptachlor epoxide	1.1	2	8.7	190,000	ND	ND	ND	ND	ND	ND	ND	0.00076	0.0048 J	0.0095	0.0025	0.0014	0.0012
Hexachlorobenzene	0.96	11	50	190,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00029	ND	0.00046
Semivolatile Organic Compounds																	
1,2,4-Trichlorobenzene	27	2,200	10,000	10,000	ND	0.017 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	2,300	22,000	190,000	190,000	ND	0.016 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	3.1	66	840	190,000	ND	0.022 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	32	4,400	10,000	10,000	ND	0.053 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	0.05	58	260	190,000	0.024 J	**0.053 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	1.10	220	2,800	190,000	0.025 J	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	2,900	4,400	10,000	10,000	0.028 J	0.053 J	0.22	0.23	1.1	ND	ND	0.043 J	0.24	0.14	0.026 J	0.049	0.045 J
2-Nitroaniline	0.033	13	160	190,000	0.017 J	0.029 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3´-Dichlorobenzidine	8.3	40	180	190,000	0.019 J	0.022 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3+4-Methylphenol	37	1,100	10,000	10,000	0.047 J	0.07	0.14	ND	0.12	ND	ND	0.02 J	0.27	0.18	ND	0.064	0.072
3-Nitroaniline	0.038	13	160	190,000	0.0088 J	0.015 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	ND	0.38 C	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenylether	NA	NA	NA	NA	ND	0.016 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	NA	1,100	14,000	190,000	0.034 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenylether	NA	NA	NA	NA	ND	0.046 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline	0.031	13	160	190,000	**0.036 J**	**0.035 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	4.1	1,800	22,000	190,000	0.15	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	2,700	13,000	170,000	190,000	0.071	0.065 J	1	0.83	2.3	ND	ND	0.17	0.23	0.19	0.016 J	0.08	0.17
Acenaphthylene	2,500	13,000	170,000	190,000	0.047 J	0.043 J	0.14	0.13	0.098	ND	ND	0.015 J	0.085	0.053 J	0.021 J	0.019 J	0.022 J
Anthracene	350	66,000	190,000	190,000	0.47	0.37	1	1.9	4.1	ND	ND	0.1	0.56	0.31	0.045 J	0.2	0.13
Azobenzene	NA	NA	NA	NA	ND	0.014 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	25	25	110	190,000	0.53	0.35	2.4	2.1	2	ND	ND	0.3	0.88	0.71	0.15	0.43	0.46
Benzo(a)pyrene	2.5	2.5	11	190,000	0.4	0.31	1.7	1.6	1.2	ND	ND	0.22	0.8	0.6	0.19	0.36	0.36
Benzo(b)fluoranthene	25	25	110	190,000	0.39	0.26	2.1	2.1	1.3	ND	ND	0.29	1.1	0.7	0.23	0.34	0.37
Benzo(g,h,i)perylene	180	13,000	170,000	190,000	0.29	0.23	0.78	0.78	0.61	ND	ND	0.12	0.53	0.4	0.17	0.25	0.2
Benzo(k)fluoranthene	250	250	1,100	190,000	0.38	0.24	1.2	1.2	0.88	ND	ND	0.17	0.67	0.67	0.19	0.32	0.29
Bis(2-ethylhexyl)phthalate	130	1,300	5,700	10,000	0.79	6.1 E	6.1	11	6.6	0.23	0.088	0.13	6.6	2.6	0.59	0.56	0.3
Butyl benzyl phthalate	10,000	10,000	10,000	10,000	0.12	0.092	ND	ND	ND	0.12	0.094	0.095	ND	ND	0.06	0.074	0.11
Carbazole	21	900	4,000	190,000	0.025 J	0.045 J	ND	ND	0.49	ND	ND	0.023 J	ND	ND	ND	0.023 J	ND
Chrysene	230	2,500	11,000	190,000	0.63	0.44	3.3	3	2.7	ND	ND	0.32	1.4	1.1	0.23	0.44	0.44
Dibenzo(a,h)anthracene	2.50	2.5	11	190,000	0.11	0.074	0.29	0.36	0.22	ND	ND	0.056	0.21	0.2	0.052	0.076	0.086
Dibenzofuran	NA	NA	NA	NA	0.026 J	0.051 J	0.39	0.38	1.3	ND	ND	0.052	0.18	0.11	ND	0.055	0.048 J
Diethyl phthalate	160	10,000	10,000	10,000	0.02 J	0.029 J	ND	ND	ND	ND	ND	0.022 J	ND	ND	0.023 J	0.015 J	0.023 J
Dimethyl phthalate	NA	NA	NA	NA	0.018 J	0.028 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	1,500	10,000	10,000	10,000	0.026 J	0.12	ND	ND	ND	ND	ND	0.025 J	ND	ND	ND	ND	0.021 J
Di-n-octyl phthalate	NA	4,400	10,000	10,000	0.026 J	0.023 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	3,200	8,800	110,000	190,000	0.71	0.61	4.6	4.5	5.3	ND	ND	0.55	1.9	1.3	0.2	0.93	0.8
Fluorene	3,000	8,800	110,000	190,000	0.084	0.095	1.1	0.9	2.5	ND	ND	0.097	0.32	0.22	0.019 J	0.11	0.084
Hexachlorobenzene	0.96	11	50	190,000	0.037 J	0.087	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	0.056	220	2,800	190,000	0.02 J	0.024 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	25	25	110	190,000	0.33	0.25	0.89	0.85	0.64	ND	ND	0.14	0.58	0.49	0.19	0.29	0.23
Isophorone	1.9	10,000	10,000	10,000	ND	0.029 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	25	4,400	56,000	190,000	0.047 J	0.067	0.28	0.26	0.23	ND	ND	0.069	0.34	0.21	0.04 J	0.081	0.077
N-Nitrosodi-n-propylamine	0.0013	2.6	11	10,000	ND	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	20	3,700	16,000	190,000	0.061	0.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	5	150	660	190,000	ND	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	10,000	66,000	190,000	190,000	0.46	0.36	5	3.5	8.8	ND	ND	0.36	1	0.3	0.14	0.59	0.69
Phenol	66.00	130,000	190,000	190,000	ND	0.01 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	2,200	6,600	84,000	190,000	1.0	0.88	5.4	4.2	5.4	ND	ND	0.8	2.6	2.2	0.25	1.1	0.94

Table 5b
Bulk Sediment Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	PADEP Clean Fill Criteria [a] mg/kg	PADEP Residential MSC [b] mg/kg	PADEP Non-Residential Surface Soil MSC [b] mg/kg	PADEP Non-Residential Sub-Surface Soil MSC [b] mg/kg	Comp S 1003216-02 03/18/2010 mg/kg	Comp T 1003216-03 03/18/2010 mg/kg	Core 41 1004080-01 04/06/2010 mg/kg	Core 42 1004080-02 04/06/2010 mg/kg	Core 43 1004080-03 04/06/2010 mg/kg	Core 44 1004080-04 04/06/2010 mg/kg	Core 45 1004080-05 04/07/2010 mg/kg	Core 46 1004020-01 03/31/2010 mg/kg	Core 47 1004020-02 03/31/2010 mg/kg	Core 47 DUP 1004020-03 03/31/2010 mg/kg	Core 48 1004020-04 03/31/2010 mg/kg	Core 49 1004020-05 04/01/2010 mg/kg	Core 50 1004020-06 04/01/2010 mg/kg
Inorganic Analytes																	
Aluminum	NA	190,000	190,000	190,000	6,600	15,100	18,000	17,200	17,600	13,100	11,300	4,450	16,800	21,000	13,000	3,150	6,180
Antimony	27	88	1,100	190,000	ND	0.494 J	1.61	1.29	0.725 J	ND	ND	ND	0.405 J	0.847	ND	ND	ND
Arsenic	12	12	53	190,000	5.51	48.1	20.5	21.3	19.9	5.46	4.21	4.28	16.1	24.3	5.27	2.27	6.48
Barium	8,200	15,000	190,000	190,000	60.9	451	138	171	134	86.9	70	42.3	116	145	91.2	27.2	44.4
Beryllium	320	440	5,600	190,000	ND	ND	0.734	1.35	0.536 J	ND	ND	ND	0.619	1.29	ND	ND	ND
Cadmium	38	47	210	190,000	0.633	3.41	5.11	7.95	4.5	ND	ND	0.592	3.24	4.02	1.3	0.195 J	0.5 J
Calcium	NA	NA	NA	NA	1,480	1,920	2,460	2,900	2,410	3,010	2,210	1,290	1,770	3,500	1,050	10,800	1,970
Chromium, Total	NA	NA	NA	NA	25	101	134	181	117	31.7	26.4	20.9	87.9	114	40.3	12.8	26
Chromium, Hexavalent	94	94	420	190,000	3.4	ND	ND	ND	ND	ND	ND	2	ND	ND	0.691	ND	ND
Chromium, Trivalent	190,000	190,000	190,000	190,000	21.7	101	134	181	117	31.7	26.4	85.9	87.9	114	39.6	12.8	26
Cobalt	8.1	4,400	56,000	190,000	0.478 J	ND	ND	ND	ND	ND	ND	ND	0.152 J	ND	ND	ND	ND
Copper	8,200	8,200	100,000	190,000	20.6	122	115	151	103	7	6.25	30.4	140	181	48.9	34.4	20.2
Iron	NA	66,000	190,000	190,000	18,100	24,000	34,800	34,700	33,500	24,500	19,800	15,800	30,000	34,100	21,100	11,100	16,500
Lead	450	500	1,000	190,000	24.7	282	154	199	129	7.79	6.32	51.9	111	151	33.5	28.4	29.1
Magnesium	NA	NA	NA	NA	2,330	2,760	3,360	3,500	3,920	4,320	3,520	1,710	3,440	4,700	3,780	7,880	2,310
Manganese	31,000	31,000	190,000	190,000	533	380	457	447	466	1,150	526	308	365	562	311	192	252
Mercury	10	66	840	190,000	0.11	0.347	0.681	0.828	0.582	0.0175	ND	0.0734	0.401	0.376	0.151	0.0645	0.0863
Nickel	650	4,400	56,000	190,000	14.1	24.7	32.9	39.2	32.2	18	15	11	29.5	33.9	16.9	7.23	11.6
Potassium	NA	NA	NA	NA	1,160	2,000	2,030	2,220	2,460	2,190	1,640	1,120	2,820	3,020	3,600	1,160	1,450
Selenium	26	1,100	14,000	190,000	0.696	1.22	1.47	1.59	1.15	0.879	0.521 J	0.492 J	1.23	1.35	0.43 J	ND	ND
Silver	84	1,100	14,000	190,000	0.291 J	1.36	1.94	3.13	1.81	0.174 J	ND	0.226 J	1.28	1.5	0.407 J	ND	0.204 J
Sodium	NA	NA	NA	NA	99	378	264	279	262	210	189	74.1	179	228	129	84.4	88.4
Tin	240	130,000	190,000	190,000	11.7	52.9	66.2	89	55.3	12.4	10.5	10	48.3	60.4	18.2	6.46	12.1
Vanadium	1,500	1,500	20,000	190,000	17.9	45.8	66.1	92.5	68.7	29.7	23.1	16	56.2	60	40.1	11.9	17.6
Zinc	12,000	66,000	190,000	190,000	120	395	448	549	407	49.9	42.1	148	525	803	166	133	100
Miscellaneous																	
Cyanide	200 [c]	4,400	56,000	190,000	0.769	0.522	1.03	1.28	0.791	0.104 J	3.23	ND	0.699	0.632	0.248	ND	0.210
Total DRO TPH	NA	NA	NA	NA	92	190	820	250	260	79 J	ND	36 J	470	350	ND	ND	62 J
Sulfide	---	---	---	---	Sulfide not detected at or above the method detection for these samples.												

Notes:
C= Calabration exceeded
H= Holding time exceeded
J= Analyte detected below quantitation limit
mg/kg= milligrams per kilogram
MSC= Maximum Specific Criteria
NA= Not applicable
ND= Analyte not detected
PADEP= Pennsylvania Department of Environmental Protection
a = From PA Clean Fill Policy
b = PA Act 2 Medium Specific Concentrations
c = Criteria for free cyanide.
d = Criteria for 4-dichlorobenzene

= Detected concentration exceeds the PADEP residential MSC
= Detected concentration exceeds the PADEP non-residential surface soil MSC
= Detected concentration exceeds the PADEP non-residential sub-surface soil MSC
Red Text = Detected concentration exceeds the PADEP clean fill criteria

Table 6
Sediment TCLP Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	RCRA Criteria mg/L	T-SS-1 1003121-02 03/10/2010 mg/L	T-SS-1 DUP 1003121-03 03/10/2010 mg/L	T-SS-2 1003121-10 03/10/2010 mg/L	T-SS-3A 1003168-08 03/17/2010 mg/L	T-SS-4 1003121-01 03/09/2010 mg/L	T-SS-5 1003121-06 03/11/2010 mg/L	T-SS-6 1003121-07 03/11/2010 mg/L	T-SS-7 1003121-05 03/10/2010 mg/L	T-SS-8 1003168-01 03/16/2010 mg/L
TCLP Herbicides										
	---	No herbicides detected at or above the method detection limit in these samples.								
TCLP Inorganic Analytes										
Mercury	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	5.0	0.0151 J	0.0141 J	0.0228 J	0.0149 J	0.0150 J	0.161	0.187	0.0159 J	0.0124 J
Barium	100	0.993	0.985	1.07	1.08	1.03	1.03	0.977	1.08	1.00
Cadmium	1.0	ND	ND	ND	ND	ND	0.0398 J	0.0613	ND	ND
Chromium	5.0	ND	ND	ND	ND	ND	0.0225 J	0.0217 J	ND	ND
Lead	5.0	ND	ND	0.00967 J	ND	ND	0.0947	0.0807	ND	0.00643 J
TCLP Pesticides										
	---	No pesticides detected at or above the method detection limit in these samples.								
TCLP Semivolatile Organic Compounds										
	---	No SVOCs detected at or above the method detection limit in these samples.								

Parameter	RCRA Criteria mg/L	T-SS-12 1003168-04 03/16/2010 mg/L	Comp A 1004082-08 04/06/2010 mg/L	Comp B 1004082-09 04/06/2010 mg/L	Comp-C 1003121-08 03/11/2010 mg/L	Comp-D 1003121-09 03/11/2010 mg/L	Comp E 1004082-10 04/06/2010 mg/L	Comp F 1004082-11 04/05/2010 mg/L	Comp G 1004082-12 04/06/2010 mg/L	Comp H 1004082-13 04/07/2010 mg/L
TCLP Herbicides										
	---	No herbicides detected at or above the method detection limit in these samples.								
TCLP Inorganic Analytes										
Mercury	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	5.0	0.100	0.0240 J	0.0243 J	0.0191 J	0.0198 J	0.0268 J	0.0238 J	0.0334 J	0.146
Barium	100	1.21	1.99	1.73	1.07	0.961	1.66	1.92	1.77	1.88
Cadmium	1.0	0.0256 J	ND	ND	ND	ND	ND	ND	0.00567 J	0.0299 J
Chromium	5.0	0.0246 J	ND	ND	ND	ND	ND	ND	ND	0.0219 J
Lead	5.0	0.123	ND	ND	0.00900 J	0.0115 J	0.0151 J	0.00595 J	0.0147 J	0.121
Selenium	1.0	ND	0.0103 J	0.0107 J	ND	ND	ND	ND	ND	0.0118 J
TCLP Pesticides										
	---	No pesticides detected at or above the method detection limit in these samples.								
TCLP Semivolatile Organic Compounds										
	---	No SVOCs detected at or above the method detection limit in these samples.								

Table 6
Sediment TCLP Sample Results
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	RCRA Criteria mg/L	Comp L 1003168-06 03/17/2010 mg/L	Comp M 1004082-16 04/07/2010 mg/L	Comp N 1003225-04 03/24/2010 mg/L	Comp O 1004082-17 04/07/2010 mg/L	Comp O DUP 1004082-18 04/07/2010 mg/L	Comp P 1003225-05 03/24/2010 mg/L	Comp Q 1003168-07 03/17/2010 mg/L	Comp R 1003225-01 03/18/2010 mg/L	Comp S 1003225-02 03/18/2010 mg/L
TCLP Herbicides										
	---	No herbicides detected at or above the method detection limit in these samples.								
TCLP Inorganic Analytes										
Mercury	0.2	ND	ND	ND	ND	ND	0.00208 J	ND	ND	ND
Arsenic	5.0	0.211	0.222	0.148	0.227	0.227	0.107	0.117	0.0330 J	0.107
Barium	100	0.964	1.97	1.05	2.10	2.10	1.06	1.04	1.04	1.18
Cadmium	1.0	0.0371 J	0.0773	0.0653	0.0591	0.0591	0.0608	0.0332 J	0.0110 J	0.0249 J
Chromium	5.0	0.0131 J	0.0312 J	0.0273 J	0.0402 J	0.0400 J	0.425	0.0160 J	0.00669 J	0.0219 J
Lead	5.0	0.0868	0.130	0.103	0.262	0.266	0.0952	0.0463 J	0.0207 J	0.0723
TCLP Pesticides										
	---	No pesticides detected at or above the method detection limit in these samples.								
TCLP Semivolatile Organic Compounds										
	---	No SVOCs detected at or above the method detection limit in these samples.								

Parameter	RCRA Criteria mg/L	Core 43 1004082-03 04/06/2010 mg/L	Core 44 1004082-04 04/06/2010 mg/L	Core 45 1004082-05 04/07/2010 mg/L	Core 46 1004022-01 03/31/2010 mg/L	Core 47 1004022-02 03/31/2010 mg/L	Core 47 DUP 1004022-03 03/31/2010 mg/L	Core 48 1004022-04 03/31/2010 mg/L	Core 49 1004022-05 04/01/2010 mg/L	Core 50 1004022-06 04/01/2010 mg/L
TCLP Herbicides										
	---	No herbicides detected at or above the method detection limit in these samples.								
TCLP Inorganic Analytes										
Arsenic	5.0	0.305	0.0397 J	0.0217 J	0.0168 J	0.0682	0.0913	ND	0.0379 J	0.0614
Barium	100	1.72	1.84	1.70	1.14	1.15	1.24	1.21	0.871	0.944
Cadmium	1.0	0.0153 J	ND	ND	0.0179 J	0.0556	0.0656	0.0254 J	0.00932 J	0.0170 J
Chromium	5.0	0.0108 J	ND	ND	0.0153 J	0.0223 J	0.0228 J	0.0254 J	0.0212 J	0.0169 J
Lead	5.0	0.0435 J	0.0105 J	ND	0.667	0.111	0.132	0.0381 J	0.104	0.101
Selenium	1.0	ND	ND	0.0115 J	0.0173 J	0.0115 J	0.0140 J	0.0118 J	ND	0.0124 J
TCLP Pesticides										
	---	No pesticides detected at or above the method detection limit in these samples.								
TCLP Semivolatile Organic Compounds										
	---	No SVOCs detected at or above the method detection limit in these samples.								

Parameters	RCRA Criteria mg/L	Core 9 1004081-12 04/06/2010 mg/L	Core 10 1004081-15 04/06/2010 mg/L	Core 11 1004081-16 04/05/2010 mg/L	Core 12 1004081-17 04/05/2010 mg/L	Core 13 1004081-18 04/06/2010 mg/L	Core 14 1004081-19 04/05/2010 mg/L	Core 15 1004081-20 04/07/2010 mg/L	Core 16 1004081-21 04/07/2010 mg/L	Core 17 1004081-22 04/07/2010 mg/L
TCLP VOCs										
1,4-Dichlorobenzene	7.5	ND	ND	ND	ND	2.9	ND	ND	ND	ND

Notes:
J= Analyte detected below quantification limit
mg/L = milligrams per liter
NA= Not Applicable
ND = Not Detected
RCRA = Resource Conservation and Recovery Act
TCLP = Toxicity Characteristic Leaching Procedure

Table 7a
Summary of PCB Congener in Bulk Sediment
Southport Container Terminal
Philadelphia, Pennsylvania

PCB Congener	Co-Eluters	P-SS-1 1003118-33 3/9/2010 (ng/kg)	P-SS-3 1003166-18 3/17/2010 (ng/kg)	P-SS-5 1003118-35 3/9/2010 (ng/kg)	P-SS-7 1003118-34 3/9/2010 (ng/kg)	P-SS-9 1003166-19 3/16/2010 (ng/kg)	P-SS-11 1003118-32 3/9/2010 (ng/kg)
2-Chlorobiphenyl (1)		ND	33.79	138.11	ND	ND	ND
3-Chlorobiphenyl (2)		ND	ND	42.98	ND	ND	ND
4-Chlorobiphenyl (3)		ND	34.41	113.97	ND	ND	ND
2,2'-Dichlorobiphenyl (4)	C	ND	114.94	640.88	ND	ND	ND
2,3-Dichlorobiphenyl (5)	C	ND	217.3	1064.26	ND	ND	ND
2,3'-Dichlorobiphenyl (6)		ND	81.48	247.69	ND	ND	ND
2,4-Dichlorobiphenyl (7)	C	ND	25.08	110.60	ND	ND	ND
2,4'-Dichlorobiphenyl (8)	C 5						
2,5-Dichlorobiphenyl (9)	C 9						
2,6-Dichlorobiphenyl (10)	C 10						
3,3'-Dichlorobiphenyl (11)		78.14	147.84	ND	91.28	131.64	94.45
3,4-Dichlorobiphenyl (12)		ND	ND	43.03	ND	ND	ND
3,4'-Dichlorobiphenyl (13)		ND	41.25	ND	ND	ND	ND
3,5-Dichlorobiphenyl (14)		ND	ND	ND	ND	ND	ND
4,4'-Dichlorobiphenyl (15)		ND	142.16	1024.23	ND	ND	ND
2,2',3-Trichlorobiphenyl (16)	C	ND	486.96	113.89	ND	12.27	ND
2,2',4-Trichlorobiphenyl (17)		ND	640.15	2436.21	ND	ND	ND
2,2',5-Trichlorobiphenyl (18)		ND	1669.83	6782.62	ND	ND	ND
2,2',6-Trichlorobiphenyl (19)		ND	96.14	405.51	ND	ND	ND
2,3,3'-Trichlorobiphenyl (20)	C	28.95	849.52	3368.09	34.4	60.74	35.66
2,3,4-Trichlorobiphenyl (21)	C 20						
2,3,4'-Trichlorobiphenyl (22)		20.17	742.76	2794.78	23.66	44.11	26.06
2,3,5-Trichlorobiphenyl (23)		ND	ND	103.27	ND	ND	ND
2,3,6-Trichlorobiphenyl (24)		ND	ND	8881.62	ND	ND	ND
2,3',4-Trichlorobiphenyl (25)		ND	331.58	667.91	ND	ND	ND
2,3',5-Trichlorobiphenyl (26)		ND	479.21	3761.21	ND	ND	ND
2,3',6-Trichlorobiphenyl (27)		ND	65.95	126.00	ND	ND	ND
2,4,4'-Trichlorobiphenyl (28)		54.63	2970.2	9913.52	61.15	116.46	63.05
2,4,5-Trichlorobiphenyl (29)		ND	ND	42.79	ND	ND	ND
2,4,6-Trichlorobiphenyl (30)		ND	ND	ND	ND	ND	ND
2,4',5-Trichlorobiphenyl (31)		ND	1999.5	6814.79	ND	68.72	ND
2,4',6-Trichlorobiphenyl (32)	C 16						
2',3,4-Trichlorobiphenyl (33)	C 20						
2',3,5-Trichlorobiphenyl (34)		ND	23.2	ND	ND	ND	ND
3,3',4-Trichlorobiphenyl (35)		ND	23.9	86.72	ND	ND	ND
3,3',5-Trichlorobiphenyl (36)		ND	ND	74.26	ND	ND	ND
3,4,4'-Trichlorobiphenyl (37)		ND	259.74	1239.47	ND	ND	ND
3,4,5-Trichlorobiphenyl (38)		ND	ND	ND	ND	ND	ND
3,4',5-Trichlorobiphenyl (39)		ND	124.05	1779.92	ND	ND	ND
2,2',3,3'-Tetrachlorobiphenyl (40)		ND	540.45	1463.56	ND	ND	ND
2,2',3,4-Tetrachlorobiphenyl (41)	C	ND	138.83	1064.06	ND	ND	ND
2,2',3,4'-Tetrachlorobiphenyl (42)		ND	780.06	2566.88	ND	ND	ND
2,2',3,5-Tetrachlorobiphenyl (43)	C	ND	4324.77	67225.25	ND	ND	ND
2,2',3,5'-Tetrachlorobiphenyl (44)		ND	2877.55	7170.49	ND	ND	ND
2,2',3,6-Tetrachlorobiphenyl (45)		ND	335.44	936.12	ND	ND	ND
2,2',3,6'-Tetrachlorobiphenyl (46)		ND	199.37	1901.88	ND	ND	ND
2,2',4,4'-Tetrachlorobiphenyl (47)	C	ND	699.7	10059.20	ND	ND	ND
2,2',4,5-Tetrachlorobiphenyl (48)		ND	554.55	ND	ND	ND	ND
2,2',4,5'-Tetrachlorobiphenyl (49)		ND	1967.88	32973.45	ND	ND	ND
2,2',4,6-Tetrachlorobiphenyl (50)		ND	ND	29.13	ND	ND	ND
2,2',4,6'-Tetrachlorobiphenyl (51)		ND	187.95	6318.26	ND	ND	ND
2,2',5,5'-Tetrachlorobiphenyl (52)	C 43						
2,2',5,6-Tetrachlorobiphenyl (53)		ND	498.1	32435.10	ND	ND	ND
2,2',6,6'-Tetrachlorobiphenyl (54)		ND	9.8	13.37	ND	ND	ND
2,3,3',4'-Tetrachlorobiphenyl (55)		ND	ND	ND	ND	ND	ND
2,3,3',4'-Tetrachlorobiphenyl (56)		ND	1214.23	3386.84	ND	ND	ND
2,3,3',5-Tetrachlorobiphenyl (57)		ND	ND	61.77	ND	ND	ND
2,3,3',5'-Tetrachlorobiphenyl (58)	C	ND	167.69	274.00	ND	ND	ND
2,3,3',6-Tetrachlorobiphenyl (59)		ND	168.8	ND	ND	ND	ND
2,3,4,4'-Tetrachlorobiphenyl (60)		ND	555.05	1345.00	ND	ND	ND
2,3,4,5-Tetrachlorobiphenyl (61)		ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorobiphenyl (62)		ND	ND	ND	ND	ND	ND
2,3,4',5-Tetrachlorobiphenyl (63)		ND	98.61	251.84	ND	ND	ND
2,3,4',6-Tetrachlorobiphenyl (64)	C	ND	1325.6	3478.70	ND	ND	ND
2,3,5,6-Tetrachlorobiphenyl (65)		ND	ND	ND	ND	ND	ND
2,3',4,4'-Tetrachlorobiphenyl (66)		ND	2318.5	ND	ND	ND	ND
2,3',4,5-Tetrachlorobiphenyl (67)	C 58						
2,3',4,5'-Tetrachlorobiphenyl (68)	C 64						
2,3',4,6-Tetrachlorobiphenyl (69)		ND	ND	55.92	ND	ND	ND
2,3',4',5-Tetrachlorobiphenyl (70)		ND	3085.2	8293.44	ND	ND	ND
2,3',4',6-Tetrachlorobiphenyl (71)		ND	840.37	2336.14	ND	ND	ND
2,3',5,5'-Tetrachlorobiphenyl (72)	C 41						
2,3',5',6-Tetrachlorobiphenyl (73)		ND	ND	3240.51	ND	ND	ND
2,4,4',5-Tetrachlorobiphenyl (74)	C	ND	1739.12	4886.10	ND	ND	ND

Table 7a
Summary of PCB Congener in Bulk Sediment
Southport Container Terminal
Philadelphia, Pennsylvania

PCB Congener	Co-Eluters	P-SS-1 1003118-33 3/9/2010 (ng/kg)	P-SS-3 1003166-18 3/17/2010 (ng/kg)	P-SS-5 1003118-35 3/9/2010 (ng/kg)	P-SS-7 1003118-34 3/9/2010 (ng/kg)	P-SS-9 1003166-19 3/16/2010 (ng/kg)	P-SS-11 1003118-32 3/9/2010 (ng/kg)
2,4,4',6-Tetrachlorobiphenyl (75)	C 47						
2',3,4,5-Tetrachlorobiphenyl (76)	C 74						
3,3',4,4'-Tetrachlorobiphenyl (77)		ND	192.37	578.55	ND	ND	ND
3,3',4,5-Tetrachlorobiphenyl (78)		ND	ND	ND	ND	ND	ND
3,3',4,5'-Tetrachlorobiphenyl (79)		ND	ND	ND	ND	ND	ND
3,3',5,5'-Tetrachlorobiphenyl (80)		ND	ND	7986.91	ND	ND	ND
3,4,4',5-Tetrachlorobiphenyl (81)		ND	53.52	96.02	ND	ND	ND
2,2',3,3',4-Pentachlorobiphenyl (82)		ND	481.82	ND	ND	ND	ND
2,2',3,3',5-Pentachlorobiphenyl (83)	C	ND	269.42	610.00	ND	ND	ND
2,2',3,3',6-Pentachlorobiphenyl (84)	C	ND	1771.62	8830.00	ND	ND	ND
2,2',3,4,4'-Pentachlorobiphenyl (85)		ND	633.61	1218.75	ND	ND	ND
2,2',3,4,5-Pentachlorobiphenyl (86)		ND	ND	59.12	ND	ND	ND
2,2',3,4,5'-Pentachlorobiphenyl (87)	C	ND	1796.72	173.52	ND	ND	ND
2,2',3,4,6-Pentachlorobiphenyl (88)		ND	ND	ND	ND	ND	ND
2,2',3,4,6'-Pentachlorobiphenyl (89)	C 84						
2,2',3,4',5-Pentachlorobiphenyl (90)	C84						
2,2',3,4',6-Pentachlorobiphenyl (91)		ND	911.1	7527.41	ND	ND	ND
2,2',3,5,5'-Pentachlorobiphenyl (92)		ND	1345.9	1511.29	ND	ND	ND
2,2',3,5,6-Pentachlorobiphenyl (93)		ND	ND	ND	ND	ND	ND
2,2',3,5,6'-Pentachlorobiphenyl (94)		ND	ND	1430.27	ND	ND	ND
2,2',3,5',6-Pentachlorobiphenyl (95)	C	ND	4490.5	19559.97	ND	ND	ND
2,2',3,6,6'-Pentachlorobiphenyl (96)		ND	ND	73.03	ND	ND	ND
2,2',3',4,5-Pentachlorobiphenyl (97)		ND	1793.8	ND	ND	ND	ND
2,2',3',4,6-Pentachlorobiphenyl (98)		ND	ND	270.60	ND	ND	ND
2,2',4,4',5-Pentachlorobiphenyl (99)		ND	3373.3	5775.81	ND	ND	ND
2,2',4,4',6-Pentachlorobiphenyl (100)		ND	ND	2399.00	ND	ND	ND
2,2',4,5,5'-Pentachlorobiphenyl (101)	C	ND	6241.4	10704.45	ND	ND	ND
2,2',4,5,6'-Pentachlorobiphenyl (102)		ND	ND	ND	ND	ND	ND
2,2',4,5',6-Pentachlorobiphenyl (103)		ND	91.31	3516.10	ND	ND	ND
2,2',4,6,6'-Pentachlorobiphenyl (104)		ND	ND	13.89	ND	ND	ND
2,3,3',4,4'-Pentachlorobiphenyl (105)		ND	1144.4	2308.29	ND	ND	ND
2,3,3',4,5-Pentachlorobiphenyl (106)		ND	ND	ND	ND	ND	ND
2,3,3',4',5-Pentachlorobiphenyl (107)	C	ND	577.95	1001.11	ND	ND	ND
2,3,3',4,5'-Pentachlorobiphenyl (108)		ND	ND	525.50	ND	ND	ND
2,3,3',4,6-Pentachlorobiphenyl (109)		ND	ND	ND	ND	ND	ND
2,3,3',4',6-Pentachlorobiphenyl (110)		ND	6204.95	ND	ND	ND	ND
2,3,3',5,5'-Pentachlorobiphenyl (111)	C 87						
2,3,3',5,6-Pentachlorobiphenyl (112)	C 83						
2,3,3',5',6-Pentachlorobiphenyl (113)	C 101						
2,3,4,4',5-Pentachlorobiphenyl (114)		ND	129.6	256.11	ND	ND	ND
2,3,4,4',6-Pentachlorobiphenyl (115)		ND	ND	ND	ND	ND	ND
2,3,4,5,6-Pentachlorobiphenyl (116)	C 87						
2,3,4',5,6-Pentachlorobiphenyl (117)	C87						
2,3',4,4',5-Pentachlorobiphenyl (118)		ND	3598.8	6597.48	ND	ND	ND
2,3',4,4',6-Pentachlorobiphenyl (119)		ND	202.03	ND	ND	ND	ND
2,3',4,5,5'-Pentachlorobiphenyl (120)		ND	ND	ND	ND	ND	ND
2,3',4,5',6-Pentachlorobiphenyl (121)	C 95						
2',3,3',4,5-Pentachlorobiphenyl (122)		ND	51.88	79.00	ND	ND	ND
2',3,4,4',5-Pentachlorobiphenyl (123)	C 107						
2',3,4,5,5'-Pentachlorobiphenyl (124)		ND	ND	148.70	ND	ND	ND
2',3,4,5,6'-Pentachlorobiphenyl (125)		ND	ND	ND	ND	ND	ND
3,3',4,4',5-Pentachlorobiphenyl (126)		ND	ND	12.09	ND	ND	ND
3,3',4,5,5'-Pentachlorobiphenyl (127)		ND	ND	ND	ND	ND	ND
2,2',3,3',4,4'-Hexachlorobiphenyl (128)		ND	1254.9	1970.32	ND	ND	ND
2,2',3,3',4,5-Hexachlorobiphenyl (129)		ND	181.56	274.17	ND	ND	ND
2,2',3,3',4,5'-Hexachlorobiphenyl (130)		ND	379.88	563.73	ND	ND	ND
2,2',3,3',4,6-Hexachlorobiphenyl (131)	C	ND	249.62	575.10	ND	ND	ND
2,2',3,3',4,6'-Hexachlorobiphenyl (132)	C	82.62	12465.7	17884.00	81.41	102.40	88.04
2,2',3,3',5,5'-Hexachlorobiphenyl (133)	C 131						
2,2',3,3',5,6-Hexachlorobiphenyl (134)		ND	393.9	707.10	ND	ND	ND
2,2',3,3',5,6'-Hexachlorobiphenyl (135)		ND	1274.9	3196.42	ND	ND	ND
2,2',3,3',6,6'-Hexachlorobiphenyl (136)		ND	885.6	2526.29	ND	ND	ND
2,2',3,4,4',5-Hexachlorobiphenyl (137)		ND	248.5	415.65	ND	ND	ND
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	C	ND	7279.8	10890.20	ND	64.44	52.84
2,2',3,4,4',6-Hexachlorobiphenyl (139)		ND	9403.3	18069.20	ND	ND	ND
2,2',3,4,4',6'-Hexachlorobiphenyl (140)		ND	101.3	585.99	ND	ND	ND
2,2',3,4,5,5'-Hexachlorobiphenyl (141)		ND	1925.1	2904.38	ND	ND	ND
2,2',3,4,5,6-Hexachlorobiphenyl (142)	C 131						
2,2',3,4,5,6'-Hexachlorobiphenyl (143)		ND	275.57	410.19	ND	ND	ND
2,2',3,4,5',6-Hexachlorobiphenyl (144)		ND	73.69	117.45	ND	ND	ND
2,2',3,4,6,6'-Hexachlorobiphenyl (145)		ND	ND	ND	ND	ND	ND
2,2',3,4',5,5'-Hexachlorobiphenyl (146)		ND	2006.2	3365.69	ND	ND	ND
2,2',3,4',5,6-Hexachlorobiphenyl (147)		ND	ND	ND	ND	ND	ND
2,2',3,4',5,6'-Hexachlorobiphenyl (148)		ND	ND	111.45	ND	ND	ND

Table 7a
Summary of PCB Congener in Bulk Sediment
Southport Container Terminal
Philadelphia, Pennsylvania

PCB Congener	Co-Eluters	P-SS-1 1003118-33 3/9/2010 (ng/kg)	P-SS-3 1003166-18 3/17/2010 (ng/kg)	P-SS-5 1003118-35 3/9/2010 (ng/kg)	P-SS-7 1003118-34 3/9/2010 (ng/kg)	P-SS-9 1003166-19 3/16/2010 (ng/kg)	P-SS-11 1003118-32 3/9/2010 (ng/kg)
2,2',3,4',5',6-Hexachlorobiphenyl (149)		ND	ND	ND	ND	ND	ND
2,2',3,4',6,6'-Hexachlorobiphenyl (150)		ND	ND	428.49	ND	ND	ND
2,2',3,5,5',6-Hexachlorobiphenyl (151)		ND	1710.2	3513.00	ND	ND	ND
2,2',3,5,6,6'-Hexachlorobiphenyl (152)		ND	ND	ND	ND	ND	ND
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	C 132						
2,2',4,4',5',6-Hexachlorobiphenyl (154)		ND	204.6	748.78	ND	ND	ND
2,2',4,4',6,6'-Hexachlorobiphenyl (155)		ND	ND	20.87	ND	ND	ND
2,3,3',4,4',5-Hexachlorobiphenyl (156)		ND	725.28	1064.75	ND	ND	ND
2,3,3',4,4',5'-Hexachlorobiphenyl (157)		ND	99.74	146.96	ND	ND	ND
2,3,3',4,4',6-Hexachlorobiphenyl (158)	C 160						
2,3,3',4,5,5'-Hexachlorobiphenyl (159)		ND	ND	ND	ND	ND	ND
2,3,3',4,5,6-Hexachlorobiphenyl (160)	C	ND	8740.8	1311.95	ND	ND	ND
2,3,3',4,5',6-Hexachlorobiphenyl (161)		ND	ND	ND	ND	ND	ND
2,3,3',4',5,5'-Hexachlorobiphenyl (162)		ND	ND	ND	ND	ND	ND
2,3,3',4',5,6-Hexachlorobiphenyl (163)	C 138						
2,3,3',4',5',6-Hexachlorobiphenyl (164)		ND	685.9	1019.00	ND	ND	ND
2,3,3',5,5',6-Hexachlorobiphenyl (165)		ND	ND	ND	ND	ND	ND
2,3,4,4',5,6-Hexachlorobiphenyl (166)		ND	ND	60.00	ND	ND	ND
2,3',4,4',5,5'-Hexachlorobiphenyl (167)		ND	282.92	380.51	ND	ND	ND
2,3',4,4',5',6-Hexachlorobiphenyl (168)		ND	ND	ND	ND	ND	ND
3,3',4,4',5,5'-Hexachlorobiphenyl (169)		ND	10.79	ND	ND	ND	ND
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)		ND	1606.96	2138.56	ND	ND	ND
2,2',3,3',4,4',6-Heptachlorobiphenyl (171)		ND	483.72	663.24	ND	ND	ND
2,2',3,3',4,5,5'-Heptachlorobiphenyl (172)		ND	285.2	ND	ND	ND	ND
2,2',3,3',4,5,6-Heptachlorobiphenyl (173)		ND	ND	ND	ND	ND	ND
2,2',3,3',4,5,6'-Heptachlorobiphenyl (174)		ND	2573.03	3740.93	ND	ND	ND
2,2',3,3',4,5',6-Heptachlorobiphenyl (175)	C	ND	ND	134.97	ND	ND	ND
2,2',3,3',4,6,6'-Heptachlorobiphenyl (176)		ND	250.12	356.10	ND	ND	ND
2,2',3,3',4',5,6-Heptachlorobiphenyl (177)		ND	1164.1	1704.74	ND	ND	ND
2,2',3,3',5,5',6-Heptachlorobiphenyl (178)		ND	421.98	730.69	ND	ND	ND
2,2',3,3',5,6,6'-Heptachlorobiphenyl (179)		ND	865.2	1520.44	ND	ND	ND
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)		ND	4773.5	ND	ND	ND	ND
2,2',3,4,4',5,6-Heptachlorobiphenyl (181)		ND	ND	ND	ND	ND	ND
2,2',3,4,4',5,6'-Heptachlorobiphenyl (182)	C 175						
2,2',3,4,4',5',6-Heptachlorobiphenyl (183)		ND	1094.9	1491.94	ND	ND	ND
2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)		ND	ND	ND	ND	ND	ND
2,2',3,4,5,5',6-Heptachlorobiphenyl (185)		ND	302.47	442.45	ND	ND	ND
2,2',3,4,5,6,6'-Heptachlorobiphenyl (186)		ND	ND	ND	ND	ND	ND
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)		ND	3527.7	5507.67	ND	ND	ND
2,2',3,4',5,6,6'-Heptachlorobiphenyl (188)		ND	ND	22.99	ND	ND	ND
2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)		ND	130.28	165.56	ND	ND	ND
2,3,3',4,4',5,6-Heptachlorobiphenyl (190)		ND	339.9	455.63	ND	ND	ND
2,3,3',4,4',5',6-Heptachlorobiphenyl (191)		ND	ND	ND	ND	ND	ND
2,3,3',4,5,5',6-Heptachlorobiphenyl (192)		ND	ND	465.68	ND	ND	ND
2,3,3',4',5,5',6-Heptachlorobiphenyl (193)		ND	ND	6931.94	ND	ND	ND
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (194)		ND	1365.32	1838.79	ND	ND	ND
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)		ND	548.73	730.37	ND	ND	ND
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (196)		ND	474.4	646.95	ND	ND	ND
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (197)		ND	ND	ND	ND	ND	ND
2,2',3,3',4,5,5',6-Octachlorobiphenyl (198)		ND	ND	ND	ND	ND	ND
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (199)		ND	1554	2208.10	ND	ND	ND
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (200)		ND	109.18	ND	ND	ND	ND
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (201)		ND	112.99	157.10	ND	ND	ND
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (202)		ND	336.96	502.18	ND	ND	ND
2,2',3,4,4',5,5',6-Octachlorobiphenyl (203)		ND	912.3	1244.00	ND	ND	ND
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (204)		ND	ND	ND	ND	ND	ND
2,3,3',4,4',5,5',6-Octachlorobiphenyl (205)		ND	66.8	79.41	ND	ND	ND
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)		ND	1558.22	1945.34	ND	ND	ND
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (207)		ND	ND	102.67	ND	ND	ND
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (208)		ND	579.24	706.62	ND	ND	ND
Decachlorobipheny (209)		ND	2444.79	2031.86	ND	ND	ND
Total PCBs (sum)		265	150,326	439776.87	292	600.78	360
Total PCBs (sum) ug/kg		**0.3**	**150.3**	**439.78**	**0.3**	**0.60**	**0.4**

Notes:
ng/kg = Nanogram per kilogram
u g/kg = Microgram per kilogram.

Table 7b
Summary of PCB Congener in Elutriate Samples
Southport Container Terminal
Philadelphia, Pennsylvania

PCB Congener	Co-Eluters	E-13 (Total) 1003122-07A 3/11/2010 (ng/L)	E-13 (Dissolved) 1003124-07A 3/11/2010 (ng/L)
2-Chlorobiphenyl (1)		3.93	0.0245
3-Chlorobiphenyl (2)		1.765	ND
4-Chlorobiphenyl (3)		2.899	0.0307
2,2'-Dichlorobiphenyl (4)	C	10.944	1.0211
2,3-Dichlorobiphenyl (5)	C	7.207	0.2047
2,3'-Dichlorobiphenyl (6)		1.027	0.03562
2,4-Dichlorobiphenyl (7)	C	0.5585	ND
2,4'-Dichlorobiphenyl (8)	C 5		
2,5-Dichlorobiphenyl (9)	C 9		
2,6-Dichlorobiphenyl (10)	C 10		
3,3'-Dichlorobiphenyl (11)		1.488	0.286
3,4-Dichlorobiphenyl (12)		1.078	0.06498
3,4'-Dichlorobiphenyl (13)		1.723	0.0311
3,5-Dichlorobiphenyl (14)		0.1315	ND
4,4'-Dichlorobiphenyl (15)		8.999	0.3291
2,2',3-Trichlorobiphenyl (16)	C	24.236	1.8752
2,2',4-Trichlorobiphenyl (17)		43	2.5716
2,2',5-Trichlorobiphenyl (18)		110	7.3502
2,2',6-Trichlorobiphenyl (19)		8.986	0.6755
2,3,3'-Trichlorobiphenyl (20)	C	263.3	0.2614
2,3,4-Trichlorobiphenyl (21)	C 20		
2,3,4'-Trichlorobiphenyl (22)		49.6	0.2441
2,3,5-Trichlorobiphenyl (23)		0.0929	ND
2,3,6-Trichlorobiphenyl (24)		1.3578	0.0791
2,3',4-Trichlorobiphenyl (25)		6.817	0.0453
2,3',5-Trichlorobiphenyl (26)		23.614	0.4061
2,3',6-Trichlorobiphenyl (27)		6.882	0.3787
2,4,4'-Trichlorobiphenyl (28)		120.5	1.7476
2,4,5-Trichlorobiphenyl (29)		0.682	ND
2,4,6-Trichlorobiphenyl (30)		0.05936	ND
2,4',5-Trichlorobiphenyl (31)		69	1.8604
2,4',6-Trichlorobiphenyl (32)	C 16		
2',3,4-Trichlorobiphenyl (33)	C 20		
2',3,5-Trichlorobiphenyl (34)		1.1743	ND
3,3',4-Trichlorobiphenyl (35)		1.1218	ND
3,3',5-Trichlorobiphenyl (36)		0.0556	ND
3,4,4'-Trichlorobiphenyl (37)		19.523	0.7229
3,4,5-Trichlorobiphenyl (38)		0.05422	ND
3,4',5-Trichlorobiphenyl (39)		5.908	0.16198
2,2',3,3'-Tetrachlorobiphenyl (40)		37.6	1.5999
2,2',3,4-Tetrachlorobiphenyl (41)	C	46.066	
2,2',3,4'-Tetrachlorobiphenyl (42)		51.25	1.9948
2,2',3,5-Tetrachlorobiphenyl (43)	C	210	10.9424
2,2',3,5'-Tetrachlorobiphenyl (44)		150	7.8358
2,2',3,6-Tetrachlorobiphenyl (45)		23.908	1.1024
2,2',3,6'-Tetrachlorobiphenyl (46)		14.5648	0.6338
2,2',4,4'-Tetrachlorobiphenyl (47)	C	39.61	1.5812
2,2',4,5-Tetrachlorobiphenyl (48)		ND	1.9842
2,2',4,5'-Tetrachlorobiphenyl (49)		105	4.7442
2,2',4,6-Tetrachlorobiphenyl (50)		0.4459	ND
2,2',4,6'-Tetrachlorobiphenyl (51)		10.6867	0.4504
2,2',5,5'-Tetrachlorobiphenyl (52)	C 43		
2,2',5,6-Tetrachlorobiphenyl (53)		36.38	1.6059
2,2',6,6'-Tetrachlorobiphenyl (54)		0.34372	ND
2,3,3',4'-Tetrachlorobiphenyl (55)		1.0442	ND
2,3,3',4'-Tetrachlorobiphenyl (56)		57	1.8455
2,3,3',5-Tetrachlorobiphenyl (57)		0.6692	ND
2,3,3',5'-Tetrachlorobiphenyl (58)	C	7.1823	0.2484
2,3,3',6-Tetrachlorobiphenyl (59)		12.4265	0.5218
2,3,4,4'-Tetrachlorobiphenyl (60)		31	0.8697
2,3,4,5-Tetrachlorobiphenyl (61)		ND	ND
2,3,4,6-Tetrachlorobiphenyl (62)		ND	ND
2,3,4',5-Tetrachlorobiphenyl (63)		6.349	0.1846
2,3,4',6-Tetrachlorobiphenyl (64)	C	68	3.48398
2,3,5,6-Tetrachlorobiphenyl (65)		ND	ND
2,3',4,4'-Tetrachlorobiphenyl (66)		110	4.6281
2,3',4,5-Tetrachlorobiphenyl (67)	C 58		
2,3',4,5'-Tetrachlorobiphenyl (68)	C 64		
2,3',4,6-Tetrachlorobiphenyl (69)		0.25416	ND
2,3',4',5-Tetrachlorobiphenyl (70)		140	6.50356
2,3',4',6-Tetrachlorobiphenyl (71)		ND	2.3368
2,3',5,5'-Tetrachlorobiphenyl (72)	C 41		

Table 7b
Summary of PCB Congener in Elutriate Samples
Southport Container Terminal
Philadelphia, Pennsylvania

PCB Congener	Co-Eluters	E-13 (Total) 1003122-07A 3/11/2010 (ng/L)	E-13 (Dissolved) 1003124-07A 3/11/2010 (ng/L)
2,3',5',6-Tetrachlorobiphenyl (73)		0.5634	0.0202
2,4,4',5-Tetrachlorobiphenyl (74)	C	76	3.4476
2,4,4',6-Tetrachlorobiphenyl (75)	C 47		
2',3,4,5-Tetrachlorobiphenyl (76)	C 74		
3,3',4,4'-Tetrachlorobiphenyl (77)		11.106	0.4233
3,3',4,5-Tetrachlorobiphenyl (78)		ND	ND
3,3',4,5'-Tetrachlorobiphenyl (79)		0.2066	ND
3,3',5,5'-Tetrachlorobiphenyl (80)		ND	ND
3,4,4',5-Tetrachlorobiphenyl (81)		1.9098	0.0824
2,2',3,3',4-Pentachlorobiphenyl (82)		22.486	0.8873
2,2',3,3',5-Pentachlorobiphenyl (83)	C	12.3047	0.4486
2,2',3,3',6-Pentachlorobiphenyl (84)	C	51.674	2.2682
2,2',3,4,4'-Pentachlorobiphenyl (85)		29.774	1.1108
2,2',3,4,5-Pentachlorobiphenyl (86)		1.5	0.0795
2,2',3,4,5'-Pentachlorobiphenyl (87)	C	63.5	3.1036
2,2',3,4,6-Pentachlorobiphenyl (88)		ND	ND
2,2',3,4,6'-Pentachlorobiphenyl (89)	C 84		
2,2',3,4',5-Pentachlorobiphenyl (90)	C84		
2,2',3,4',6-Pentachlorobiphenyl (91)		31.2	1.4387
2,2',3,5,5'-Pentachlorobiphenyl (92)		39.3	1.8693
2,2',3,5,6-Pentachlorobiphenyl (93)		1.05496	0.0348
2,2',3,5,6'-Pentachlorobiphenyl (94)		1.48322	0.0613
2,2',3,5',6-Pentachlorobiphenyl (95)	C	151	6.9418
2,2',3,6,6'-Pentachlorobiphenyl (96)		1.5181	0.05596
2,2',3',4,5-Pentachlorobiphenyl (97)		ND	ND
2,2',3',4,6-Pentachlorobiphenyl (98)		0.68082	0.0291
2,2',4,4',5-Pentachlorobiphenyl (99)		110	5.1565
2,2',4,4',6-Pentachlorobiphenyl (100)		1.6278	0.0627
2,2',4,5,5'-Pentachlorobiphenyl (101)	C	195	9.2704
2,2',4,5,6'-Pentachlorobiphenyl (102)		ND	ND
2,2',4,5',6-Pentachlorobiphenyl (103)		3.8261	0.1446
2,2',4,6,6'-Pentachlorobiphenyl (104)		0.02974	ND
2,3,3',4,4'-Pentachlorobiphenyl (105)		43	2.3245
2,3,3',4,5-Pentachlorobiphenyl (106)		0.31936	ND
2,3,3',4',5-Pentachlorobiphenyl (107)	C	24.244	0.705
2,3,3',4,5'-Pentachlorobiphenyl (108)		0.9802	ND
2,3,3',4,6-Pentachlorobiphenyl (109)		ND	ND
2,3,3',4',6-Pentachlorobiphenyl (110)		202	9.9551
2,3,3',5,5'-Pentachlorobiphenyl (111)	C 87		
2,3,3',5,6-Pentachlorobiphenyl (112)	C 83		
2,3,3',5',6-Pentachlorobiphenyl (113)	C 101		
2,3,4,4',5-Pentachlorobiphenyl (114)		6.0421	0.2382
2,3,4,4',6-Pentachlorobiphenyl (115)		3.1049	0.11998
2,3,4,5,6-Pentachlorobiphenyl (116)	C 87		
2,3,4',5,6-Pentachlorobiphenyl (117)	C87		
2,3',4,4',5-Pentachlorobiphenyl (118)		177.6	6.93796
2,3',4,4',6-Pentachlorobiphenyl (119)		7.09	0.2551
2,3',4,5,5'-Pentachlorobiphenyl (120)		0.89592	0.0306
2,3',4,5',6-Pentachlorobiphenyl (121)	C 95		
2',3,3',4,5-Pentachlorobiphenyl (122)		2.4536	0.0821
2',3,4,4',5-Pentachlorobiphenyl (123)	C 107		
2',3,4,5,5'-Pentachlorobiphenyl (124)		4.2607	0.1536
2',3,4,5,6'-Pentachlorobiphenyl (125)		ND	ND
3,3',4,4',5-Pentachlorobiphenyl (126)		0.2842	ND
3,3',4,5,5'-Pentachlorobiphenyl (127)		ND	0.0464
2,2',3,3',4,4'-Hexachlorobiphenyl (128)		51.254	1.9055
2,2',3,3',4,5-Hexachlorobiphenyl (129)		7.0239	0.2836
2,2',3,3',4,5'-Hexachlorobiphenyl (130)		14.8265	0.5428
2,2',3,3',4,6-Hexachlorobiphenyl (131)	C	9.3411	0.3342
2,2',3,3',4,6'-Hexachlorobiphenyl (132)	C	360	17.0662
2,2',3,3',5,5'-Hexachlorobiphenyl (133)	C 131		
2,2',3,3',5,6-Hexachlorobiphenyl (134)		16.0118	0.5646
2,2',3,3',5,6'-Hexachlorobiphenyl (135)		49.802	2.3811
2,2',3,3',6,6'-Hexachlorobiphenyl (136)		36.542	1.6552
2,2',3,4,4',5-Hexachlorobiphenyl (137)		11.2272	0.4057
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	C	211.74	10.1381
2,2',3,4,4',6-Hexachlorobiphenyl (139)		302.5	13.7672
2,2',3,4,4',6'-Hexachlorobiphenyl (140)		3.1771	ND
2,2',3,4,5,5'-Hexachlorobiphenyl (141)		57	2.7605
2,2',3,4,5,6-Hexachlorobiphenyl (142)	C 131		
2,2',3,4,5,6'-Hexachlorobiphenyl (143)		11.2193	0.51998
2,2',3,4,5',6-Hexachlorobiphenyl (144)		2.7932	0.0992

Table 7b
Summary of PCB Congener in Elutriate Samples
Southport Container Terminal
Philadelphia, Pennsylvania

PCB Congener	Co-Eluters	E-13 (Total) 1003122-07A 3/11/2010 (ng/L)	E-13 (Dissolved) 1003124-07A 3/11/2010 (ng/L)
2,2',3,4,6,6'-Hexachlorobiphenyl (145)		0.05434	ND
2,2',3,4',5,5'-Hexachlorobiphenyl (146)		57.45	2.6974
2,2',3,4',5,6-Hexachlorobiphenyl (147)		2.956	ND
2,2',3,4',5,6'-Hexachlorobiphenyl (148)		1.0671	0.0476
2,2',3,4',5',6-Hexachlorobiphenyl (149)		ND	ND
2,2',3,4',6,6'-Hexachlorobiphenyl (150)		0.9948	0.0413
2,2',3,5,5',6-Hexachlorobiphenyl (151)		66	3.1989
2,2',3,5,6,6'-Hexachlorobiphenyl (152)		0.1308	ND
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	C 132		
2,2',4,4',5',6-Hexachlorobiphenyl (154)		7.3289	0.3202
2,2',4,4',6,6'-Hexachlorobiphenyl (155)		0.06358	ND
2,3,3',4,4',5-Hexachlorobiphenyl (156)		30.152	1.2795
2,3,3',4,4',5'-Hexachlorobiphenyl (157)		4.6279	0.1981
2,3,3',4,4',6-Hexachlorobiphenyl (158)	C 160		
2,3,3',4,5,5'-Hexachlorobiphenyl (159)		0.03818	ND
2,3,3',4,5,6-Hexachlorobiphenyl (160)	C	34.346	1.2208
2,3,3',4,5',6-Hexachlorobiphenyl (161)		ND	ND
2,3,3',4',5,5'-Hexachlorobiphenyl (162)		ND	ND
2,3,3',4',5,6-Hexachlorobiphenyl (163)	C 138		
2,3,3',4',5',6-Hexachlorobiphenyl (164)		26.864	1
2,3,3',5,5',6-Hexachlorobiphenyl (165)		0.1866	ND
2,3,4,4',5,6-Hexachlorobiphenyl (166)		1.557	0.0556
2,3',4,4',5,5'-Hexachlorobiphenyl (167)		11.4029	0.4903
2,3',4,4',5',6-Hexachlorobiphenyl (168)		ND	ND
3,3',4,4',5,5'-Hexachlorobiphenyl (169)		0.3704	ND
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)		49.1	2.6892
2,2',3,3',4,4',6-Heptachlorobiphenyl (171)		19.7307	0.8358
2,2',3,3',4,5,5'-Heptachlorobiphenyl (172)		12.2919	0.5117
2,2',3,3',4,5,6-Heptachlorobiphenyl (173)		2.1711	0.0853
2,2',3,3',4,5,6'-Heptachlorobiphenyl (174)		99.1	4.77398
2,2',3,3',4,5',6-Heptachlorobiphenyl (175)	C	4.02698	0.1592
2,2',3,3',4,6,6'-Heptachlorobiphenyl (176)		10.8881	0.4507
2,2',3,3',4',5,6-Heptachlorobiphenyl (177)		42.9	2.0747
2,2',3,3',5,5',6-Heptachlorobiphenyl (178)		17.494	0.7558
2,2',3,3',5,6,6'-Heptachlorobiphenyl (179)		35.506	1.6131
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)		170	8.0672
2,2',3,4,4',5,6-Heptachlorobiphenyl (181)		0.41258	ND
2,2',3,4,4',5,6'-Heptachlorobiphenyl (182)	C 175		
2,2',3,4,4',5',6-Heptachlorobiphenyl (183)		38.43	1.8793
2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)		0.05948	ND
2,2',3,4,5,5',6-Heptachlorobiphenyl (185)		13.3379	0.5442
2,2',3,4,5,6,6'-Heptachlorobiphenyl (186)		ND	ND
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)		130	6.1925
2,2',3,4',5,6,6'-Heptachlorobiphenyl (188)		0.2131	ND
2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)		3.9391	0.1804
2,3,3',4,4',5,6-Heptachlorobiphenyl (190)		13.8519	0.5509
2,3,3',4,4',5',6-Heptachlorobiphenyl (191)		2.6376	0.1066
2,3,3',4,5,5',6-Heptachlorobiphenyl (192)		ND	ND
2,3,3',4',5,5',6-Heptachlorobiphenyl (193)		ND	ND
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (194)		46.988	1.3847
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)		19.3791	0.573
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (196)		17.4091	0.8462
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (197)		2.0736	0.0919
2,2',3,3',4,5,5',6-Octachlorobiphenyl (198)		ND	ND
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (199)		61.4	2.9364
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (200)		4.6924	0.2085
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (201)		5.0875	0.2174
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (202)		14.0942	0.6509
2,2',3,4,4',5,5',6-Octachlorobiphenyl (203)		27.708	1.1407
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (204)		ND	ND
2,3,3',4,4',5,5',6-Octachlorobiphenyl (205)		2.2792	0.0986
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)		42.5	2.6776
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (207)		3.3106	0.1538
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (208)		22.032	1.0105
Decachlorobipheny (209)		60	3.253
Total PCBs (sum)		5,623	243
Total PCBs (sum) µg/L		**5.623**	**0.243**

Notes:
ng/L = nanograms per liter.
*u*g/L = Microgram per liter.

Table 8
Summary of Radiological Results in Bulk Sediments
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	SS-1A 1003118-07 03/10/2010	SS-1B 1003118-08 03/10/2010	SS-1C 1003118-09 03/10/2010	SS-1C DUP 1003118-10 03/10/2010	SS-2A 1003118-11 03/10/2010	SS-2B 1003118-12 03/10/2010	SS-2C 1003118-13 03/10/2010	SS-3A 1003118-14 03/10/2010	SS-3B 1003166-15 03/17/2010	SS-3C 1003166-16 03/17/2010	SS-3D 1003166-17 03/17/2010	SS-4A 1003118-01 03/09/2010	SS-4B 1003118-02 03/09/2010	SS-4C 1003118-03 03/09/2010	SS-5A 1003118-22 03/11/2010	SS-5B 1003118-23 03/11/2010
Radioactivity																
Gross Alpha (pci/g)	ND +/- 0.28	ND +/- 0.20	ND +/- 0.20	ND +/- 0.22	ND +/- 0.25	ND +/- 0.21	ND +/- 0.17	ND +/- 0.14	ND +/- 0.22	ND +/- 0.15	ND +/- 0.15	ND +/- 0.18	ND +/- 0.16	ND +/- 0.17	ND +/- 0.00	ND +/- 0.25
Gross Beta (pci/g)	ND +/- 0.13	ND +/- 0.17	ND +/- 0.15	ND +/- 0.15	ND +/- 0.15	ND +/- 0.15	ND +/- 0.14	ND +/- 0.15	ND +/- 0.11	ND +/- 0.15	ND +/- 0.15	ND +/- 0.15	ND +/- 0.12	ND +/- 0.12	ND +/- 0.14	ND +/- 0.14
Radium-226 (pci/g)	ND +/- 0.34	ND +/- 0.28	ND +/- 0.28	ND +/- 0.21	ND +/- 0.27	ND +/- 0.26	ND+/- 0.29	ND+/- 0.29	ND +/- 0.2	ND +/- 0.21	ND +/- 0.19	ND +/- 0.23	ND +/- 0.23	ND +/- 0.21	ND +/- 0.22	ND +/- 0.21
Radium-228 (pci/g)	ND +/- 0.42	ND +/- 0.52	ND +/- 0.47	ND +/- 0.39	ND +/- 0.30	ND +/- 0.41	ND +/- 0.49	ND +/- 0.44	ND +/- 0.15	ND +/- 0.14	ND +/- 0.12	ND +/- 0.44	ND +/- 0.36	ND +/- 0.41	ND +/- 0.35	ND +/- 0.29

Parameter	SS-6A 1003118-24 03/11/2010	SS-6B 1003118-25 03/11/2010	SS-6C 1003118-26 03/11/2010	SS-6C DUP 1003118-29 03/11/2010	SS-7A 1003118-17 03/10/2010	SS-7B 1003118-20 03/10/2010	SS-7C 1003118-21 03/10/2010	SS-8A 1003166-06 03/16/2010	SS-8B 1003118-27 03/11/2010	SS-8C 1003118-28 03/11/2010	SS-9A 1003166-07 03/16/2010	SS-9B 1003166-04 03/15/2010	SS-9C 1003166-05 03/15/2010	SS-10A 1003166-08 03/16/2010	SS-10B 1003166-03 03/15/2010	SS-11A 1003118-04 03/09/2010
Radioactivity																
Gross Alpha (pci/g)	ND +/-0.20	ND+/- 0.23	ND +/- 0.16	ND +/- 0.16	ND +/- 0.22	ND +/- 0.17	ND +/- 0.20	ND +/- 0.16	ND +/- 0.14	ND +/- 0.13	ND +/- 0.16	ND +/- 0.17	ND +/- 0.14	ND +/- 0.16	ND +/- 0.17	ND +/- 0.20
Gross Beta (pci/g)	ND+/- 0.11	ND +/- 0.10	ND +/- 0.12	ND +/- 0.11	ND +/- 0.17	ND +/-0.14	ND +/- 0.13	ND +/- 0.16	ND +/- 0.12	ND +/- 0.12	ND +/- 0.16	ND +/- 0.13	ND +/- 0.13	ND +/- 0.13	ND +/- 0.14	ND +/- 0.12
Radium-226 (pci/g)	ND +/- 0.37	ND +/- 0.24	ND +/- 0.25	ND +/- 0.21	ND +/- 0.33	ND +/- 0.21	ND +/- 0.22	ND +/- 0.15	ND +/- 0.20	ND +/- 0.19	ND +/- 0.2	ND +/- 0.15	ND +/- 0.18	ND +/- 0.19	ND +/- 0.51	ND+/- 0.23
Radium-228 (pci/g)	ND +/- 0.31	ND +/- 0.31	ND +/- 0.33	ND +/- 0.35	ND+/- 0.32	ND +/- 0.26	ND +/- 0.23	ND +/- 0.12	ND +/- 0.31	ND +/- 0.26	ND +/- 0.13	ND +/- 0.21	ND +/- 0.15	ND +/- 0.13	ND +/- 0.15	ND +/- 0.41

Parameter	SS-11B 1003118-05 03/09/2010	SS-11C 1003118-06 03/09/2010	SS-12A 1003166-09 03/16/2010	SS-12B 1003166-01 03/15/2010	SS-12C 1003166-02 03/15/2010	Comp A 1004080-08 04/06/2010	Comp B 1004080-09 04/06/2010	Comp-C 1003118-30 03/11/2010	Comp-D 1003118-31 03/11/2010	Comp E 1004080-10 04/06/2010	Comp F 1004080-13 04/05/2010	Comp G 1004080-14 04/06/2010	Comp H 1004080-15 04/07/2010	Comp I 1004080-16 04/07/2010	Comp I DUP 1004080-17 04/07/2010	Comp J 1004080-18 04/07/2010
Radioactivity																
Gross Alpha (pci/g)	ND +/- 0.19	ND +/- 0.29	ND +/- 0.20	ND +/- 0.17	ND +/- 0.21	ND +/- 0.20	ND +/- 0.15	ND +/- 0.19	ND +/- 0.19	ND +/- 0.22	ND +/- 0.23	ND +/- 0.20	ND +/- 0.22	ND +/- 0.22	ND +/- 0.15	ND +/- 0.19
Gross Beta (pci/g)	ND +/- 0.14	ND +/- 0.16	ND +/- 0.12	ND +/- 0.16	ND +/- 0.14	ND +/- 0.17	ND +/- 0.16	ND +/- 0.15	ND +/- 0.12	ND +/- 0.15	ND +/- 0.15	ND +/- 0.16	ND +/- 0.16	ND +/- 0.18	ND +/- 0.12	ND +/- 0.21
Radium-226 (pci/g)	ND +/- 0.32	3.47 +/- 0.89	ND+/- 0.21	ND+/- 0.23	ND+/- 0.41	ND +/- 0.20	ND +/- 0.27	ND +/- 0.23	ND +/- 0.24	<3.0 +/- 0.29	ND +/- 0.25	ND +/- 0.20	ND +/- 0.23	ND +/- 0.36	ND +/- 0.33	ND +/- 0.34
Radium-228 (pci/g)	ND +/- 0.36	ND +/- 0.43	ND +/- 0.13	ND +/- 0.2	ND +/- 0.09	ND +/- 0.27	ND +/- 0.29	ND +/- 0.31	ND +/- 0.43	ND +/- 0.23	ND +/- 0.23	ND +/- 0.25	ND +/- 0.32	ND +/- 0.25	ND +/- 0.22	ND +/- 0.26

Parameter	Comp K 1003166-10 03/17/2010	Comp L 1003166-13 03/17/2010	Comp M 1004080-19 04/07/2010	Comp N 1003216-04 03/24/2010	Comp O 1004080-20 04/07/2010	Comp P 1003216-05 03/24/2010	Comp Q 1003166-14 03/17/2010	Comp R 1003216-01 03/18/2010	Comp S 1003216-02 03/18/2010	Comp T 1003216-03 03/18/2010	Core 41 1004080-01 04/06/2010	Core 42 1004080-02 04/06/2010	Core 43 1004080-03 04/06/2010	Core 44 1004080-04 04/06/2010	Core 45 1004080-05 04/07/2010	Core 46 1004020-01 03/31/2010
Radioactivity																
Gross Alpha (pci/g)	ND +/- 0.16	ND +/- 0.22	ND +/- 0.19	ND +/- 0.19	ND +/- 0.25	ND +/- 0.21	ND +/- 0.19	ND +/- 0.34	ND +/- 0.17	ND +/- 0.14	ND +/- 0.17	ND +/- 0.21	ND +/- 0.21	ND +/- 0.2	ND +/- 0.13	<2.0 +/- 0.16
Gross Beta (pci/g)	ND +/- 0.15	ND +/- 0.15	ND +/- 0.14	ND +/- 0.15	ND +/- 0.19	ND +/- 0.14	ND +/- 0.12	ND +/- 0.16	ND +/- 0.12	ND +/- 0.11	ND +/- 0.19	ND +/- 0.16	ND +/- 0.15	ND +/- 0.18	ND +/- 0.14	<3.0 +/- 0.13
Radium-226 (pci/g)	ND +/- 0.18	ND +/- 0.22	ND +/- 0.42	ND +/- 0.24	ND +/- 0.42	ND +/- 0.25	ND +/- 0.24	ND +/- 0.2	ND +/- 0.2	ND +/- 0.28	ND +/- 0.29	ND +/- 0.25	ND +/- 0.25	ND +/- 0.30	ND +/- 0.26	<3.0 +/- 0.34
Radium-228 (pci/g)	ND +/- 0.26	ND +/- 0.13	ND +/- 0.13	ND +/- 0.29	ND +/- 0.29	ND +/- 0.31	ND +/- 0.13	ND +/- 0.9	ND +/- 0.32	ND +/- 0.28	ND +/- 0.24	ND +/- 0.22	ND +/- 0.30	ND +/- 0.30	ND +/- 0.30	<2.0 +/- 0.27

Parameter	Core 47 1004020-02 03/31/2010	Core 47 DUP 1004020-03 03/31/2010	Core 48 1004020-04 03/31/2010	Core 49 1004020-05 04/01/2010	Core 50 1004020-06 04/01/2010
Radioactivity					
Gross Alpha (pci/g)	<2.0 +/- 0.23	<2.0 +/-0.20	<2.0 +/- 0.20	<2.0 +/- 0.13	<2.0 +/- 0.15
Gross Beta (pci/g)	<3.0 +/- 0.15	<3.0 +/- 0.13	<3.0 +/- 0.14	<3.0 +/- 0.11	<3.0 +/- 0.11
Radium-226 (pci/g)	<3.0 +/- 0.43	<3.0 +/- 0.67	<3.0 +/- 0.32	<3.0 +/- 0.24	<3.0 +/- 0.37
Radium-228 (pci/g)	<2.0 +/- 0.28	<2.0 +/- 0.32	<2.0 +/- 0.27	<2.0 +/- 0.09	<2.0 +/- 0.09

Notes:
ND = Non detect
pci/g = picocuries per gram

Table 9
Total Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-1 24 Hour 1003122-01 03/09/2010 µg/L	E-1 72 Hour 1003122-02 03/09/2010 µg/L	E-2 1003122-04 03/10/2010 µg/L	E-2 DUP 1003122-05 03/10/2010 µg/L	E-3 1004083-07 04/06/2010 µg/L	E-4 - 24 Hour 1003169-05 03/17/2010 µg/L	E-4 - 72 Hour 1003169-06 03/17/2010 µg/L	E-5 1003226-01 03/18/2010 µg/L	E-6 1003122-06 03/10/2010 µg/L
Polychlorinated Biphenyls													
Aroclor 1260	1	0.014	NA	0.014	ND	ND	ND	ND	ND	0.63	0.56	ND	ND
Pesticides													
4,4´-DDE	0.55	0.001	1.1	0.001	ND	ND	ND	ND	ND	ND	ND	0.39	ND
delta-BHC	NA	NA	NA	NA	ND	ND	0.0029 J	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	NA	NA	NA	NA	ND	ND	0.024	0.054	ND	0.037	0.033	0.013 J	ND
Endrin	0.09	0.0023	0.086	0.036	ND	ND	0.039	0.22	ND	0.10 E	0.13 E	ND	ND
Heptachlor epoxide	NA	NA	0.5	0.0038	ND	ND	ND	ND	0.0093 J	ND	ND	ND	ND
Hexachlorobenzene	NA	NA	NA	NA	ND	ND	ND	0.032	ND	ND	0.058	ND	ND
Semivolatile Organic Compounds													
2-Methylnaphthalene	NA	NA	NA	NA	ND	ND	0.52 J	0.51 J	ND	6.6	2.9 J	2.1 J	ND
3+4-Methylphenol	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	4.4 J	ND
Acenaphthene	NA	NA	83	17	ND	ND	ND	0.59 J	ND	56	22	3.0 J	ND
Acenaphthylene	NA	NA	NA	NA	ND	ND	ND	ND	ND	1.4 J	ND	ND	ND
Anthracene	NA	NA	NA	NA	ND	ND	ND	0.65 J	ND	31	12	1.5 J	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	ND	ND	0.53 J	0.55 J	ND	20	8.6	1.5 J	ND
Benzo(a)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	9.7	4.0 J	0.55 J	ND
Benzo(b)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	11	4.2 J	0.58 J	ND
Benzo(g,h,i)perylene	NA	NA	NA	NA	ND	ND	ND	ND	ND	3.8 J	1.9 J	ND	ND
Benzo(k)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	9.6	4.2 J	ND	ND
Bis(2-chloroethyl)ether	NA	NA	30,000	6,000	ND	ND	ND	ND	ND	ND	ND	0.77 J	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4,500	910	1.7 J	2.2 J	11	14	0.79 BJ	51	27	4.9 BJ	1.8 J
Butyl benzyl phthalate	NA	NA	140	35	0.77 J	1.7 J	ND	0.72 J	1.1 J	ND	ND	3.3 J	0.89 J
Carbazole	NA	NA	NA	NA	ND	ND	ND	ND	ND	1.2 J	0.77 J	ND	ND
Chrysene	NA	NA	NA	NA	ND	ND	0.74 J	0.82 J	ND	17	7.6	1.5 J	ND
Dibenzo(a,h)anthracene	NA	NA	NA	NA	ND	ND	ND	ND	ND	1.9 J	0.83 J	ND	ND
Dibenzofuran	NA	NA	NA	NA	ND	ND	ND	ND	ND	29	12	1.5 J	ND
Diethyl phthalate	NA	NA	4,000	800	ND	ND	ND	ND	0.79 J	ND	ND	0.50 J	ND
Di-n-butyl phthalate	NA	NA	110	21	ND	0.84 J	0.67 J	ND	ND	ND	0.57 J	ND	ND
Di-n-octyl phthalate	NA	NA	NA	NA	ND	ND	ND	ND	ND	5.9	1.7 J	ND	ND
Fluoranthene	NA	NA	200	40	ND	ND	1.6 J	1.6 J	ND	87	35	5.1	ND
Fluorene	NA	NA	NA	NA	ND	ND	ND	ND	ND	56	21	2.7 J	ND
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	4.4 J	2.1 J	ND	ND
Naphthalene	NA	NA	140	43	ND	ND	0.61 J	0.82 J	ND	7.3	3.6 J	2.6 J	ND
Phenanthrene	NA	NA	5	1	ND	ND	1.5 J	1.5 J	ND	190	68	7.4	ND
Pyrene	NA	NA	NA	NA	ND	ND	1.4 J	1.7 J	ND	75	32	4.8 J	ND
Benzo(a)anthracene (SIM)	NA	NA	0.5	0.1	ND	ND	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene (SIM)	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene (SIM)	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene (SIM)	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
Chrysene (SIM)	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene (SIM)	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene (SIM)	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA

Table 9
Total Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-1 24 Hour 1003122-01 03/09/2010 µg/L	E-1 72 Hour 1003122-02 03/09/2010 µg/L	E-2 1003122-04 03/10/2010 µg/L	E-2 DUP 1003122-05 03/10/2010 µg/L	E-3 1004083-07 04/06/2010 µg/L	E-4 - 24 Hour 1003169-05 03/17/2010 µg/L	E-4 - 72 Hour 1003169-06 03/17/2010 µg/L	E-5 1003226-01 03/18/2010 µg/L	E-6 1003122-06 03/10/2010 µg/L
Inorganic Analytes													
Aluminum	750	87	750	NA	255,000	125,000	350,000	349,000	467,000	525,000	433,000	174,000	226,000
Antimony	NA	NA	1,100	200	11.3 J	ND	21.5 J	17.8 J	ND	32.5	23.9 J	ND	ND
Arsenic	360	190	340	150	60.1	30.3	515	530	99.4	782	588	117	56.4
Barium	NA	NA	21,000	4,100	1,690	849	4,760	4,940	2,420	4,980	3,800	1,790	1,630
Beryllium	NA	NA	NA	NA	ND	ND	50.5	52.5	ND	17.6 J	12.8 J	ND	ND
Cadmium [c]	2.79	0.9	1.57	0.217	ND	ND	168	174	ND	297	184	29.1	ND
Calcium	NA	NA	NA	NA	46,100	28,800	62,700	65,100	65,600	66,800	51,700	31,700	41,500
Chromium, Trivalent [c]	1,357	161.7	445	57.9	659	316	5,810	6,010	1,020	5,450	4,370	1,140	594
Chromium	NA	NA	NA	NA	659	316	5,810	6,010	1,020	5,450	4,370	1,140	594
Copper [c]	13.35	9.14	10.5	7.2	130	86	4,370	4,550	190	4,350	3,350	828	136
Iron	NA	NA	NA	NA	242,000	137,000	319,000	323,000	704,000	787,000	629,000	411,000	233,000
Lead	48	16	55.6 [c]	2.17 [c]	115	55	4,860	5,040	178	6,020	4,460	979	109
Magnesium	NA	NA	NA	NA	96,600	46,700	75,600	77,300	144,000	105,000	80,600	56,300	88,300
Manganese	NA	NA	NA	NA	5,300	2,310	6,550	6,740	12,000	10,300	6,710	5,050	5,660
Nickel [c]	1,099	122.2	364	40.4	314	147	718	734	492	752	571	268	299
Potassium	NA	NA	NA	NA	58,600	28,900	54,800	54,100	71,600	63,600	51,200	31,900	50,700
Selenium	20	5	NA	4.99	ND	ND	23 J	27.1	11.9 J	37	28.4	ND	ND
Silver [c]	2.42	NA	2.42	NA	ND	ND	107	111	ND	84.2	69.1	18.2 J	ND
Sodium	NA	NA	NA	NA	11,800	11,000	13,200	13,500	10,500	12,300	10,500	8,270	10,800
Thallium	NA	NA	65	13	11.8 J	14.5 J	52.9	51.3	ND	ND	ND	ND	12.6 J
Tin	NA	NA	NA	NA	252	121	2,690	2,800	400	2,900	2,300	570	220
Vanadium	NA	NA	510	100	563	262	2,840	2,920	847	1,760	1,390	639	498
Zinc [c]	90.7	82.1	93	93	978	526	11,600	12,000	1,600	17,300	11,900	3,190	903
Miscellaneous													
pH	NA	NA	NA	NA	7.26 H	7.20 H	7.37 H	7.25 H	7.15 H	7.40	7.01	6.87 H	7.26 H
Cyanide (mg/L)	22	5.2	22	5.2	ND	ND	ND	ND	0.00767 J	0.0699	0.0350	0.0202	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	6820 H	2860 H	19500 H	19500 H	10400	14400	9740	6480	7780 H
Total Organic carbon (mg/L)	NA	NA	NA	NA	9.3	9.4	59.9	41.8	11	47.3	34.2	21.9	7.4

Table 9
Total Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-7 1003169-04 03/17/2010 µg/L	E-8 1003122-08 03/11/2010 µg/L	E-9 1003122-09 03/10/2010 µg/L	E-10 1003169-01 03/15/2010 µg/L	E-11 1003122-03 03/09/2010 µg/L	E-12 1003169-02 03/15/2010 µg/L	E-13 1003122-07 03/11/2010 µg/L	E-14 1004083-08 04/06/2010 µg/L	E-15 1003169-03 03/16/2010 µg/L
Polychlorinated Biphenyls													
Aroclor 1260	1	0.014	NA	0.014	ND	0.64	ND	ND	ND	ND	ND	ND	ND
Pesticides													
delta-BHC	NA	NA	NA	NA	ND	ND	0.038	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	NA	NA	NA	NA	ND	0.044	ND	ND	ND	ND	0.028	ND	ND
Endrin	0.09	0.0023	0.086	0.036	ND	0.23	ND	ND	ND	ND	0.24	ND	ND
Hexachlorobenzene	NA	NA	NA	NA	0.011 J	ND	0.021	ND	ND	ND	0.012 J	ND	ND
Semivolatile Organic Compounds													
3+4-Methylphenol	NA	NA	160	30	ND	ND	ND	ND	ND	ND	1.1 J	ND	ND
2-Methylnaphthalene	NA	NA	NA	NA	ND	0.96 J	ND	ND	ND	ND	20	ND	ND
4-Nitroaniline	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.1 J	ND	ND
Acenaphthene	NA	NA	83	17	ND	0.73 J	ND	ND	ND	ND	23	ND	ND
Anthracene	NA	NA	NA	NA	ND	0.82 J	ND	ND	ND	ND	9.5	ND	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	ND	0.78 J	ND	ND	ND	ND	6.7	ND	ND
Benzo(a)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	3.0 J	ND	ND
Benzo(b)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	3.5 J	ND	ND
Benzo(g,h,i)perylene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.1 J	ND	ND
Benzo(k)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	2.8 J	ND	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	1.7 J	15	4.7 J	1.9 J	1.2 J	3.7 J	13	1.0 BJ	2.7 J
Butyl benzyl phthalate	NA	NA	140	35	ND	ND	ND	ND	0.66 J	ND	1.8 J	1.3 J	ND
Carbazole	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	6.1	ND	ND
Chrysene	NA	NA	NA	NA	ND	0.93 J	ND	ND	ND	ND	6.1	ND	ND
Dibenzofuran	NA	NA	NA	NA	ND	0.57 J	ND	ND	ND	ND	12	ND	ND
Di-n-butyl phthalate	NA	NA	110	21	ND	1.3 J	1.9 J	ND	ND	ND	1.1 J	ND	ND
Fluoranthene	NA	NA	200	40	ND	2.0 J	ND	ND	ND	ND	30	ND	0.55 J
Fluorene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	22	ND	ND
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.1 J	ND	ND
Naphthalene	NA	NA	140	43	ND	1.5 J	ND	ND	ND	ND	4.0 J	ND	ND
Phenanthrene	NA	NA	5	1	ND	1.9 J	ND	ND	ND	ND	59	ND	0.70 J
Pyrene	NA	NA	NA	NA	ND	1.8 J	ND	ND	ND	ND	23	ND	0.72 J
Inorganic Analytes													
Aluminum	750	87	750	NA	500,000	312,000	323,000	289,000	290,000	168,000	154,000	509,000	84,000
Antimony	NA	NA	1,100	200	ND	12.8 J	ND	ND	ND	ND	13.9 J	ND	23.2 J
Arsenic	360	190	340	150	106	496	82.2	122	65.7	61	244	106	38.3
Barium	NA	NA	21,000	4,100	3,000	3,620	2,500	2,430	1,910	1,390	2,000	2,620	741
Beryllium	NA	NA	NA	NA	ND	7.02 J	ND	ND	ND	ND	15.9 J	ND	ND
Cadmium [c]	2.79	0.9	1.57	0.217	ND	142	ND	ND	ND	ND	56.6	ND	ND
Calcium	NA	NA	NA	NA	77,100	53,800	58,900	52,700	53,100	36,000	33,700	72,900	19,400
Chromium, Trivalent [c]	1,357	161.7	445	57.9	1,130	4,230	875	862	777	493	2,020	1,180	253
Chromium	NA	NA	NA	NA	1130	4230	875	862	777	493	2020	1180	253
Copper [c]	13.35	9.14	10.5	7.2	247	3,540	202	294	146	141	1,490	212	180
Iron	NA	NA	NA	NA	772,000	293,000	296,000	662,000	267,000	378,000	177,000	728,000	158,000
Lead	48	16	55.6 [c]	2.17 [c]	211	3,840	173	269	126	120	1,860	186	221
Magnesium	NA	NA	NA	NA	161,000	77,400	127,000	110,000	113,000	65,600	40,400	163,000	25,100
Manganese	NA	NA	NA	NA	13,000	6,800	9,520	13,200	6,660	8,180	2,570	12,300	3,460
Nickel [c]	1,099	122.2	364	40.4	563	619	437	428	375	244	278	554	120
Potassium	NA	NA	NA	NA	80,100	52,300	72,400	61,600	67,600	34,900	27,700	80,600	16,500
Selenium	20	5	NA	4.99	ND	29.5	ND	ND	ND	ND	ND	11.9 J	ND
Silver [c]	2.42	NA	2.42	NA	ND	84.3	ND	ND	ND	ND	32.3	ND	ND
Sodium	NA	NA	NA	NA	11,200	12,500	12,000	10,800	11,700	9,350	12,000	10,500	8,850
Thallium	NA	NA	65	13	ND	ND	ND	ND	ND	ND	29	ND	ND
Tin	NA	NA	NA	NA	472	1,980	310	411	289	222	946	468	121
Vanadium	NA	NA	510	100	905	1,360	716	692	652	414	819	972	174
Zinc [c]	90.7	82.1	93	93	1,820	11,000	1,400	1,700	1,110	877	4,580	1,760	1,100
Miscellaneous													
pH	NA	NA	NA	NA	7.46	7.16 H	7.05 H	7.24	7.27 H	7.53	7.34 H	7.28 H	7.27
Cyanide (mg/L)	22	5.2	22	5.2	ND	ND	ND	ND	ND	ND	ND	0.00637 J	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	14000	12600 H	10900 H	8520	8780 H	5320	5440 H	13900	2440
Total Organic Carbon (mg/L)	NA	NA	NA	NA	23.2	33.3	11.9	15.5	18.6	27.7	21.3	25	11.7

Table 9
Total Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-16 (24 Hour) 1004083-11 04/07/2010 µg/L	E-16 (72 Hour) 1004083-12 04/07/2010 µg/L	E-17 1003226-02 03/24/2010 µg/L	E-18 1004083-13 04/07/2010 µg/L	E-19 1004083-14 04/07/2010 µg/L	Core 42 1004083-01 04/06/2010 µg/L	Core 43 1004083-02 04/06/2010 µg/L	Core 44 1004083-03 04/06/2010 µg/L	Core 45 1004083-04 04/07/2010 µg/L
Polychlorinated Biphenyls													
Aroclor 1260	1	0.014	NA	0.014	ND	ND	0.95	ND	ND	ND	ND	ND	ND
Pesticides													
4,4´-DDD	0.55	0.001	1.1	0.001	ND	ND	ND	ND	ND	0.11	ND	ND	ND
4,4´-DDE	0.55	0.001	1.1	0.001	0.051	0.040	1.7	0.89	0.19	2.2	1.9	0.0056 J	ND
Endosulfan sulfate	NA	NA	NA	NA	ND	ND	0.071	ND	ND	ND	ND	ND	ND
Endrin	0.09	0.0023	0.086	0.036	ND	ND	0.28 C	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	NA	NA	0.5	0.0038	ND	ND	ND	ND	ND	ND	ND	0.0073 J	ND
Hexachlorobenzene	NA	NA	NA	NA	ND	ND	0.028	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds													
2-Methylnaphthalene	NA	NA	NA	NA	3.9 J	4.1 J	1.1 J	3.1 J	7.3	1.2 J	8.3	ND	ND
3+4-Methylphenol	NA	NA	NA	NA	6.5	7.1	0.77 J	3.0 J	16	0.88 J	ND	ND	ND
Acenaphthene	NA	NA	83	17	2.8 J	2.4 J	0.58 J	21	3.1 J	4.7 J	19	ND	ND
Acenaphthylene	NA	NA	NA	NA	ND	ND	ND	ND	0.55 J	ND	ND	ND	ND
Anthracene	NA	NA	NA	NA	2.4 J	1.9 J	0.64 J	12	3.6 J	5.5	7.8	ND	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	1.2 J	1.2 J	0.54 J	5.1	2.4 J	3.8 J	5.6	ND	ND
Benzo(a)pyrene	NA	NA	NA	NA	ND	ND	ND	2.2 J	ND	1.9 J	2.3 J	ND	ND
Benzo(b)fluoranthene	NA	NA	NA	NA	ND	ND	ND	2.5 J	ND	2.2 J	3.1 J	ND	ND
Benzo(g,h,i)perylene	NA	NA	NA	NA	ND	ND	ND	0.99 J	0.81 J	1.1 J	1.1 J	ND	ND
Benzo(k)fluoranthene	NA	NA	NA	NA	ND	ND	ND	1.8 J	ND	1.9 J	2.1 J	ND	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	ND	3.1 J	4.7 BJ	16	4.5 J	30	18	0.75 J	0.53 J
Butyl benzyl phthalate	NA	NA	140	35	ND	ND	1.8 J	1.4 J	ND	ND	ND	0.74 J	0.63 J
Carbazole	NA	NA	NA	NA	ND	ND	ND	1.3 J	0.81 J	ND	1.9 J	ND	ND
Chrysene	NA	NA	NA	NA	1.9 J	1.9 J	0.89 J	6.3	3.0 J	5.8	6.1	ND	ND
Dibenzofuran	NA	NA	NA	NA	1.6 J	1.3 J	ND	9.7	2.9 J	1.7 J	8.9	ND	ND
Diethyl phthalate	NA	NA	4000	800	ND	0.78 J	ND	0.57 J	ND	ND	ND	ND	ND
Di-n-butyl phthalate	NA	NA	110	21	ND	ND	1.7 J	ND	ND	ND	0.86 J	ND	ND
Fluoranthene	NA	NA	200	40	4.9 J	5.8	1.5 J	26	9.1	12	22	ND	ND
Fluorene	NA	NA	NA	NA	2.8 J	2.7 J	ND	19	4.1 J	4.3 J	16	ND	ND
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	ND	ND	ND	0.84 J	ND	0.79 J	0.96 J	ND	ND
Naphthalene	NA	NA	140	43	6.8	7.5	1.2 J	4.6 J	14	1.4 J	2.1 J	ND	ND
N-Nitrosodiphenylamine	NA	NA	300	59	ND	ND	0.96 J	ND	ND	ND	ND	ND	ND
Pentachlorophenol	9.07	5.73	8.72 [d]	6.69 [d]	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	NA	NA	5	1	7.3	7.3	1.7 J	54	12	14	49	ND	ND
Pyrene	NA	NA	NA	NA	6.4	6.4	1.7 J	28	10	13	21	ND	ND
Inorganic Analytes													
Aluminum	750	87	750	NA	595,000	601,000	300,000	468,000	530,000	232,000	302,000	648,000	554,000
Antimony	NA	NA	1,100	200	ND	10.6 J	ND	19.3 J	ND	25.8	32.8	ND	ND
Arsenic	360	190	340	150	521	434	280	555	613	349	593	133	119
Barium	NA	NA	21,000	4,100	4,080	3,460	3,050	3,880	4,250	3,790	3,720	3,260	2,970
Beryllium	NA	NA	NA	NA	ND	ND	8.07 J	30.3	ND	54.3	30.5	ND	ND
Cadmium [c]	2.79	0.9	1.57	0.217	114	92.8	69.5	132	172	142	117	ND	ND
Calcium	NA	NA	NA	NA	66,900	56,700	57,500	59,900	54,800	48,400	58,200	86,600	77,800
Chromium, Trivalent [c]	1,357	161.7	445	57.9	3,140	2,840	2,740	4,830	3,730	4,490	4,650	1,380	1,160
Chromium	NA	NA	NA	NA	3,140	2,840	2,740	4,830	3,730	4,490	4,650	1,380	1,160
Copper [c]	13.35	9.14	10.5	7.2	2,780	2,430	1,930	3,410	3,810	3,140	3,060	260	243
Iron	NA	NA	NA	NA	825,000	786,000	668,000	603,000	735,000	434,000	598,000	863,000	821,000
Lead	48	16	55.6 [c]	2.17 [c]	3,460	2,980	2,210	4,320	4,680	4,190	4,250	240	223
Magnesium	NA	NA	NA	NA	139,000	122,000	94,000	85,100	92,700	54,500	83,700	191,000	162,000
Manganese	NA	NA	NA	NA	12,200	9,100	8,540	6,050	8,670	4,110	6,130	15,800	15,000
Nickel [c]	1,099	122.2	364	40.4	697	602	533	677	631	493	644	651	567
Potassium	NA	NA	NA	NA	76,400	75,100	56,600	58,800	56,400	35,300	53,900	93,000	76,600
Selenium	20	5	NA	4.99	30.6	28.6	ND	31.6	43.4	28	34.2	17.6 J	14.3 J
Silver [c]	2.42	NA	2.42	NA	32.3	28.1	52.8	84.2	56.5	87.4	77.8	ND	ND
Sodium	NA	NA	NA	NA	10,600	10,500	12,200	12,200	10,500	10,400	14,000	10,800	10,800
Thallium	NA	NA	65	13	ND	ND	ND	19.9	ND	50.5	53.3	ND	ND
Tin	NA	NA	NA	NA	1,560	1,410	1,360	2,410	1,910	2,340	2,310	543	449
Vanadium	NA	NA	510	100	1,090	993	1,230	1,840	936	1,480	1,980	1,160	960
Zinc [c]	90.7	82.1	93	93	11,600	9,690	5,760	10,600	15,400	8,550	9,430	2,060	1,800

Table 9
Total Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-16 (24 Hour) 1004083-11 04/07/2010 µg/L	E-16 (72 Hour) 1004083-12 04/07/2010 µg/L	E-17 1003226-02 03/24/2010 µg/L	E-18 1004083-13 04/07/2010 µg/L	E-19 1004083-14 04/07/2010 µg/L	Core 42 1004083-01 04/06/2010 µg/L	Core 43 1004083-02 04/06/2010 µg/L	Core 44 1004083-03 04/06/2010 µg/L	Core 45 1004083-04 04/07/2010 µg/L
Miscellaneous													
pH	NA	NA	NA	NA	7.14 H	7.01 H	6.96 H	7.30 H	7.12 H	7.45 H	7.37 H	7.29 H	7.54 H
Cyanide (mg/L)	22	5.2	22	5.2	0.0309	0.0287	0.0264	0.0273	0.0389	0.0400	0.0318	0.00636 J	0.00872 J
Suspended Solids (mg/L)	NA	NA	NA	NA	14400	11800	10800	10800	11400	6420	11700	15300	13000
Total Organic Carbon (mg/L)	NA	NA	NA	NA	24	46	17.4	46	25	42	45	15	31

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	Core 46 1004023-01 03/31/2010 µg/L	Core 47 1004023-02 03/31/2010 µg/L	Core 47 DUP 1004023-03 03/31/2010 µg/L	Core 48 1004023-04 03/31/2010 µg/L	Core 49 1004023-05 04/01/2010 µg/L	Core 50 1004023-06 04/01/2010 µg/L
Polychlorinated Biphenyls										
No PCB's detected at or above the method detection limit in these samples.										
Pesticides										
4,4´-DDD	0.55	0.001	1.1	0.001	0.028 C	0.064 C	0.057 C	0.033 C	ND	ND
4,4´-DDE	0.55	0.001	1.1	0.001	0.020	0.18	0.15	0.067	0.029	0.011 J
Dieldrin	1.25	0.0019	0.24	0.056	0.0098 J	ND	0.010 J	0.086	ND	ND
Heptachlor epoxide	NA	NA	0.5	0.0038	ND	ND	ND	0.033	ND	ND
Semivolatile Organic Compounds										
2-Methylnaphthalene	NA	NA	NA	NA	ND	0.66 J	0.61 J	ND	ND	ND
Acenaphthene	NA	NA	83	17	9.4	3.3 J	2.8 J	ND	0.70 J	ND
Anthracene	NA	NA	NA	NA	0.71 J	2.3 J	1.7 J	ND	ND	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	1.2 J	1.8 J	1.4 J	ND	0.86 J	0.66 J
Benzo(a)pyrene	NA	NA	NA	NA	0.53 J	1.1 J	0.82 J	ND	0.90 J	ND
Benzo(b)fluoranthene	NA	NA	NA	NA	0.76 J	1.3 J	1.1 J	ND	0.80 J	ND
Benzo(g,h,i)perylene	NA	NA	NA	NA	ND	0.56 J	ND	ND	0.83 J	ND
Benzo(k)fluoranthene	NA	NA	NA	NA	0.63 J	1.1 J	0.67 J	ND	0.73 J	0.60 J
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	4.1 J	5.5	3.4 J	5.3	2.9 J	1.2 J
Butyl benzyl phthalate	NA	NA	140	35	1.1 J	1.3 J	1.2 J	1.3 J	0.97 J	0.66 J
Carbazole	NA	NA	NA	NA	0.52 J	ND	ND	ND	ND	ND
Chrysene	NA	NA	NA	NA	1.7 J	3.3 J	2.1 J	ND	1.2 J	0.62 J
Dibenzofuran	NA	NA	NA	NA	0.89 J	0.90 J	0.84 J	ND	ND	ND
Diethyl phthalate	NA	NA	4000	800	ND	ND	ND	0.77 J	ND	ND
Di-n-butyl phthalate	NA	NA	110	21	0.65 J	0.57 J	0.70 J	0.66 J	ND	ND
Fluoranthene	NA	NA	200	40	4.6 J	6.3	5.1	ND	1.8 J	1.0 J
Fluorene	NA	NA	NA	NA	0.69 J	2.6 J	2.4 J	ND	0.53 J	ND
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	0.54 J	ND
Naphthalene	NA	NA	140	43	0.70 J	0.84 J	0.69 J	ND	ND	ND
Phenanthrene	NA	NA	5	1	1.8 J	4.6 J	3.7 J	0.66 J	1.1 J	0.55 J
Pyrene	NA	NA	NA	NA	3.9 J	8.5	5.6	0.52 J	1.9 J	1.2 J
Benzo(a)anthracene (SIM)	NA	NA	0.5	0.1	NA	NA	NA	ND	NA	NA
Benzo(a)pyrene (SIM)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene (SIM)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene (SIM)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene (SIM)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene (SIM)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene (SIM)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 9
Total Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	Core 46 1004023-01 03/31/2010 µg/L	Core 47 1004023-02 03/31/2010 µg/L	Core 47 DUP 1004023-03 03/31/2010 µg/L	Core 48 1004023-04 03/31/2010 µg/L	Core 49 1004023-05 04/01/2010 µg/L	Core 50 1004023-06 04/01/2010 µg/L
Inorganic Analytes										
Aluminum	750	87	750	NA	43,000	96,500	80,300	46,600	21,000	40,900
Antimony	NA	NA	1,100	200	32.9	11.8 J	ND	11.1 J	ND	17.3 J
Arsenic	360	190	340	150	37.4	118	94	55.8	30.6	45.9
Barium	NA	NA	21,000	4,100	387	930	758	441	238	325
Beryllium	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
Cadmium [c]	2.79	0.9	1.57	0.217	6.7 J	15.6	10.8	10.2	ND	ND
Calcium	NA	NA	NA	NA	20,800	20,300	18,900	11,700	23,000	22,000
Chromium, Trivalent [c]	1,357	161.7	445	57.9	229	924	701	414	142	187
Chromium	NA	NA	NA	NA	229	924	701	413	142	187
Copper [c]	13.35	9.14	10.5	7.2	214	705	534	341	231	159
Iron	NA	NA	NA	NA	53,700	122,000	101,000	72,200	26,400	50,300
Lead	48	16	55.6 [c]	2.17 [c]	325	1,030	764	397	209	216
Magnesium	NA	NA	NA	NA	14,300	22,200	18,700	11,700	8,590	11,400
Manganese	NA	NA	NA	NA	1,880	1,930	1,580	953	447	654
Nickel [c]	1,099	122.2	364	40.4	65.6	191	159	104	31.9	52
Potassium	NA	NA	NA	NA	9,900	18,400	16,000	11,100	5,690	9,490
Selenium	20	5	NA	4.99	ND	ND	ND	ND	ND	ND
Silver [c]	2.42	NA	2.42	NA	ND	ND	ND	ND	ND	ND
Sodium	NA	NA	NA	NA	7,670	7,880	8,260	8,240	6,600	7,150
Thallium	NA	NA	65	13	ND	ND	ND	ND	ND	ND
Tin	NA	NA	NA	NA	131	479	363	211	75	101
Vanadium	NA	NA	510	100	102	406	311	185	53	91
Zinc [c]	90.7	82.1	93	93	795	2,730	1,980	1,490	619	613
Miscellaneous										
pH	NA	NA	NA	NA	7.27 H	6.82 H	6.88 H	6.29 H	7.63 H	7.81 H
Cyanide (mg/L)	22	5.2	22	5.2	ND	ND	ND	ND	ND	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	900	2160	1700	800	320	580
Total Organic Carbon (mg/L)	NA	NA	NA	NA	7.6	12.1	9.3	10.1	5.6	5

Notes:
a= Delaware River Basin Commission (DRBC) Stream Quality Objectives (SQO) for Toxic Pollutants for the Protection of Aquatic Life (Table 5 in DRBC, 2008)
b= PA Water Quality Criteria for Toxic Substances (PA Code, Title 25, Chapter 16)
c = Value is hardness dependent. The DRBC average hardness for the Delaware River (74 mg/L) was used to calculate the criteria.
d = Value is pH dependent. A pH of 7 was used to calculate the criteria.

C= Calibration exceeded
H= Holding time exceeded
J= Analyte detected below quantitation limit

mg/L = milligrams per liter
NA= Not applicable
ND= Analyte not detected
PADEP= Pennsylvania Department of Environmental Protection
µg/L = micrograms per liter
SIM = laboratory SIM method that achieves lower detection limits

= Detected concentration exceeds DRBC acute SQO.
= Detected concentration exceeds DRBC chronic SQO.
Red Text = Detected concentration exceeds the PADEP acute WQC
Purple Text = Detected concentration exceeds the PADEP chronic WQC

Table 10
Dissolved Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-1 24 Hour 1003124-01 03/09/2010 µg/L	E-1 72 Hour 1003124-02 03/09/2010 µg/L	E-2 1003124-04 03/10/2010 µg/L	E-2 DUP 1003124-05 03/10/2010 µg/L	E-3 1004084-07 04/06/2010 µg/L	E-4 - 24 Hour 1003170-05 03/17/2010 µg/L	E-4 - 72 Hour 1003170-06 03/17/2010 µg/L	E-5 1003227-01 03/18/2010 µg/L	E-6 1003124-06 03/10/2010 µg/L
Polychlorinated Biphenyls													
Aroclor 1260	1	0.014	NA	0.014	ND	ND	ND	0.094	ND	ND	ND	0.34	ND
Pestcides													
4,4´-DDD	0.55	0.001	1.1	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4´-DDE	0.55	0.001	1.1	0.001	ND	ND	0.34	0.067	ND	ND	ND	0.45	ND
Endosulfan sulfate	NA	NA	NA	NA	ND	ND	ND	0.0049 J	ND	ND	ND	0.010 J	ND
Endrin	0.09	0.0023	0.086	0.036	ND	ND	0.026	0.0084 J	ND	0.031	ND	0.051 C	ND
Heptachlor epoxide	NA	NA	0.5	0.0038	ND	ND	ND	ND	0.0077 J	ND	ND	ND	ND
Hexachlorobenzene	NA	NA	NA	NA	ND	ND	0.014 J	ND	ND	0.043	ND	ND	0.0035 J
Semivolatile Organic Compounds													
2-Methylnaphthalene	NA	NA	NA	NA	ND	ND	ND	ND	ND	3.6 J	1.6 J	0.85 J	ND
3+4-Methylphenol	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	1.3 J	ND
Acenaphthene	NA	NA	83	17	ND	ND	ND	ND	ND	33	11	0.71 J	ND
Anthracene	NA	NA	NA	NA	ND	ND	ND	ND	ND	12	5.8	0.58 J	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	ND	ND	ND	ND	ND	5.9	2.9 J	0.54 J	ND
Benzo(a)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	3.0 J	1.3 J	ND	ND
Benzo(b)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	2.9 J	1.6 J	ND	ND
Benzo(g,h,i)perylene	NA	NA	NA	NA	ND	ND	ND	ND	ND	1.2 J	0.59 J	ND	ND
Benzo(k)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	2.3 J	1.1 J	ND	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4,500	910	1.8 J	ND	6.5	0.98 J	1.0 J	17	7.9	3.8 BJ	ND
Butyl benzyl phthalate	NA	NA	140	35	0.52 J	ND	ND	ND	0.64 J	1.9 J	1.5 J	1.5 J	ND
Carbazole	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.58 J	ND	ND
Chrysene	NA	NA	NA	NA	ND	ND	ND	ND	ND	5.1	2.7 J	0.52 J	ND
Dibenzofuran	NA	NA	NA	NA	ND	ND	ND	ND	ND	16	6.3	0.53 J	ND
Diethyl phthalate	NA	NA	4,000	800	ND	ND	4.2 J	ND	1.2 J	ND	ND	0.53 J	ND
Di-n-butyl phthalate	NA	NA	110	21	ND	ND	0.60 J	ND	ND	0.74 J	0.75 J	0.65 J	ND
Di-n-octyl phthalate	NA	NA	NA	NA	ND	ND	ND	ND	ND	2.7 J	0.52 J	ND	ND
Fluoranthene	NA	NA	200	40	ND	ND	0.58 J	ND	ND	31	14	1.6 J	ND
Fluorene	NA	NA	NA	NA	ND	ND	ND	ND	ND	27	11	0.93 J	ND
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	0.92 J	ND	ND	ND
Naphthalene	NA	NA	140	43	ND	ND	ND	ND	ND	4.4 J	2.2 J	1.3 J	ND
N-Nitrosodiphenylamine	NA	NA	300	59	ND	ND	ND	ND	ND	4.3 J	ND	0.82 J	ND
Phenanthrene	NA	NA	5	1	ND	ND	ND	ND	ND	84	31	1.8 J	ND
Pyrene	NA	NA	NA	NA	ND	ND	0.64 J	ND	ND	26	12	1.6 J	ND
Benzo(a)anthracene (SIM)	NA	NA	0.5	0.1	NA	NA	ND	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Chrysene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA

Table 10
Dissolved Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-1 24 Hour 1003124-01 03/09/2010 µg/L	E-1 72 Hour 1003124-02 03/09/2010 µg/L	E-2 1003124-04 03/10/2010 µg/L	E-2 DUP 1003124-05 03/10/2010 µg/L	E-3 1004084-07 04/06/2010 µg/L	E-4 - 24 Hour 1003170-05 03/17/2010 µg/L	E-4 - 72 Hour 1003170-06 03/17/2010 µg/L	E-5 1003227-01 03/18/2010 µg/L	E-6 1003124-06 03/10/2010 µg/L
Inorganic Analytes													
Aluminum	750	87	750	NA	1,360	3,440	507	4,960	707	787	467	509	603
Antimony	NA	NA	1,100	220	ND	ND	ND	ND	59.8	ND	ND	ND	ND
Arsenic	360	190	340	150	ND	ND	28.1	41.3	ND	50.5	42.7	ND	ND
Barium	NA	NA	21,000	4,100	224	168	232	586	377	292	160	123	254
Calcium	NA	NA	NA	NA	9,330	14,400	3,710	7,370	3,500	3,540	3,240	3,190	7,780
Chromium	NA	NA	NA	NA	8.43 J	9.4 J	7.52 J	114	ND	18 J	5.2 J	5.18 J	ND
Chromium, Trivalent [c]	1,357	161.7	445	57.9	8.43 J	9.4 J	7.52 J	114	ND	18 J	5.2 J	5.18 J	ND
Copper [c]	13.35	9.14	10.5	7.2	11.2 J	10.7 J	11 J	121	ND	24.6	5.65 J	5.12 J	30.6
Iron	NA	NA	NA	NA	2520	8550	516	7890	2010	2230	1240	742	1070
Lead	48	16	55.6 [c]	2.17 [c]	ND	6.07 J	11.1 J	171	ND	34.9	ND	ND	ND
Magnesium	NA	NA	NA	NA	5190	7520	1700	3110	1910	1460	1500	1490	4620
Manganese	NA	NA	NA	NA	132	241	19.4 J	121	128	81.8	73.6	120	141
Nickel [c]	1099	122.2	364	40.4	6.21 J	6 J	6.17 J	19.9 J	ND	ND	ND	ND	ND
Potassium	NA	NA	NA	NA	4480	4570	5840	6940	2880	3750	3980	3540	3660
Sodium	NA	NA	NA	NA	11600	12800	10500	11800	7850	7360	7020	7760	9240
Tin	NA	NA	NA	NA	ND	ND	ND	504	10.7 J	9.5 J	5.08 J	ND	9.23 J
Vanadium	NA	NA	510	100	ND	8.84 J	28.7	90.6	ND	16.3 J	12.2 J	6.87 J	ND
Zinc [c]	90.7	82.1	93	93	69.2	55.9	133	546	89.1	221	106	94.4	168
Miscellaneous													
pH	NA	NA	NA	NA	7.72 H	7.39 H	7.74 H	7.65 H	7.67 H	7.87 H	7.66 H	7.09 H	7.74 H
Cyanide (mg/L)	22	5.2	22	5.2	ND	ND	ND	ND	ND	0.0167	ND	ND	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	34.0 H	3.00 H	18.0 H	20.0 H	17.0	18.0 H	11.0 H	12.0	20.0 H
Total Organic Carbon (mg/L)	NA	NA	NA	NA	7.9	3.9	14.5	13.1	6.5	10.2	13.5	11.5	7

Table 10
Dissolved Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-7 1003170-04 03/17/2010 µg/L	E-8 1003124-08 03/11/2010 µg/L	E-9 1003124-09 03/10/2010 µg/L	E-10 1003170-01 03/15/2010 µg/L	E-11 1003124-03 03/09/2010 µg/L	E-12 1003170-02 03/15/2010 µg/L	E-13 1003124-07 03/11/2010 µg/L	E-14 1004084-08 04/06/2010 µg/L	E-15 1003170-03 03/16/2010 µg/L
Polychlorinated Biphenyls													
Aroclor 1260	1	0.014	NA	0.014	ND	0.091	ND	ND	ND	ND	ND	ND	ND
Pestcides													
4,4´-DDE	0.55	0.001	1.1	0.001	ND	ND	ND	ND	ND	ND	0.14 E	ND	0.011 J
delta-BHC	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	0.16
Endosulfan sulfate	NA	NA	NA	NA	0.015 J	ND	0.0081 J	ND	ND	ND	0.0032 J	ND	ND
Endrin	0.09	0.0023	0.086	0.036	ND	0.022	ND	ND	ND	ND	0.011 J	ND	0.0043 J
Heptachlor epoxide	NA	NA	0.5	0.0038	ND	ND	ND	ND	ND	ND	ND	0.0067 J	ND
Hexachlorobenzene	NA	NA	NA	NA	0.035	ND	0.0088 J	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds													
2-Methylnaphthalene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	2.1 J	ND	ND
3+4-Methylphenol	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	NA	NA	83	17	ND	ND	ND	ND	ND	ND	2.2 J	ND	ND
Anthracene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.1 J	ND	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	ND	ND	ND	ND	ND	ND	0.80 J	ND	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	0.98 J	1.3 J	ND	3.5 J	3.0 J	4.1 J	1.3 J	1.4 J	1.5 J
Butyl benzyl phthalate	NA	NA	140	35	1.9 J	ND	ND	ND	ND	ND	ND	ND	1.4 J
Carbazole	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.82 J	ND	ND
Chrysene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.69 J	ND	ND
Dibenzofuran	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.1 J	ND	ND
Diethyl phthalate	NA	NA	4000	800	ND	ND	ND	ND	5.2	ND	ND	0.83 J	ND
Di-n-butyl phthalate	NA	NA	110	21	ND	ND	ND	ND	1.4 J	ND	ND	ND	ND
Fluoranthene	NA	NA	200	40	ND	ND	ND	ND	ND	ND	2.7 J	ND	ND
Fluorene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.8 J	ND	ND
Naphthalene	NA	NA	140	43	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	NA	NA	5	1	ND	ND	ND	ND	ND	ND	5.3	ND	ND
Pyrene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	2.4 J	ND	ND
Inorganic Analytes													
Aluminum	750	87	750	NA	473	14,700	1,660	776	13,200	348	3,400	520	467
Antimony	NA	NA	1,100	220	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	360	190	340	150	ND	54.6	ND	ND	17.3 J	ND	30.5	ND	ND
Barium	NA	NA	21,000	4,100	223	1,230	342	276	1,910	256	404	286	226
Calcium	NA	NA	NA	NA	4,190	12,000	6,200	2,310	27,800	3,890	12,500	3,680	6,440
Chromium	NA	NA	NA	NA	ND	325	ND	ND	14.9 J	ND	69.1	ND	ND
Chromium, Trivalent [c]	1,357	161.7	445	57.9	ND	325	ND	ND	14.9 J	ND	69.1	ND	ND
Copper [c]	13.35	9.14	10.5	7.2	ND	391	ND	ND	16.6 J	ND	72.8	ND	ND
Iron	NA	NA	NA	NA	503	23,700	4,070	2,040	49,200	416	4,840	1,730	629
Lead	48	16	55.6 [c]	2.17 [c]	ND	444	ND	ND	37.7	ND	100	ND	ND
Magnesium	NA	NA	NA	NA	2,620	5,750	3,500	1,280	12,300	2,160	6,330	2,240	2,640
Manganese	NA	NA	NA	NA	86	376	186	127	1,850	104	101	112	305
Nickel [c]	1099	122.2	364	40.4	ND	41.1	ND	ND	16.4 J	ND	17.1 J	ND	ND
Potassium	NA	NA	NA	NA	3,280	8,820	4,310	2,810	6,950	2,700	8,910	2,900	4,220
Sodium	NA	NA	NA	NA	6,750	15,800	9,340	7,420	11,800	7,420	13,200	6,780	7,750
Tin	NA	NA	NA	NA	ND	148	73.4	5.65 J	ND	ND	28.9	7.03 J	ND
Vanadium	NA	NA	510	100	ND	105	ND	ND	30.4	ND	42.1	ND	ND
Zinc [c]	90.7	82.1	93	93	103	1,560	125	126	829	92.9	430	107	74.9
Miscellaneous													
pH	NA	NA	NA	NA	8.08 H	7.65 H	7.63 H	7.51 H	7.64 H	7.66 H	7.84 H	7.86 H	7.95 H
Cyanide (mg/L)	22	5.2	22	5.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	9.00 H	21.0 H	11.0 H	17.0 H	21.0 H	9.00 H	18.0 H	39.0	7.00 H
Total Organic Carbon (mg/L)	NA	NA	NA	NA	10.2	24.3	37.6	7.8	7	5.6	11.1	8.9	5.5

Table 10
Dissolved Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	E-16 (24 Hour) 1004084-11 04/07/2010 µg/L	E-16 (72 Hour) 1004084-12 04/07/2010 µg/L	E-17 1003227-02 03/24/2010 µg/L	E-18 1004084-13 04/07/2010 µg/L	E-19 1004084-14 04/07/2010 µg/L	Core 42 1004084-01 04/06/2010 µg/L	Core 43 1004084-02 04/06/2010 µg/L	Core 44 1004084-03 04/06/2010 µg/L	Core 45 1004084-04 04/07/2010 µg/L
Polychlorinated Biphenyls													
Aroclor 1260	1	0.014	NA	0.014	ND	ND	1.7	ND	ND	ND	ND	ND U	ND
Pestcides													
4,4´-DDE	0.55	0.001	1.1	0.001	ND	0.0089 J	1.5	0.36	0.062	0.35	0.20	ND U	ND
Endosulfan sulfate	NA	NA	NA	NA	ND	ND	0.080	ND	ND	ND	ND	ND U	ND
Endrin	0.09	0.0023	0.086	0.036	ND	ND	0.31 C	ND	ND	ND	ND	ND U	ND
Heptachlor epoxide	NA	NA	0.5	0.0038	ND	ND	ND	ND	ND	ND	ND	0.014 J	0.0096 J
Semivolatile Organic Compounds													
2-Methylnaphthalene	NA	NA	NA	NA	0.67 J	ND	ND	ND	0.61 J	ND	5.4	ND U	ND
3+4-Methylphenol	NA	NA	NA	NA	0.96 J	ND	ND	ND	0.89 J	ND	ND	ND U	ND
Acenaphthene	NA	NA	83	17	0.80 J	ND	ND	7.1	0.61 J	2.3 J	9.4	ND U	ND
Anthracene	NA	NA	NA	NA	0.62 J	ND	ND	3.3 J	0.51 J	1.5 J	2.6 J	ND U	ND
Benzo(a)anthracene	NA	NA	0.5	0.1	0.82 J	ND	ND	2.1 J	0.67 J	1.1 J	1.7 J	ND U	ND
Benzo(a)pyrene	NA	NA	NA	NA	ND	ND	ND	0.96 J	ND	ND	ND	ND U	ND
Benzo(b)fluoranthene	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	0.97 J	ND U	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	1.5 J	1.2 J	2.1 BJ	6.2	1.2 J	9.1	6.8	1.2 J	1.0 J
Butyl benzyl phthalate	NA	NA	140	35	1.1 J	1.0 J	1.3 J	1.5 J	1.3 J	ND	ND	0.66 J	ND
Carbazole	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	1.0 J	ND U	ND
Chrysene	NA	NA	NA	NA	1.0 J	0.57 J	ND	2.3 J	0.60 J	1.6 J	1.8 J	ND U	ND
Dibenzofuran	NA	NA	NA	NA	ND	ND	ND	2.6 J	ND	ND	3.7 J	ND U	ND
Diethyl phthalate	NA	NA	4000	800	ND	ND	ND	0.78 J	ND	ND	ND	ND U	ND
Fluoranthene	NA	NA	200	40	ND	1.7 J	ND	7.4	1.9 J	3.5 J	7.1	ND U	ND
Fluorene	NA	NA	NA	NA	0.84 J	0.58 J	ND	5.6	0.54 J	ND	7.5	ND U	ND
Naphthalene	NA	NA	140	43	1.0 J	0.70 J	ND	ND	0.64 J	ND	ND	ND U	ND
Phenanthrene	NA	NA	5	1	1.9 J	1.5 J	ND	14	1.9 J	3.9 J	16	ND U	ND
Pyrene	NA	NA	NA	NA	2.8 J	2.0 J	ND	7.1	1.9 J	3.5 J	6.4	ND U	ND
Benzo(a)anthracene (SIM)	NA	NA	0.5	0.1	NA	0.65	ND	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Chrysene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene (SIM)	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Inorganic Analytes													
Aluminum	750	87	750	NA	1,180	340	721	823	335	1,420	660	586	373
Antimony	NA	NA	1,100	220	53.4	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	360	190	340	150	43.3	27.6	14.6 J	30.7	32.5	29.9	44.7	ND	ND
Barium	NA	NA	21,000	4,100	392	204	213	313	242	415	335	365	299
Calcium	NA	NA	NA	NA	2,600	1,860	5,570	4,510	2,270	4,190	5,310	3,430	3,000
Chromium	NA	NA	NA	NA	12.4 J	ND	ND	6.83 J	ND	17.5 J	6.46 J	ND	ND
Chromium, Trivalent [c]	1,357	161.7	445	57.9	12.4 J	ND	ND	6.83 J	ND	17.5 J	6.46 J	ND	ND
Copper [c]	13.35	9.14	10.5	7.2	21.1	9.14 J	ND	6.06 J	10.3 J	12.9 J	7.56 J	ND	ND
Iron	NA	NA	NA	NA	3,000	726	887	607	693	1,160	567	1,430	587
Lead	48	16	55.6 [c]	2.17 [c]	29.2	5.14 J	ND	6.21 J	9.81 J	16.9	5.98 J	ND	ND
Magnesium	NA	NA	NA	NA	1,250	903	2,530	2,590	1,050	2,180	3,670	1,890	1,590
Manganese	NA	NA	NA	NA	103	71.4	141	25.3	67	25.6	20.6	86.3	69.7
Nickel [c]	1099	122.2	364	40.4	ND	ND	ND	6.4 J	ND	12.8 J	7.9 J	ND	ND
Potassium	NA	NA	NA	NA	3,250	2,950	3,100	6,090	2,830	6,070	8,310	3,110	2,710
Sodium	NA	NA	NA	NA	7,290	6,970	7,430	9,430	7,570	9,570	12,900	6,830	7,230
Tin	NA	NA	NA	NA	16.6 J	8.4 J	ND	7.65 J	7.18 J	8.95 J	ND	ND	ND
Vanadium	NA	NA	510	100	6 J	ND	ND	21.4	ND	44.6	34.9	ND	ND
Zinc [c]	90.7	82.1	93	93	193	139	112	135	127	192	132	90.8	142
Miscellaneous													
pH	NA	NA	NA	NA	7.64 H	7.68 H	7.27 H	7.72 H	7.39 H	7.60 H	7.84 H	7.83 H	8.11 H
Cyanide (mg/L)	22	5.2	22	5.2	0.00742 J	0.00869 J	ND	ND	0.0139	0.00610 J	0.00716 J	0.00577 J	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	14.0	14.0	12.0	12.0	20.0	13.0	10.0	35.0	10.0
Total Organic Carbon (mg/L)	NA	NA	NA	NA	6.7	6.5	6.2	15	5.1	18	17	7.9	8.3

Table 10
Dissolved Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Parameters	DRBC [a] Freshwater Acute SQOs µg/L	DRBC [a] Freshwater Chronic SQOs µg/L	PADEP [b] Acute WQC µg/L	PADEP [b] Chronic WQC µg/L	Core 46 1004024-01 03/31/2010 µg/L	Core 47 1004024-02 03/31/2010 µg/L	Core 47 DUP 1004024-03 03/31/2010 µg/L	Core 48 1004024-04 03/31/2010 µg/L	Core 49 1004024-05 04/01/2010 µg/L	Core 50 1004024-06 04/01/2010 µg/L
Polychlorinated Biphenyls										
No PCB's detected at or above the method detection limit in these samples.										
Pestcides										
4,4´-DDD	0.55	0.001	1.1	0.001	ND	0.0069 J	0.021	ND	ND	ND
4,4´-DDT	0.55	0.001	1.1	0.001	ND	ND	0.016 J	ND	ND	ND
Dieldrin	1.25	0.0019	0.24	0.056	ND	ND	ND	0.039	ND	ND
Heptachlor epoxide	NA	NA	0.5	0.0038	0.0087 J	0.013 J	ND	ND	ND	ND
Semivolatile Organic Compounds										
Acenaphthene	NA	NA	83	17	5.1	1.1 J	0.70 J	ND	ND	ND
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	1.1 J	2.1 J	1.4 J	1.3 J	2.0 J	1.1 J
Butyl benzyl phthalate	NA	NA	140	35	ND	ND	ND	ND	ND	ND
Chrysene	NA	NA	NA	NA	ND	ND	0.79 J	ND	0.60 J	ND
Fluoranthene	NA	NA	200	40	0.88 J	0.77 J	1.2 J	ND	0.90 J	0.68 J
Fluorene	NA	NA	NA	NA	ND	0.59 J	0.56 J	ND	ND	ND
Phenanthrene	NA	NA	5	1	ND	0.63 J	0.99 J	ND	0.53 J	ND
Pyrene	NA	NA	NA	NA	1.0 J	0.88 J	1.4 J	ND	1.0 J	0.78 J
Inorganic Analytes										
Aluminum	750	87	750	NA	1,270	665	530	487	792	848
Barium	NA	NA	21,000	4,100	213	186	167	185	161	208
Calcium	NA	NA	NA	NA	20800	10200	10200	8030	25100	21500
Chromium	NA	NA	NA	NA	10.2 J	5.37 J	ND	6.91 J	10 J	6.96 J
Chromium, Trivalent [c]	1,357	161.7	445	57.9	10.2 J	5.37 J	ND	6.91 J	10 J	6.96 J
Copper [c]	13.35	9.14	10.5	7.2	58.7	11.8 J	7.58 J	29.3	59.3	40.3
Iron	NA	NA	NA	NA	2580	633	411	1290	1520	1910
Lead	48	16	55.6 [c]	2.17 [c]	77.4	9.12 J	ND	23.8	55.2	34.7
Magnesium	NA	NA	NA	NA	5650	3130	2950	2500	5230	3720
Manganese	NA	NA	NA	NA	1210	365	398	243	140	109
Nickel [c]	1099	122.2	364	40.4	35.8	9.51 J	11.5 J	25.8	ND	ND
Potassium	NA	NA	NA	NA	3960	5070	4690	3970	3500	3440
Sodium	NA	NA	NA	NA	8150	7360	7560	7590	7130	8200
Tin	NA	NA	NA	NA	6.72 J	ND	ND	ND	8.59 J	ND
Vanadium	NA	NA	510	100	6.73 J	7.75 J	5.59 J	5.24 J	7.16 J	5.9 J
Zinc [c]	90.7	82.1	93	93	257	138	139	646	189	163
Miscellaneous										
pH	NA	NA	NA	NA	7.84 H	7.45 H	7.43 H	7.16 H	8.34 H	8.21 H
Cyanide, (mg/L)	22	5.2	22	5.2	ND	ND	ND	ND	ND	ND
Suspended Solids (mg/L)	NA	NA	NA	NA	46.0	3.00	3.00	5.00	52.0	24.0
Total Organic Carbon (mg/L)	NA	NA	NA	NA	8.1	5	4.5	3.7	4.7	3.7

Table 10
Dissolved Elutriate
Southport Container Terminal
Philadelphia, Pennsylvania

Notes:
a= Delaware River Basin Commission (DRBC) Stream Quality Objectives (SQO) for Toxic Pollutants for the Protection of Aquatic Life (Table 5 in DRBC, 2008)
b= PA Water Quality Criteria for Toxic Substances (PA Code, Title 25, Chapter 16)
c = Value is hardness dependent. The DRBC average hardness for the Delaware River (74 mg/L) was used to calculate the criteria.

C= Calibration exceeded
H= Holding time exceeded
J= Analyte detected below quantitation limit

mg/L = milligrams per liter
NA= Not applicable
ND= Analyte not detected
PADEP= Pennsylvania Department of Environmental Protection
µg/L = micrograms per liter
SIM = laboratory SIM method that achieves lower detection limits

= Detected concentration exceeds the DRBC freshwater acute SQOs
= Detected concentration exceeds the DRBC freshwater chronic SQOs
Red Text = Detected concentration exceeds the PADEP acute WQC
Purple Text = Detected concentration exceeds the PADEP chronic WQC

Table 11a
Summary of Detected Concentrations in Site Water Blank.
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	DRBC [a] Freshwater Acute SQOs (µg/L)	DRBC [a] Freshwater Chronic SQOs (µg/L)	PADEP [c] Acute WQC µg/L	PADEP [c] Chronic WQC µg/L	Site Water 1004085-01 4/7/2010 (µg/L)	
Volatile Organic Compounds						
Methylene chloride	NA	NA	28000	5500	8.1	B
Semivolatile Organic Compounds						
	---	---	---	---	No SVOCs detected.	
Pesticides						
TCL Pesticides	---	---	---	---	No Pesticides detected.	
Polychlorinated Biphenyls						
PCB Aroclors	---	---	---	---	No PCBs detected.	
Inorganic Analytes						
Aluminum	750	87	750	NA	46.2	
Antimony	NA	NA	1,100	220	14.7	J
Barium	NA	NA	21,000	4,100	64.9	
Calcium	NA	NA	NA	NA	12,700	
Iron	NA	NA	NA	NA	148	
Magnesium	NA	NA	NA	NA	4,310	
Manganese	NA	NA	NA	NA	45	
Potassium	NA	NA	NA	NA	1,350	
Sodium	NA	NA	NA	NA	8,650	
Zinc	90.7 [b]	82.1 [b]	93	93	26.2	
Miscellaneous						
Cyanide, total (mg/L)	22	5.2	22	5.2	ND	
pH	NA	NA	NA	NA	7.31	
Total Suspended Solids (mg/L)	NA	NA	NA	NA	5.0	

Notes:

[a] = DRBC (Delaware River Basin Commission). 2008. *Administrative Manual - Part III.* Water Quality Regulations. West Trenton, NJ. September 12, 2008.

[b] = Value is hardness dependent. The DRBC average hardness for the Delaware River (74 mg/L) was used to calculate the criteria.

[c] = PA Water Quality Criteria for Toxic Substances (PA Code, Title 25, Chapter 16)

DRBC = Delaware River Basin Commission
PADEP = Pennsylvania Department of Environmental Protection
SQO = Stream Quality Objectives
B = Analyte detected in associated method blank
J = Analyte detected below quantitation limits.

mg/L = milligrams per liter
µg/L = micrograms per liter
NA = Not available.
ND = Not detected
WQC = Water Quality Criteria

= Detected concentration exceeds the DRBC freshwater acute SQO, and chronic WQC if available.
= Detected concentration exceeds the DRBC freshwater chronic SQO.
Red Text = Detected concentration exceeds the PADEP acute WQC
Purple Text = Detected concentration exceeds the PADEP chronic WQC

Table 11b
Summary of Detected Concentrations in Rinsate Samples
Southport Container Terminal
Philadelphia, Pennsylvania

Parameter	DRBC [a] Freshwater Acute SQOs (µg/L)	DRBC [a] Freshwater Chronic SQOs (µg/L)	PADEP [c] Acute WQC (µg/L)	PADEP [c] Chronic WQC (µg/L)	Rinsate 1 1003171-01 03/15/2010 (µg/L)	Rinsate 2 1003171-02 03/18/2010 (µg/L)	Rinsate 3 1004025-01 04/01/2010 (µg/L)
Volatile Organic Compounds							
Chloroform	NA	NA	1900	390	1.9	0.36 J	ND
Methylene chloride	NA	NA	28000	5500	ND	9.4 B	ND
Semivolatile Organic Compounds							
Bis(2-ethylhexyl)phthalate	NA	NA	4500	910	2.6 J	1 J	3.2 J
Butyl benzyl phthalate	NA	NA	140	35	0.79 J	ND	0.86 BJ
Diethyl phthalate	NA	NA	4000	800	ND	ND	0.56 J
Di-n-butyl phthalate	NA	NA	110	21	0.97 J	0.98 J	1.9 J
Benzo(a)anthracene (SIM)	NA	NA	0.5	0.1	ND	ND	ND
Pesticides							
	---	---	---	---	No Pesticides detected		
Polychlorinated Biphenyls							
	---	---	---	---	No PCBs detected		
Inorganic Analytes							
Aluminum	750	87	750	NA	28.7	8.25 J	9.71 J
Antimony	NA	NA	1,100	220	ND	ND	27.4
Barium	NA	NA	21,000	4,100	8.32 J	7.46 J	10.4 J
Calcium	NA	NA	NA	NA	574	610	589
Copper	13.35 [b]	9.14 [b]	10.5	7.2	7.09 J	ND	5.07 J
Iron	NA	NA	NA	NA	113	26.3	63.3
Magnesium	NA	NA	NA	NA	104	104	114
Potassium	NA	NA	NA	NA	104	106	206
Sodium	NA	NA	NA	NA	1420	1400	2190
Zinc	90.7 [b]	82.1 [b]	93	93	20.7	45	47.5
Miscellaneous							
pH	NA	NA	NA	NA	7.88 H	6.72 H	8.35 H
Total Suspended Solids (mg/L)	NA	NA	NA	NA	2,000	ND	54,000

Notes:

[a] = DRBC (Delaware River Basin Commission). 2008. *Administrative Manual - Part III. Water Quality* Regulations. West Trenton, NJ. September 12, 2008.

[b] = Value is hardness dependent. The DRBC average hardness for the Delaware River (74 mg/L) was used to calculate criteria

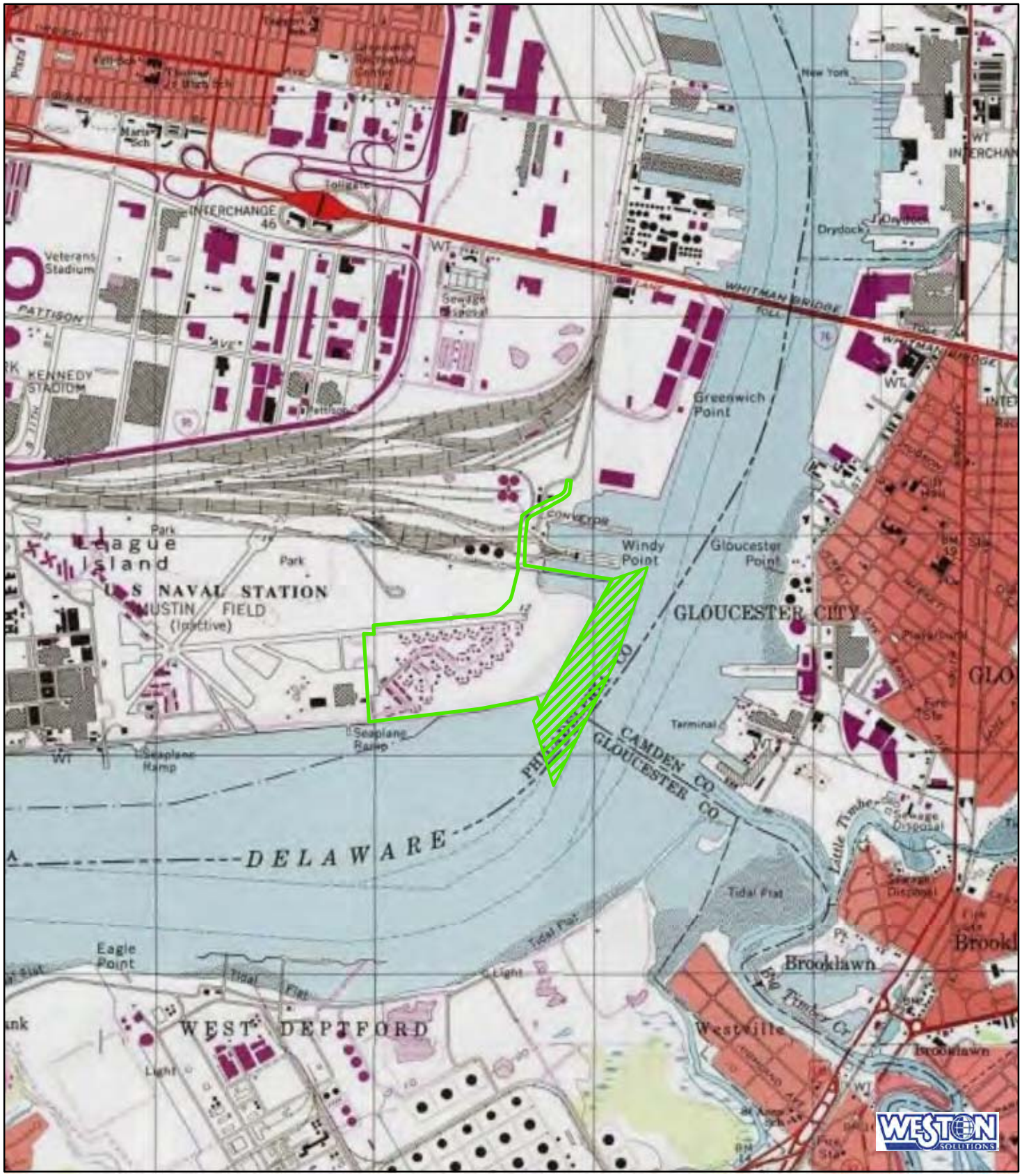
[c] = PA Water Quality Criteria for Toxic Substances (PA Code, Title 25, Chapter 16)

DRBC = Delaware River Basin Commission
PADEP = Pennsylvania Department of Environmental Protection
SIM = laboratory SIM method that achieves lower detection limits
SQO = Stream Quality Objectives
WQC = Water Quality Criteria
B :e detected in associated method blank
J = Analyte detected below quantitation limits.
H = Holding times for preparation or analysis exceeded.

mg/L = milligrams per liter
µg/L = micrograms per liter
NA = Not available.
ND = Not detected

= Detected concentration exceeds the DRBC freshwater acute SQO, and chronic WQC if available.
= Detected concentration exceeds the DRBC freshwater chronic SQO.
Red Text = Detected concentration exceeds the PADEP acute WQC
Purple Text = Detected concentration exceeds the PADEP chronic WQC

FIGURES



Legend

Southport Project Site Boundary

Proposed Dredging Template

N
W E
S

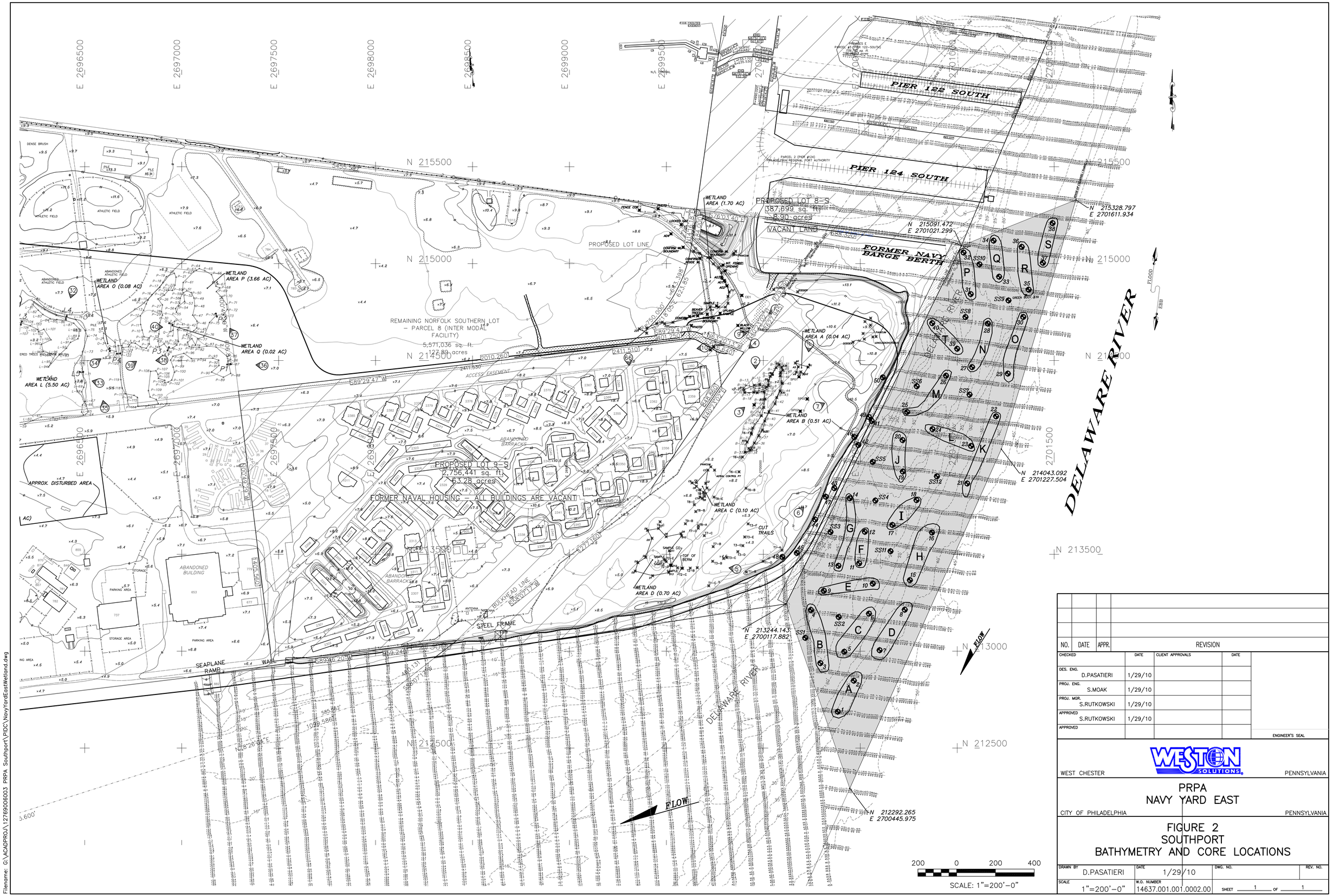
0 1,000 2,000
Feet

SOURCE: USGS 7.5 Minute Series
(Topographic) Quadrangle:
Philadelphia PA, 1986, Camden NJ, 1985

Figure 1
Overview of the Proposed
Southport Development Project

Southport Development Project
Philadelphia, PA

File: \\fsfed01\tig\naval_yard\mxd\southport\USGS_quad_siteloc.mxd, 08-Jun-10 10:34, ricksc



NO.	DATE	APPR.	REVISION

CHECKED		DATE	CLIENT APPROVALS	DATE
DES. ENG.	D.PASATIERI	1/29/10		
PROJ. ENG.	S.MOAK	1/29/10		
PROJ. MGR.	S.RUTKOWSKI	1/29/10		
APPROVED	S.RUTKOWSKI	1/29/10		
APPROVED				

ENGINEER'S SEAL

WESTON SOLUTIONS

WEST CHESTER PENNSYLVANIA

PRPA
NAVY YARD EAST

CITY OF PHILADELPHIA PENNSYLVANIA

FIGURE 2
SOUTHPORT
BATHYMETRY AND CORE LOCATIONS

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	1/29/10		
SCALE 1"=200'-0"	W.O. NUMBER 14637.001.001.0002.00	SHEET 1 OF 1	

Filename: G:\ACADPROJ\12769006003 PRPA Southport\PIDC\NavyYardEastWetland.dwg

Figure 3 - Southport Elutriate Preparation (representative photos)

Elutriate Preparation Photograph #1 (after 24 hours of settling) – Sample E-4 24 and 72 are last two columns on the right

Figure 3 - Southport Elutriate Preparation (representative photos)

Elutriate Preparation Photograph #2 (after 72 hours of settling) – Sample E-4

APPENDIX A

Email Correspondence

From: Moak, Shana
Sent: Wednesday, February 24, 2010 11:42 AM
To: Newbold, James
Cc: Rutkowski, Sonny; Ligons, Calvin; Wentzel, James; Burke, David; Yagecic John. (John.Yagecic@drbc.state.nj.us); Moak, Shana; Lisa Magee; McNamara, Kate
Subject: RE: Southport DRAFT Sampling and Analysis Plan

Good morning Jim,

Thank you for the quick review of the Draft Southport Sampling and Analysis Plan. I've responded to all comments below in italics. If these responses are acceptable, I will incorporate into a final version of the SAP and submit to your office for your files. Please let me know if this approach is acceptable to you.

1. Elutriate samples - For the purposes of characterizing the expected effluent discharge from the CDF it is not necessary to analyze sample results for all composite samples A through T and split spoon sampling 1-12. Adequate characterization can be accomplished with several representative locations and the use of further compositing.

WESTON proposes the following elutriate compositing scenario. We believe that this scenario is representative of the sediments to be dredged.

E-1 will be a composite of SS-4 and SS-11A and 11B
E-2 will be a composite of SS-6A and 6B and SS-7A and 7B
E-3 will be a composite of Composite A and B
E-4 will be a composite of Composite K and L
E-5 will be a composite of Composite Q and R

2. At least one representative elutriate sample must be analyzed for PCB congeners. DRBC experience has shown that there is not good correlation between PCB Arachlor and congener results in a water matrix.

WESTON proposes to collect a PCB Congener sample from elutriate sample E-4.

3. The Inland Testing Manual 24 hour maximum should be used for quiescent settling time for the elutriate test. The proposed 72 hour time is not justified unless it can be tied to the actual expected detention time in the CDF.

WESTON will instruct the laboratory to allow the elutriate samples to settle for 24 hours only. However, due to the fact that the retention time of the USACE CDF's varies, WESTON may collect some additional elutriate samples and allow those samples to settle for 72 hours in order to adequately represent the concentrations of analytes that could be present at this retention time. This will provide elutriate data better simulating a 72 hour holding time in the event the disposal allows a 72 hour holding period. If WESTON collects these additional samples, the results will be detailed in our Sediment Characterization Report.

4. It is recommended that sediment samples from -42 to -47 feet MLLW be archived for future elutriate analysis.

WESTON will archive one 1-gallon jar for potential elutriate analyses for sediment samples collected from -42' to -47'.

Once again, thank you for your quick review of this plan. If these changes are acceptable to the group, I will incorporate and submit final versions of the SAP as soon as possible.

Please do not hesitate to contact me with any questions or comments.

Regards,

APPENDIX B

Core Logs

Appendix B
Delaware River Sediment Sampling

Group Name	Sample Name	Core Type	Latitude, Longitude	Anticipated Water Depth from Bathymetry (MLLW)	Target Sample Bottom (MLLW)	Target Core Length (feet)	Observed Water Depth (MLLW)	Actual Sample Bottom (MLLW)	Actual Core Length (feet)	Description (Grain type, Color, Inclusions, PID reading)	PID	Sample Time	Sample Date
SS-1	SS-1A	Vibracore	39.88856, 75.14212	20'	32'	12'	19.3'	31.3'	12'	silt and clay	0.0	1200	3/10/2010
	SS-1B	Split Spoon		20'	37'	5'	20'	37'	5'	med/fine sandy silt, some clay	0.0	1230	3/10/2010
	SS-1C	Split Spoon		20'	42'	5'	20'	42'	5'	med/fine sand and silt	0.0	1300	3/10/2010
SS-2	SS-2A	Vibracore	39.88884, 75.14149	20'	32'	12'	16.3'	28.3	12'	coarse/fine gravel at surface, silt and clay, trace med/fine sand	0.0	1002	3/10/2010
	SS-2B	Split Spoon		20'	42'	10'	20'	42'	13.7'	silt and med/fine sand trace clay	0.0	0930	3/10/2010
	SS-2C	Split Spoon		20'	47'	5'	20'	47'	5'	med/fine sand some silt	0.0	1100	3/10/2010
SS-3	SS-3A	Vibracore	39.89005, 75.14160	20'	32'	12'	25.2'	32'	6.8'	silt some med/fine sand	0.0	1330	3/10/2010
	SS-3B	Split Spoon		20'	37'	5'	21.5'	33.3'	5'	gray silt with fine sand		1545	3/17/2010
	SS-3C	Split Spoon		20'	42'	5'	21.5'	38.3'	5'	gray silt with fine sand		1615	3/17/2010
	SS-3D	Split Spoon		20'	47'	5'	21.5'	43.3'	5'	gray silt with fine sand		1645	3/17/2010
SS-4	SS-4A	Vibracore	39.89048, 75.14075	18'	30'	12'	18.3'	30'	11.7'	Not recorded		1600	3/9/2010
	SS-4B	Split Spoon		18'	36'	6'	21.5'	39.2'	6'	gray med/fine sandy silt trace clay to med/fine sand	0.0	1030	3/9/2010
	SS-4C	Split Spoon		18'	42'	6'	21.5'	45.2'	6'	gray silty med/fine sand, some clay lenses		1220	3/9/2010
SS-5	SS-5A	Vibracore	39.89102, 75.14078	22'	34'	12'	34.4'	42.4'	8'	gray med/fine sandy silt, gray silt with some sand, wood debris	2.3	1015	3/11/2010
	SS-5B	Split Spoon		22'	42'	8'	25'	41'	8'	gray med/fine sandy silt, some wood debris	1.9	1045	3/11/2010
SS-6	SS-6A	Vibracore	39.89208, 75.13993	25'	37'	12'	25.5'	37'	11.5'	gray fine/med sandy silt, trace clay	0.0	1300	3/11/2010
	SS-6B	Split Spoon		25'	42'	5'	25'	42'	5'	gray fine/med sandy silt, trace clay	0.0	1230	3/11/2010
	SS-6C	Split Spoon		25'	47'	5'	25'	47'	5'	gray, silty medium sand	0.0	1230	3/11/2010
SS-7	SS-7A	Vibracore	39.89194, 75.13897	20'	32'	12'	21.3'	32'	10.7'	gray silt and clay, some fine sand		1700	3/10/2010
	SS-7B	Split Spoon		20'	42'	10'	24.5'	45.2'	10'	silty sand medium/fine (37')		1720	3/10/2010
	SS-7C	Split Spoon		20'	47'	5'	24.5'	50.2'	5'	fine/med sand some silt (45')		1800	3/10/2010
SS-8	SS-8A	Vibracore	39.89304, 75.13900	14'	26'	12'	18.5'	21'	2.5'	gray fine sand with some silt, trace round gravel		1045	3/16/2010
	SS-8B	Split Spoon		14'	34'	8'	19'	34.5'	13'	gray medium sand with some silt, trace round gravel		1500	3/11/2010
	SS-8C	Split Spoon		14'	42'	8'	19'	42.5'	8'	gray silt with fine sand and trace gravel, trace clay		1500	3/11/2010
SS-9	SS-9A	Vibracore	39.89325, 75.13820	25'	37'	12'	30.5'	35.5'	5'	gray silt, some sand		1145	3/16/2010
	SS-9B	Split Spoon		25'	42'	5'	26'	37.5'	6.5'	medium sand with silt, gray and black, odor	2.3	1200	3/15/2010
	SS-9C	Split Spoon		25'	47'	5'	26'	42.5'	5'	gray medium sand, trace round gravel, trace clay	0.0	1230	3/15/2010
SS-10	SS-10A	Vibracore	39.89378, 75.13871	23'	35'	12'	28'	33.5'	5.5'	gray silt, some fine sand, trace gravel	0.0	1330	3/16/2010
	SS-10B	Split Spoon		23'	42'	7'	25'	34.5'	7'	gray medium sand trace round gravel		1445	3/15/2010
SS-11	SS-11A	Vibracore	39.88975, 75.14050	20'	32'	12'	17.5'	29.5'	12'	gray silt and clay, slight odor	0.0	1530	3/9/2010
	SS-11B	Split Spoon		20'	42'	10'	22.5'	47'	12.5'	gray silt and sand, trace fine gravel	0.0	1320	3/9/2010
	SS-11C	Split Spoon		20'	47'	5'	22.5'	52'	5'	gray silt and sand, trace fine gravel	0.0	1410	3/9/2010
SS-12	SS-12A	Vibracore	39.89079, 75.13961	20'	32'	12'	18.3'	21.3'	2 x 3'	gray fine sand and silt		1430	3/16/2010
	SS-12B	Split Spoon		20'	42'	10'	20'	40.7'	17.7'	gray medium sand with silt and trace gravel	0.0	1005	3/15/2010
	SS-12C	Split Spoon		20'	47'	5'	20'	45.7'	5'	gray medium sand, trace silt	0.0	1035	3/15/2010

Appendix B
Delaware River Sediment Sampling

Group Name	Sample Name	Core Type	Latitude, Longitude	Anticipated Water Depth from Bathymetry (MLLW)	Target Sample Bottom (MLLW)	Target Core Length (feet)	Observed Water Depth (MLLW)	Actual Sample Bottom (MLLW)	Actual Core Length (feet)	Description (Grain type, Color, Inclusions, PID reading)	PID	Sample Time	Sample Date
Comp-A	Core-1	Vibracore	39.88750, 75.14156	36'	42'	6'	38'	42'	4'	gray fine, sandy silt, some clay		0800	4/6/2010
	Core-2	Vibracore	39.88793, 75.14125	37'	42'	5'	35'	42'	7'	gray silt, some fine to medium sand		0900	4/6/2010
Comp-B	Core-3	Vibracore	39.88820, 75.14185	20'	32'	12'	22'	32'	10'	gray silt, some fine to medium sand		1110	4/6/2010
	Core-4	Vibracore	39.88895, 75.14200	19'	31'	12'	25'	31'	6'	gray silt, some clay, sand in core catcher fingers		1204	4/6/2010
Comp-C	Core-5	Vibracore	39.88835, 75.14141	25'	37'	12'	20.1'	30.1	10'	gray, silty, note: found one large rock	0.0	1600	3/10/2010
	Core-6	Vibracore	39.88888, 75.14093	25'	37'	12'	22'	30'	8'	gray silt with sand	0.0	1430	3/11/2010
Comp-D	Core-7	Vibracore	39.88836, 75.14076	37'	42'	5'	36'	42'	6'	gray silt with sand, some gravel	0.0	1115	3/11/2010
	Core-8	Vibracore	39.88892, 75.14027	38'	42'	4'	39.5'	42'	2.5'	gray, silty, some organics, note: found shell	0.0	0900	3/11/2010
Comp-E	Core-9	Vibracore	39.88922, 75.14175	20'	32'	12'	22.8'	32'	9.2'	gray silt, some clay	0.0	1310	4/6/2010
	Core-10	Vibracore	39.88930, 75.14085	21'	33'	12'	21.4'	33'	11.6'	gray silt, some clay		1450	4/6/2010
Comp-F	Core-11	Vibracore	39.88959, 75.14109	18'	30'	12'	20'	30'	10'	gray, silty	0.0	1330	4/5/2010
	Core-12	Vibracore	39.89004, 75.14096	17'	29'	12'	21'	29'	8'	gray silt	0.0	1600	4/5/2010
Comp-G	Core-13	Vibracore	39.88957, 75.14147	20'	32'	12'	23.7'	32'	8.3'	gray clay, silt	0.0	0800	4/6/2010
	Core-14	Vibracore	39.89052, 75.14122	20'	32'	12'	17.9'	27.9'	10'	gray silty clay, some sand and shells (0-2')	0.0	1520	4/5/2010
Comp-H	Core-15	Vibracore	39.88933, 75.14016	35'	42'	7'	38.8'	42'	3.2'	gray/brown silt, some clay	0.0	0930	4/7/2010
	Core-16	Vibracore	39.89000, 75.13973	35'	42'	7'	37.9'	42'	4.1'	gray/brown silt, some clay	0.0	1010	4/7/2010
Comp-I	Core-17	Vibracore	39.89012, 75.14045	18'	30'	12'	18'	24'	6'	gray silt, some fine sand	0.0	1040	4/7/2010
	Core-18	Vibracore	39.89047, 75.14000	19'	31'	12'	19'	31'	12'	gray/brown silt	0.0	1125	4/7/2010
Comp-J	Core-19	Vibracore	39.89088, 75.14023	30'	42'	12'	33.5'	42'	8.5'	gray silt, some gravel, micaceous sand, organics	0.0	1430	4/7/2010
	Core-20	Vibracore	39.89132, 75.14022	30'	42'	12'	30.5'	42'	11.5'	gray silt, some gravel, micaceous sand, organics and odor	0.0	1500	4/7/2010
Comp-K	Core-21	Vibracore	39.89068, 75.13906	38'	42'	4'	36'	38'	2'	gray silty sand, clay, some gravel		1630	3/16/2010
	Core-22	Vibracore	39.89162, 75.13849	37'	42'	5'	36.3'	38.8'	2.5'	gray silt with sand, clam shells	0.0	1000	3/17/2010

Appendix B
Delaware River Sediment Sampling

Group Name	Sample Name	Core Type	Latitude, Longitude	Anticipated Water Depth from Bathymetry (MLLW)	Target Sample Bottom (MLLW)	Target Core Length (feet)	Observed Water Depth (MLLW)	Actual Sample Bottom (MLLW)	Actual Core Length (feet)	Description (Grain type, Color, Inclusions, PID reading)	PID	Sample Time	Sample Date
Comp-L	Core-23	Vibracore	39.89121, 75.13897	33'	42'	9'	33'	40.5'	7.5'	gray silty sand, odor	0.0	1100	3/17/2010
	Core-24	Vibracore	39.89146, 75.13967	34'	42'	8'	30.4'	36.9'	6.5'	gray silt with sand	0.0	1200	3/17/2010
Comp-M	Core-25	Vibracore	39.89172, 75.14012	25'	37'	12'	27.3'	37'	9.7'	gray silt, some gravel, sheen		1450	4/7/2010
	Core-26	Vibracore	39.89221, 75.13939	25'	37'	12'	25.3'	35.3'	10'	gray silt, some gravel, sheen		1530	4/7/2010
Comp-N	Core-27	Vibracore	39.89233, 75.13890	20'	32'	12'	14.5'	18.5'	4'	sandy silt with gravel	0.0	1400	3/18/2010
	Core-28	Vibracore	39.89294, 75.13859	20'	32'	12'	20'	24'	4'	gray silt with trace fime to medium sand, some round gravel, cobble in core catcher		1200	3/24/2010
Comp-O	Core-29	Vibracore	39.89222, 75.13825	38'	42'	4'	32'	42'	10'	gray silt, some organics		1245	4/7/2010
	Core-30	Vibracore	39.89301, 75.13794	38'	42'	4'	35'	42'	7'	gray silt, slight sheen		1320	4/7/2010
Comp-P	Core-31	Vibracore	39.89336, 75.13889	16'	28'	12'	14'	21'	7'	gray silt with some fine to medium sand		1320	3/24/2010
	Core-32	Vibracore	39.89395, 75.13900	16'	28'	12'	17.5'	24.5'	7'	gray silt		1430	3/24/2010
Comp-Q	Core-33	Vibracore	39.89359, 75.13836	27'	39'	12'	26.8'	34.8'	8'	gray silt with clay, bottom foot silty sand with some gravel	0.0	1445	3/17/2010
	Core-34	Vibracore	39.89411, 75.13844	27'	39'	12'	15.5'	23.5'	8'	gray silt wit clay	0.0	1545	3/17/2010
Comp-R	Core-35	Vibracore	39.89340, 75.13782	32'	42'	10'	39.7'	42'	2.3'	typical, gray silt with clay		0915	3/18/2010
	Core-36	Vibracore	39.89401, 75.13793	32'	42'	10'	30'	32.5'	2.5'	gray silt, with sand, dead clam, sheen in core material	0.0	1015	3/18/2010
Comp-S	Core-37	Vibracore	39.89377, 75.13755	36'	42'	6'	33'	40'	7'	gray silt with sand at bottom foot, sand bottom of sample, clam shells	0.5	1045	3/18/2010
	Core-38	Vibracore	39.89433, 75.13735	35'	42'	7'	32.2'	37.7'	5.5'	gray silt with clay, PID reading from bottom where material is sand	0.7	1120	3/18/2010
Comp-T	Core-39	Vibracore	39.89259, 75.13917	18'	30'	12'	20.2'	24.2'	4'	gray silt with clay, dead clams, coal layer 1.5' below ground surface, about 4" thick	0.0	1200	3/18/2010
	Core-40	Vibracore	39.89296, 75.13961	18'	30'	12'	23.9'	28.4'	4.5'	gray silt with clay, pieces of wire cable at bottom of sample		1315	3/18/2010

Appendix B
Delaware River Sediment Sampling

Group Name	Sample Name	Core Type	Latitude, Longitude	Anticipated Water Depth from Bathymetry (MLLW)	Target Sample Bottom (MLLW)	Target Core Length (feet)	Observed Water Depth (MLLW)	Actual Sample Bottom (MLLW)	Actual Core Length (feet)	Description (Grain type, Color, Inclusions, PID reading)	PID	Sample Time	Sample Date
	Core-41	Vibracore	39.89161, 75.14078	NA	NA	12'	21'	33'	12'	gray silt, odor		1430	4/6/2010
	Core-42	Vibracore	39.89127, 75.14104	NA	NA	12'	15'	27'	12'	gray silt, some organics, sheen, odor		1520	4/6/2010
	Core-43	Vibracore	39.89067, 75.14150	NA	NA	12'	22'	32'	10'	gray silt, trace micaceous sand, some clay and organics, strong odor		1630	4/6/2010
	Core-44	Vibracore	39.89023, 75.14187	NA	NA	12'	26'	38'	12'	gray fine, sandy silt, slight odor		1730	4/6/2010
	Core-45	Vibracore	39.88977, 75.14223	NA	NA	12'	25'	37'	12'	gray silt medium to fine sand at bottom foot		0800	4/7/2010
	Core-46	Split Spoon	39.89138, 75.14111	Cores collected on land		15'	Cores collected on land.	15'	13'	brown to gray silt and sand (top two feet excluded from sample)	0.0	1000	3/31/2010
	Core-47	Split Spoon	39.89055, 75.14166			15'		15'	8'	brown to gray silt and sand (additional five-foot shortage due to refusal as a result of buried rubble) (top two feet excluded from sample)	0.0	1245	3/31/2010
	Core-48	Split Spoon	39.88972, 75.14250			15'		15'	13'	brown to gray silt and sand (top two feet excluded from sample)	0.0	1630	3/31/2010
	Core-49	Split Spoon	39.89166, 75.14083			15'		15'	13'	brown to gray silt and sand (top two feet excluded from sample)	0.0	0900	4/1/2010
	Core-50	Split Spoon	39.89222, 75.14055			13'		15'	11'	brown to gray silt and sand (top two feet excluded from sample)	0.0	1030	4/1/2010

APPENDIX C

Data Packages American Analytical Laboratories, LLC
NOTE THAT THE ENTIRETY OF APPENDIX C IS PROVIDED ON THE ENCLOSED CD

APPENDIX C.1 – Bulk Sediment and Physical Results

AAL Report Nos. 1003118, 1003119, 1003121, 1003166, 1003167, 1003168, 1003216, 1003217, 1003225, 1004020, 1004021, 1004022, 1004080, 1004081, and 1004082.

APPENDIX C.2 – Total and Dissolved Elutriate Results

AAL Report Nos. 1003122, 1003169, 1003226, 1004023, and 1004083 and 1003124, 1003170, 1004024, and 1004084.

APPENDIX C.3 – Site Water and Rinsate Blank Results

AAL Report Nos. 1003148, 1003171, 1004012, 1004025, and 1004085.

APPENDIX C.4 – Quality Assurance and Quality Control Summary

APPENDIX B

COASTAL ZONE

DRAFT

COASTAL ZONE MANAGEMENT PROGRAMS EVALUATION

SOUTHPORT DEVELOPMENT PROJECT
PHILADELPHIA, PA

PHILADELPHIA REGIONAL PORT AUTHORITY
3460 N. Delaware Avenue
Philadelphia, PA 19134

AND

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF GENERAL SERVICES
200 S. Broad Street
Philadelphia, PA

Prepared by

WESTON SOLUTIONS, INC.
1400 Weston Way
West Chester, PA 19380

July 2010

COASTAL ZONE

PENNSYLVANIA COASTAL ZONE MANAGEMENT PROGRAM

INTRODUCTION

This evaluation reviews the proposed federal action to be undertaken by the U.S. Army Corps of Engineers ("Corps") in connection with the Southport Project to determine whether that action is consistent with Pennsylvania and New Jersey coastal zone management programs, to the extent applicable. The evaluation concludes that the federal action is indeed consistent with those programs.

The proposed federal action would involve the Corps issuing a joint permit under Section 10 of the federal Rivers and Harbors Act and Section 404 of the federal Clean Water Act to authorize dredging and construction activities in wetlands and waters of the United States. These activities would include filling and buttressing the existing shoreline area, re-routing a stormwater conveyance channel and dredging to deepen an access channel in the Delaware River. The activities to be authorized by the joint permit would be undertaken in conjunction with development of the Southport Marine Terminal with two docking berths to handle the container shipment of goods, as described more fully in the accompanying Environmental Assessment. All activities occurring as part of the federal action, and in connection with construction of the Southport Project, would be occurring in Pennsylvania.

All of the information regarding the Pennsylvania coastal zone were derived from *Commonwealth of Pennsylvania Coastal Resources Management Program Technical Guidance Document*, prepared by the Pennsylvania Department of Environmental Protection. Pennsylvania defines the Coastal Zone in the Southport area as:

- Extends eastward to the New Jersey state boundary, which is the middle of the Delaware River;
- Extends southward to the Delaware State boundary;
- Extends northward to the falls at Morrisville where the tidal influence on the Delaware River ends;

- Extends westward inland varying in width from 1/8 mile in urban areas like Philadelphia, Bristol, and Chester to over 3.5 miles in Falls Township, Bucks County, to include floodplains of the Delaware and Schuylkill Rivers and the upper limit of tidal influence on their tributaries and tidal and freshwater coastal wetlands.

The Commonwealth of Pennsylvania, through the Department of General Services, and the Philadelphia Regional Port Authority, as initial proponents of the Southport Project, have been following guidelines of the Pennsylvania Department of Environmental Protection ("PADEP") to assure consistency with Pennsylvania's Coastal Resources Management Program. PADEP will be receiving and reviewing the application for the joint permit described above. That joint application also includes and constitutes an application for a Pennsylvania permit under 25 Pa Code Chapter 105 to engage in construction in waters of the Commonwealth, and under Chapter 106 as necessary to regulate construction in floodplains of the Commonwealth not otherwise addressed under Chapter 105.

Wetlands impacts from the federal action will be mitigated through the creation of new wetlands and habitat as described in Appendix K accompanying the Environmental Assessment pertaining to the federal action associated with the Southport Project. Maintenance dredging associated with the Project, most likely hydraulic dredging given the proposed site conditions, will be performed utilizing best management practices to protect water quality in the area. All required stormwater discharge and erosion and sedimentation permits will be obtained closer to the time of commencement of construction, and no direct sewage discharges are planned.

A Cultural Resources Survey attached to the Environmental Assessment as Appendix H concludes that no archaeological, architectural or historically significant sites are located within the areas affected by the proposed federal action, or even within the proposed Southport site. Other appendices to the Environmental Assessment show how impacts from the federal action are either not significant or are mitigated to the extent they are not significant. These parallel actions and analyses, which have been described and/or provided to PADEP, help demonstrate that activities to be covered by the joint permit, once completing the necessary permitting processes, will be consistent with the enforceable policies of Pennsylvania's Coastal Resources Program.

NEW JERSEY COASTAL ZONE MANAGEMENT PROGRAM

The proposed Southport Marine Terminal (Southport) is located in Philadelphia, Pennsylvania at the eastern end of the former Philadelphia Naval Shipyard. The activities associated with Southport, including the activities requiring a federal permit from the United States Army Corps of Engineers, will occur in Pennsylvania and not in the New Jersey coastal zone. Certain dredging and disposal of dredged material activities subject to permitting by USACE under Section 10 of the Rivers and Harbors Act and/or under Section 404 of the Clean Water Act and that occur in or along Pennsylvania's portion of the Delaware River, however, are subject to a consistency determination under the New Jersey Coastal Management Plan. As described below, the activities associated with construction of the Southport terminal that require a permit from USACE are consistent with the New Jersey Coastal Management Program.

Southport will require dredging of sediment from the Southport site docking area and future routine maintenance dredging. Either Hydraulic or clamshell dredging or both will be used to perform necessary dredging activities, with disposal proposed to be at the Fort Mifflin CDF, located in Philadelphia, PA, or other approved disposal site. If Southport chooses to implement hydraulic dredging, the dredged material would be pumped through an underwater pipeline that will be placed under the Schuylkill navigation channel to the Fort Mifflin CDF. If clamshell dredging is implemented, the dredged material would be deposited into watertight scows, which would then be pumped into the Fort Mifflin site. The Southport Environmental Assessment and Southport Sediment Characterization Report provide much of the background information for the project and address many of the specific NJ Coastal Zone Management Program Regulations.

A review of the Coastal Zone Management rules (N.J.A.C. 7:7E) determined that the following policies may warrant evaluation as theoretically applicable to the proposed dredging activities:

7:7E-3 - Special Areas.

7:7E-3.5 – Finfish migratory pathways

7:7E-3.7 – Navigation channels

7:7E-3.11 – Ports

7:7E-3.38 – Endangered or threatened wildlife or plant species habitats

7:7E-4 – General Water Areas

7:7E-4.6 – Maintenance dredging

7.7E-4.7 – New dredging

7:7E-4.8 – Dredged material disposal

7:7E-4.18 Realignment of water areas

7:7E-8 – Resource Rules

7:7E-8.2 – Marine Fish and Fisheries

7:7E-8.4 – Water quality

7:7E-8.5 – Surface Water Use

Even though the dredging and other activities are to be federally permitted, the construction of the Southport Project as a whole, does not involve any activities occurring in New Jersey's coastal Zone. This evaluation below examines how the activities might relate to these regulatory policies as applicable in New Jersey. The applicable Coastal Zone Management Rule is written in normal text and discussion of how the proposed activities do not materially affect or New Jersey's coastal resources or otherwise are consistent with the Coastal Management Plan follows in ***bold italics.***

7:7E-3 - Special Areas

7:7E-3.5 – Finfish Migratory Pathways

(a) Finfish migratory pathways are waterways (rivers, streams, creeks, bays, and inlets) which can be determined to serve as passageways for diadromous fish to or from seasonal spawning areas, including juvenile anadromous fish which migrate in autumn and those listed by H.E. Zich (1977) "New Jersey Anadromous Fish Inventory" NJDEP Miscellaneous Report No.

41, and including those portions of the Hudson and Delaware Rivers within the coastal zone boundary.

1. Species of concern include: alewife or river herring (*Alossa pseudoharengus*), blueback herring (*Alosa sapidissima*), American shad (*Alosa aspidissima*), striped bass (*Monroe saxatilis*), Atlantic sturgeon (*Acipenser oxyrhynchus*), Shortnose sturgeon (*Acipenser brevirostrum*), and American eel (*Anguilla rostrata*).

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the dredging restrictions for clamshell dredging from 15 March to 1 June, and for hydraulic dredging from 15 April to 21 June, established per federal resource agency guidelines are in place to protect migrating fish species. Dredging of the Southport dock areas will adhere to these restrictions.

(b) Development, such as dams, dikes, spillways, channelization, tide gates and intake pipes, which creates a physical barrier to the movement of fish along finfish migratory pathways is prohibited, unless acceptable mitigating measures such as fish ladders, erosion control, or oxygenation are used.

Dredging activities will not occur in the New Jersey coastal zone. The proposed project involves the maintenance dredging of sediment from the Southport Facility dock areas with disposal occurring into the Fort Mifflin CDF, located in Philadelphia, PA, or other approved disposal site. The dredging and disposal of this sediment does not include development that would create a physical barrier to the movement of fish.

(c) Development which lowers water quality to such an extent as to interfere with the movement of fish along finfish migratory pathways or to violate State and Delaware River Basin Commission water quality standards is prohibited.

Dredging activities will not occur in the New Jersey coastal zone. Maintenance dredging of the Southport Facility dock areas will be performed using hydraulic dredging, with the material being pumped into the Fort Mifflin CDF, located in Philadelphia, PA, or other permitted disposal site. These activities will be performed by utilizing best management practices to protect water quality in the area. USACE has been issued NPDES permits from PADEP to discharge decant water from this facility.

1. Mitigating measures are required for any development which would result in: lowering dissolved oxygen levels, releasing toxic chemicals, raising ambient water temperature,

impinging or suffocating fish, entrainment of fish eggs, larvae or juveniles, causing siltation, or raising turbidity levels during migration periods.

Dredging activities will not occur in the New Jersey coastal zone. Maintenance dredging of the Southport Facility dock areas will occur along the margins of the river and will create minimal, temporary, and localized turbidity. However, by limiting the dredging operations between the dates of 15 March and June 1 for clamshell dredging, and 15 April and 21 June for hydraulic dredging, the migratory pathways in the Delaware River will not be impacted by this temporary turbidity. Siltation and turbidity induced by dredging is trivial relative to natural siltation from the deposit of upstream eroded sediments during a storm event.

Additionally, the release of contaminants during dredging operations is not anticipated based on the sediment characteristics at the dock areas, as shown in recent sampling detailed in the Southport Terminal Sediment Characterization Report prepared by Weston Solutions, Inc. (WESTON; July 2010) and included in the accompanying Environmental Assessment as Appendix A. There will be no impact to oxygen levels, water temperature, fish impingement, or entrainment.

(d) Water's edge development which incorporates migration access structures, such as functioning fish ladders, will be conditionally acceptable, provided that the Department's Division of Fish and Wildlife approves the design of the access structure. As of January, 1994, the Department's Division of Fish and Wildlife is evaluating anadromous fish spawning areas for potential enhancement work. This may include building of fish ladders, removal of obstructions, stocking, and other means. A development proposal shall be consistent with these Department efforts.

Dredging activities will not occur in the New Jersey coastal zone. The proposed project involves the new maintenance dredging of sediment from the Southport Facility dock areas with disposal into the Fort Mifflin CDF, located in Philadelphia, PA, or other approved disposal site and does not include any water's edge development that incorporate migration access structures.

7:7E-3.7 – Navigation Channels

(a) Navigation channels are tidal water areas including the Atlantic Ocean, inlets, bays, rivers and tidal guts with sufficient depth to provide safe navigation. Navigation channels include all areas between the top of the channel slopes on either side. These navigation channels are often marked with buoys or stakes. Major navigation channels are shown on NOAA/National Ocean Service Charts.

Dredging activities will not occur in the New Jersey coastal zone, and will not occur in a navigation channel.

(b) Standards relevant to navigation channels are as follows:

1. Development which would cause terrestrial soil and shoreline erosion and siltation in navigation channels shall utilize appropriate mitigation measures.

   Dredging activities will not occur in the New Jersey coastal zone. Maintenance dredging and disposal of dredged material from the Southport Facility dock areas will not result in terrestrial soil and shoreline erosion or siltation in the navigation channel.

2. Development which would result in loss of navigability is prohibited.

   Dredging activities will not occur in the New Jersey coastal zone. Maintenance dredging and disposal of dredged material from the Southport Marine Terminal dock areas will not result in the loss of navigability since dredging will occur along the Southport Facility dock areas, and not in the federal navigation channel. Additionally, disposal of this dredged material will not affect navigation since the disposal area, the Southport property, is not located in the navigation channel of the Delaware River.

3. Any construction which would extend into a navigation channel is prohibited.

   Dredging activities will not occur in the New Jersey coastal zone, and will not occur in a navigation channel. Maintenance dredging and disposal of dredged material from the Southport Facility dock areas will not include construction in a navigation channel.

4. The placement of structures within 50 feet of any authorized navigation channel is discouraged, unless it can be demonstrated that the proposed structure will not hinder navigation.

   Dredging activities will not occur in the New Jersey coastal zone, and will not occur in a navigation channel. Maintenance dredging and disposal of dredged material from the Southport Facility dock areas will not involve the placement of any permanent structures within 50 feet of a navigation channel.

<u>7:7E-3.11 – Ports</u>

(a) Ports are water areas having, or lying immediately adjacent to, concentrations of shoreside marine terminals and transfer facilities for the movement of waterborne cargo (including fluids), and including facilities for loading, unloading and temporary storage.

1. Port locations in New Jersey include, among others, Newark, Elizabeth, Bayonne, Jersey City, Weehawken, Hoboken, Woodbridge, Perth Amboy, Camden, Gloucester City, Paulsboro and Salem.

   The Southport Facility will be located in Philadelphia, PA, and not in New Jersey.

2. Standards for a docking facility or concentrations of docks for a single industrial or manufacturing facility are found at N.J.A.C. 7:7E-4.4, Docks and piers for cargo and commercial fisheries.

(b) Any use which would preempt or interfere with port uses of this water area is prohibited.

(c) Aquaculture and dumping of solid waste or semi-solid waste is prohibited.

(d) Boat ramps for recreational boating are conditionally acceptable provided the ramp complies with all Special Areas Rules (N.J.A.C. 7:7E-3) and provided it does not interfere with the port use.

(e) Docks and piers for cargo movements are encouraged.

7:7E-3.38 Endangered or threatened wildlife or plant species habitats

(a) Endangered or threatened wildlife or plant species habitats are areas known to be inhabited on a seasonal or permanent basis by or to be critical at any stage in the life cycle of any wildlife or plant identified as "endangered" or "threatened" species on official Federal or State lists of endangered or threatened species, or under active consideration for State or Federal listing. The definition of endangered or threatened wildlife or plant species habitats include a sufficient buffer area to ensure continued survival of the population of the species. Absence of such a buffer area does not preclude an area from being endangered or threatened wildlife or plant species habitat.

Dredging activities will not occur in the New Jersey coastal zone. The proposed dredging activities will not impact any endangered or threatened wildlife or plant species in the New Jersey coastal zone.

7:7E-4 – General Water Areas

7:7E-4.6 - Maintenance dredging

(a) Maintenance dredging is the removal of accumulated sediment from previously authorized and legally dredged navigation access channels, marina, lagoons, canals, or boat moorings for the purpose of maintaining a previously authorized water depth and width for safe navigation.

1. To be considered maintenance dredging:

   i. The proposed dredge area must be limited to the same depth, length and width as the previous dredging operation;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the proposed maintenance dredge area will be limited to the same template as the construction dredging project. Details of the dredged template and dredging activities are presented in the Southport Terminal Sediment Characterization Report.

   ii. For natural water areas, the area must have been either:

   (1) Currently used for navigation or mooring of vessels requiring the proposed water depth;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the Southport Facility dock areas are not currently used for navigation of mooring of vessels, but will be following construction dredging and wharf construction, at which point, maintenance dredging will apply.

   (2) Dredged within the last 10 years;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the Southport Facility dock areas will undergo maintenance dredging following construction dredging, which will occur more frequently than every 10 years.

(b) Maintenance dredging is conditionally acceptable to the authorized depth, length, and width within all General Water Areas to ensure that adequate water depth is available for safe navigation, provided:

1. An acceptable dredged material placement site, with sufficient capacity will be used. (See N.J.A.C. 7:7E-4.8 Dredged material disposal in water areas and N.J.A.C. 7:7E-7.12 Dredged material placement on land);

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the dredged material from the Southport Facility dock areas will be deposited into the USACE Fort Mifflin CDF or other approved disposal facility.

2. Pre-dredging chemical and physical analysis of the dredged material and/or its elutriate may be required where the Department suspects contamination of sediments. Additional testing, such as bioaccumulation and bioassay testing of sediments, may also be required as needed to determine the acceptability of the proposed placement site for the dredged material. The results of these tests will be used to determine if contaminants may be resuspended at the dredging site and what methods may be needed to control their escape. The results will also be used to determine acceptability of the proposed dredged material placement method and site;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, sediment sampling was performed at the Southport Facility dock area in March 2010. These samples were sent to New Jersey and Pennsylvania certified laboratories, for chemical and physical analyses. The results of the sediment sampling are detailed in the Southport Terminal Sediment Characterization Report prepared by WESTON in July 2010. The results of the sediment sampling indicate that the sediments to be dredged are not contaminated.

3. Turbidity concentrations (that is, suspended sediments) and other water quality parameters at, downstream, and upstream of the dredging site, and slurry or decant water overflows shall meet applicable State Surface Water Quality Standards at N.J.A.C. 7:9B. The Department may require the permittee to conduct biological, physical and chemical water quality monitoring before, during, and after dredging and disposal operations to ensure that water quality standards are not exceeded;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, maintenance dredging of the Southport Facility docks will be performed utilizing best management practices to protect water quality in the area.

4. If predicted water quality parameters are likely to exceed State Surface Water Quality Standards, or if pre-dredging chemical analysis of dredged material or elutriate reveals significant contamination, the Department will work cooperatively with the applicant to fashion acceptable control measures and will impose seasonal restrictions under specific circumstances identified at (b)7;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the chemical analysis of the material and elutriate did not reveal significant exceedances of contaminants of concern, and is not considered contaminated material.

5. For mechanical dredges such as clamshell bucket, dragline, grab, or ladders, deploying silt curtains at the dredging site may be required, if feasible based on site conditions. Where the use of silt curtains is infeasible, dredging using closed watertight buckets or lateral digging buckets may be required. The Department may decide not to allow mechanical dredging of highly contaminated sites even if turbidity control measures were planned.

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, maintenance dredging will be performed utilizing a hydraulic dredge and best management practices during both the construction dredging and ongoing maintenance dredging of the Southport Facility dock areas. All material will be pumped from the scows to the USACE Fort Mifflin CDF or other approved CDF.

6. For hydraulic dredges specific operational procedures designed to minimize water quality impacts, such as removal of cutter head, flushing of pipeline sections prior to disconnection, or limitations on depth of successive cuts may be required;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, maintenance dredging at the Southport Facility dock areas will be performed using appropriate hydraulic dredge or clamshell dredging procedures. All material will be pumped via pipeline into the Fort Mifflin CDF or other approved CDF.

7. The Department may authorize dredging on a seasonally restricted basis only, in waterways characterized by the following:

   i. Known spawning, wintering or nursery areas of shortnose sturgeon, winter flounder Atlantic sturgeon, alewife, blueback herring, striped bass, white perch, or blue crab;

      Dredging activities will not occur in the New Jersey coastal zone. To protect fish species migrating in the area, clamshell dredging will only occur from 2 June to 15 March, and hydraulic dredging will only occur from 21 June to 15 April. Also, dredging is performed in the margins of the river and minimal turbidity migration into the channel is expected due to the longitudinally stratified and laminar flow of the river.

   ii. Water bodies downstream of known anadromous fish spawning sites under N.J.A.C. 7:7E-3.5 Finfish migratory pathways, where the predicted turbidity plume will encompass the entire cross-sectional area of the water body, thus forming a potential blockage to upstream migration;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, to protect fish species migrating in the area, clamshell dredging will only occur from 2 June to 15 March, and hydraulic dredging will only occur from 21 June to 15 April. Also, dredging is performed in the margins of the river and minimal turbidity migration into the channel is expected due to the longitudinally stratified and laminar flow of the river.

iii. Areas of contaminated sediments with high levels of fecal coliform and/or streptococcus bacteria, and/or hazardous substances adjacent to (upstream or downstream) State approved shellfishing waters and public or private bathing beaches;

Dredging activities will not occur in the New Jersey coastal zone. The Southport Facility dock areas are located in Pennsylvania and are not adjacent to New Jersey approved shellfishing waters. They are also not adjacent to New Jersey approved public or private bathing beaches.

iv. Areas within 1,000 meters or less of oyster beds are defined in N.J.A.C. 7:7E-3.2;

Dredging activities will not occur in the New Jersey coastal zone. The Southport Facility dock areas and the upland CDFs are not within 1,000 meters or less of oyster beds.

8. Maintenance dredging side slopes shall not be steeper than 3:1 adjacent to wetlands to prevent undermining and/or sloughing of the wetlands.

Dredging activities will not occur in the New Jersey coastal zone. Maintenance dredging of the Southport Facility docking areas is not immediately adjacent to wetlands.

(c) Reprofiling, which is the movement of material from one area of a berth or channel to an adjacent, deeper location, is discouraged in all water areas except the New York-New Jersey Harbor Area as provided at (c) 1 below.

1. Reprofiling is conditionally acceptable in the New York-New Jersey Harbor Area north of Sandy Hook, excluding the Raritan Bay and its tributaries east of the Cheesequake Creek provided:

i. The applicant has demonstrated that there is no other available dredged material management alternative;

ii. The project involves the movement of less than 5,000 cubic yards of material;

iii. The depth of the material to be removed is limited to three feet;

iv. There exists a suitable adjacent deep water area with sufficient capacity to accommodate the relocated material within which the material will be stable and located so as not to interfere with adjacent navigation channels or berths; and

v. The reprofiling is performed by dragging a steel beam or pipe across the berth and/or channel bottom, thereby leveling accumulated sediment to a uniform, specified depth. Alternative procedures will be considered only under special instances where the use of a drag bar is impractical due to limited space in the project area.

Dredging activities will not occur in the New Jersey coastal zone. Reprofiling will not occur at the Southport Facility dock areas. Maintenance dredging will be accomplished using a hydraulic or clamshell dredge.

(d) Propwash dredging, which is the movement of sediment by resuspending accumulated material by scouring the bottom with boat propellers or specially designed equipment with propellers, is prohibited.

Dredging activities will not occur in the New Jersey coastal zone. Propwash dredging will not be used for this project.

7:7E-4.7 – *New Dredging*

(a) New dredging is the removal of sediment that does not meet the definition of maintenance dredging at N.J.A.C. 7:7E-4.6.

(b) New dredging is conditionally acceptable in all General Water Areas for boat moorings, navigation channels or anchorages provided:

1. There is a demonstrated need that cannot be satisfied by existing facilities;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, market analyses indicate additional port facilities are needed in the Delaware River as evidenced by the proposed construction of the Paulsboro Marine Terminal.

2. The facilities served by the new dredging satisfy the location requirements for Special Water's Edge Area's;

Dredging activities will not occur in the New Jersey coastal zone.

3. The adjacent water areas are currently used for recreational boating, commercial fishing or marine commerce;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, adjacent areas are not used for recreational boating and the proposed marine commerce is consistent with this area of the Delaware River.

4. The dredge area causes no significant disturbance to Special Water or Water's Edge Areas;

   Dredging activities will not occur in the New Jersey coastal zone.

5. The adverse environmental impacts are minimized to the maximum extent feasible;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the final design of the dredged template was reduced from three berths to two berths, which limited the impact to open water and intertidal areas to only that which is necessary. Potential environmental impacts will be mitigated through a proposed mitigation plan.

6. The dredge area is reduced to the minimum practical;

   See above

7. The maximum depth of the newly dredged area shall not exceed that of the connecting access or navigation channel necessary for vessel passage to the bay or ocean;

   Dredging activities will not occur in the New Jersey coastal zone. The dredged area will be deepened to the current depth of the adjacent Federal Navigation Channel -40 ft (+2-ft optional overdredge) and may deepened to -45 ft (+2 ft optional overdredge), but only if the navigation channel is deepened to -45 ft+2 ft.

8. Dredging will have no adverse impacts on groundwater resources;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, dredging will have no adverse impacts on groundwater resources because groundwater used as resources are deeper than -45 ft (+2-ft overdredge). Further detail is provided in the Environmental Assessment.

9. No dredging shall occur within 10 feet of any wetlands. The proposed slope from this 10 foot buffer to the nearest edge of the dredged area shall not exceed three vertical to one horizontal; and

   Dredging activities will not occur in the New Jersey coastal zone and will not impact New Jersey wetlands.

10. Dredging shall be accomplished consistent with all of the following conditions, as appropriate to the dredging method;

    i. An acceptable dredged material placement site with sufficient capacity will be used.

    Dredging activities will not occur in the New Jersey coastal zone. Dredged material will be deposited into the Fort Mifflin CDF or other approved disposal site. Further detail is provided in the Sediment Characterization Report and the Environmental Assessment.

    ii. Pre-dredging chemical and physical analysis of the dredged material and/or its elutriate may be required where the Department suspects contamination of sediments. Additional testing, such as bioaccumulation and bioassay testing of sediments, may also be required as needed to determine the acceptability of the proposed placement site for the dredged material. The results of these tests will be used to determine if contaminants may be resuspended at the dredging site and what methods may be needed to control their escape. The results will also be used to determine acceptability of the proposed dredged material placement method and site;

    Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, dredged material will be deposited into the Fort Mifflin CDF or another approved facility used to deposit dredged material with similar characteristics. Bioassay testing of sediments is not appropriate for depositing dredged material in a dedicated disposal area.

    Sediment sampling was performed at the Southport Facility dock area in March 2010. These samples were sent to New Jersey and Pennsylvania certified laboratories, for chemical and physical analyses. The results of the sediment sampling are detailed in the Southport Marine Terminal Sediment Characterization Report prepared by WESTON in July 2010. The results of the sediment sampling indicate that the sediments to be dredged do not pose a danger to habitats within the CDF.

iii. Turbidity concentrations (that is, suspended sediments) and other water quality parameters at, downstream, and upstream of the dredging site, and slurry water overflows shall meet applicable State Surface Water Quality Standards at N.J.A.C. 7:9B. The Department may require the permittee to conduct biological, physical and chemical water quality monitoring before, during, and after dredging and disposal operations to ensure that water quality standards are not exceeded;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, best management practices will be used to limit impacts on water quality. Maintenance dredging will be performed utilizing a hydraulic dredge or clamshell dredge and best management practices during both the construction dredging and ongoing maintenance dredging of the Southport Facility dock areas. All material will be pumped from the scows to the USACE Fort Mifflin CDF or other approved CDF.

iv. If predicted water quality parameters are likely to exceed State Surface Water Quality Standards, or if pre-dredging chemical analysis of dredged material or elutriate reveals significant contamination, then the Department will work cooperatively with the applicant to fashion acceptable control measures and will impose seasonal restrictions under the specific circumstances identified at (b)11vii below;

Dredging activities will not occur in the New Jersey coastal zone. Based on the chemical analysis of dredged material and elutriates, contaminant impacts to Surface Water Standards will be negligible. Refer to the Sediment Characterization Report for more detail. Dredging of the Southport Facility docks will be performed utilizing best management practices to limit the impacts of turbidity water quality in the area.

v. For new dredging using mechanical dredges such as clamshell bucket, dragline, grab, or ladders, deploying silt curtains is infeasible, dredging using closed watertight buckets or lateral digging buckets may be required. The Department may decide not to allow mechanical dredging of highly contaminated sites even if turbidity control measures were planned;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, dredging of the Southport Facility berths will be performed utilizing best management practices to limit the impacts of turbidity water quality in the area.

vi. For hydraulic dredges, specific operational procedures designed to minimize water quality impacts, such as removal of cutter head, flushing of pipeline sections prior to disconnection, or limitations on depth of successive cuts, may be required;

Best Management Practices including line flushing and cleaning of equipment and cut strategies to limit turbidity will be practiced.

vii. The Department may authorize dredging on a seasonally restricted basis only, in waterways characterized by the following:

(1) Known spawning, wintering or nursery areas of shortnose sturgeon, winter flounder, Atlantic surgeon, alewife, blueback herring, striped bass or blue crab;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, to protect fish species migrating in the area, clamshell dredging will only occur from 2 June to 15 March, and hydraulic dredging will only occur from 21 June to 15 April. Also, dredging is performed in the margins of the river and minimal turbidity migration into the channel is expected due to the longitudinally stratified and laminar flow of the river.

(2) Water bodies downstream of known anadromous fish spawning sites under N.J.A.C. 7:7E-3.5 Finfish migratory pathways, where the predicted turbidity plume will encompass the entire cross-sectional area of the water body, thus forming a potential blockage to upstream migration;

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, to protect fish species migrating in the area, clamshell dredging will only occur from 2 June to 15 March, and hydraulic dredging will only occur from 21 June to 15 April. Also, dredging is performed in the margins of the river and minimal turbidity migration into the channel is expected due to the longitudinally stratified and laminar flow of the river.

(3) Areas of contaminated sediments with high levels of fecal coliform and/or streptococcus bacteria, and/or hazardous substances adjacent to (upstream or downstream) State approved shellfishing waters and public or private bathing beaches; or

Dredging activities will not occur in the New Jersey coastal zone. The Southport Facility dock areas are located in Pennsylvania and are not adjacent to New Jersey approved shellfishing waters. They are also not adjacent to New Jersey approved public or private bathing beaches.

(4) Areas within 1,000 meters or less of oyster beds as defined in N.J.A.C. 7:7E-3.2; and

Dredging activities will not occur in the New Jersey coastal zone. The Southport Facility dock areas and the upland CDFs are not within 1,000 meters or less of oyster beds.

viii. Side slopes shall not be steeper than 3:1 adjacent to wetlands to prevent undermining and/or sloughing of the wetlands.

Dredging activities will not occur in the New Jersey coastal zone and will not impact New Jersey wetlands. Nonetheless, side slopes of the dredged template will be constructed to 3:1 and no wetlands are adjacent to the tops of these slopes after construction. Wetlands outside New Jersey potentially impacted by the construction dredging will be mitigated per the NEPA process.

(c) Propwash dredging, which is the movement of sediment by resuspending accumulated material by scouring the bottom with boat propellers or specially designed equipment with propellers is prohibited.

N/A

(d) New dredging or excavation to create new lagoons for residential development is prohibited in wetlands, N.J.A.C. 7:7E-3.27, wetlands buffer, N.J.A.C. 7:7E-3.28, endangered or threatened wildlife or vegetation species habitats, N.J.A.C. 7:7E-3.38, and discouraged elsewhere.

N/A

(e) New dredging is conditionally acceptable to control situation in lakes, ponds and reservoirs, provided that an acceptable sedimentation control plan is developed to address re-sedimentation of these water bodies.

N/A

(f) The Department has prepared a dredging technical manual, titled "The Management and Regulation of Dredging Activities and Dredged Material Disposal in New Jersey's Tidal Waters." October 1997, which provides guidance on dredged material sampling, testing, transporting, processing, management, and placement. The manual is available from the

Department's Office of Maps and Publications, PO Box 420, Trenton, New Jersey, 08625-0420, (609) 777-1038.

(g) With the exception of N.J.A.C. 7:7E-4.7 (b), (c), (d) and (e) above, new dredging is discouraged.

Dredging activities will not occur in the New Jersey coastal zone. New dredging is a necessary adjunct to use for use of the Southport Shoreline as berthing of vessels and for use of the Southport shoreline and upland as a container terminal.

7:7E-4.8 - *Dredged material disposal*

(a) Dredged material disposal is the discharge of sediments removed during dredging operations.

(b) The standards relevant to dredged material disposal in water areas are as follows:

1. Dredged material disposal is prohibited in tidal guts, man-made harbors, medium rivers, creeks and streams, and lakes, ponds, and reservoirs. Dredged material disposal is discouraged in open bays, semi-enclosed and backbays where the water depth is less than six feet;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF located west of the Navy Yard or other approved CDF.

2. Disposal of dredged materials in the ocean and bays deeper than six feet is conditionally acceptable provided that there is no feasible beneficial use or upland placement site available and it is in conformance with the USEPA and US Army Corps of Engineers Guidelines (40 C.F.R. parts 220-228 and 230-232 and 33 CFR, parts 320-330 and 335-338) established under Section 404(b) of the Clean Water Act and the Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual, EPA-503/8-91/001, February 1991, and Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters Testing Manual, EPA-000/0-93/000, May 1993, as appropriate to the proposed disposal site;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF located west of the Navy Yard or other approved CDF.

3. Dredged material disposal in water areas shall conform with applicable State Surface Water Quality Standards at N.J.A.C. 7:9B;

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF located west of the Navy Yard or other approved CDF.

4. Overboard disposal (also known as aquatic, open water, side casting, subaqueous, or wet) of uncontaminated sediments into unconfined disposal sites in existing anoxic dredge holes, shall comply with the following:

   i. Data on water quality, benthic productivity and seasonal finfish use demonstrate that the unconfined disposal site has limited biological value;

   ii. All subaqueous dredged material disposal shall utilize best management techniques such as submerged elbows or underwater diffusers and may be limited to a particular tidal cycle to further minimize impacts; and

   iii. The hole shall not be filled higher than the depth of the surrounding waters.

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF located west of the Navy Yard or other approved CDF.

5. Overboard disposal of sediments consisting of less than 90 percent sand shall be conditionally acceptable in unconfined disposal sites when shallow waters preclude removal to an upland or confined site. Such disposal shall comply with the following;

   i. Shellfish habitats (as defined in N.J.A.C. 7:7E-3.2) are not within 1,000 meters;

   ii. Disposal will not smother or cause condemnation or contamination of harvestable shellfish resources (as in N.J.A.C. 7:7E-3.2);

   iii. Sediment characteristics of the dredged material and disposal site are similar; and

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF located west of the Navy Yard or other approved CDF.

6. Uncontaminated dredged sediments with 75 percent sand or greater are generally encouraged for beach nourishment.

   Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility dock areas are greater than 75% sand and will be deposited into the Fort Mifflin CDF located west of the Navy Yard or other approved CDF.

7:7E-4.18 Realignment of water areas

(a) Realignment of water areas means the physical alteration or relocation of the surface configuration of any water area. This does not include the rebulkheading of a previously bulkheaded water area or the bulkheading at or above the spring high water line.

(b) Realignment of naturally occurring water areas is discouraged. Discouraged uses can only be approved if it can be demonstrated that the proposed development is in the public interest and mitigation for the impact is provided.

(c) Realignment of previously realigned water areas is conditionally acceptable, provided:

   1. It is demonstrated that no adverse environmental impacts (that is, water quality, flood hazard, species diversity reduction/alteration) will result; and

   2. A net recreational/ecological benefit will demonstrably accrue.

   Dredging activities will not occur in the New Jersey coastal zone, and will not realign water areas in New Jersey.

7:7E-7.12 - *Dredged material placement on land*

(a) Dredged material placement is the disposal or beneficial use of sediments removed during dredging operations. Beneficial uses of dredged material include, but are not limited to, fill, topsoil, bricks, and lightweight aggregate. This rule applies to the placement of dredged

material landward of the spring high water line. The standards for dredged material disposal in Water Areas are found at N.J.A.C. 7:7E-4.8.

(b) Dredged material placement on land is conditionally acceptable provided that the use is protective of human health, groundwater quality, and surface water quality, and manages ecological risks. Testing of the dredged material may be required as needed to determine the acceptability of the placement of the material on a particular site.

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, material dredged from the Southport Facility will be deposited into the Fort Mifflin CDF or other approved CDF. Sediment sampling was performed at the Southport Facility dock area in March 2010. These samples were sent to New Jersey and Pennsylvania certified laboratories, for chemical and physical analyses. The results of the sediment sampling are detailed in the Southport Marine Terminal Sediment Characterization Report prepared by WESTON in July 2010. The results of the sediment sampling indicate that the sediments to be dredged are not contaminated.

(c) Dredged material disposal is prohibited on wetlands unless the disposal satisfies the criteria found at N.J.A.C. 7:7E-3.27.

Dredging activities will not occur in the New Jersey coastal zone. Material dredged from the Southport Facility will not be deposited into wetlands in New Jersey.

(d) The use of dredged material of appropriate quality and particle size for purposes such as restoring landscape, enhancing farming areas, capping and remediating landfills and brownfields, beach protection, creating marshes, capping contaminated dredged material disposal site areas, and making new wildlife habitats is encouraged.

Dredging activities will not occur in the New Jersey coastal zone. Material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF or other approved CDF.

(e) Effects associated with the transfer of the dredged materials from the dredging site to the disposal site shall be minimized to the maximum extent feasible.

Dredging activities will not occur in the New Jersey coastal zone. Material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF or other approved CDF.

(f) Dredged material disposal in wet and dry borrow pits is conditionally acceptable (see N.J.A.C. 7:7E-3.14, and 3.35).

Dredging activities will not occur in the New Jersey coastal zone. Material dredged from the Southport Facility dock areas will be deposited into the Fort Mifflin CDF or other approved CDF.

(g) If pre-dredging sediment analysis indicates contamination, then special precautions shall be imposed including but not necessarily limited to increasing retention time of water in the disposal site or rehandling basin through weir and dike design modifications, use of coagulants, ground water monitoring, or measures to prevent biological uptake by colonizing plants.

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, sediment to be dredged from Southport Facility has been analyzed. The results do not indicate contamination. Please refer to the Sediment Characterization Report for further detail.

(h) All potential releases of water from confined (diked) disposal sites and rehandling basins shall meet existing States Surface Water Quality Standards (N.J.A.C. 7:9B) and State Groundwater Quality Standards (N.J.A.C. 7:9).

Dredging activities will not occur in the New Jersey coastal zone. USACE has been issued an NPDES permit by PADEP to discharge decant water into the Schuylkill River during operations of this facility.

7:7E-8 – Resource Rules

7:7E-8.1 – Purpose and Scope

(a) In addition to satisfying the location and use rules, a proposed development must satisfy the requirements of this subchapter. This subchapter contains the standards the Department utilizes to analyze the proposed development in terms of its effects on various resources of the built and natural environment of the coastal zone, both at the proposed site as well as in its surrounding region.

No evaluation called for here

7:7E-8.2 Marine Fish and Fisheries

(a) Marine fish are marine and estuarine animals other than marine mammals and birds. Marine fisheries means:

1. One or more stocks of marine fish which can be treated as a unit for the purposes of conservation and management and which are identified on the basis of geographical, scientific, technical, recreational and economic characteristics; and

   N/A

2. The catching, taking or harvesting of marine fish.

   N/A

(b) Any activity that would adversely impact on the natural functioning of marine fish, including the reproductive, spawning and migratory patterns or species abundance or diversity of marine fish, is discouraged. In addition, any activity that would adversely impact any New Jersey based marine fisheries or access thereto is discouraged, unless it complies with (c) below.

(c) The following coastal activities are conditionally acceptable provided that the activity complies with the appropriate general water area rule(s) at N.J.A.C 7:7E-4;

1. Construction of submerged cables and pipelines;

   N/A

2. Sand and gravel mining to obtain material for beach nourishment, provided :

   i. The beach nourishment project is in the public interest;

      N/A

   ii. There are no alternative borrow sites that would result in less impact to marine fish and fisheries;

      N/A

iii. Any alteration of existing bathymetry within Prime Fishing areas, as defined at N.J.A.C. 7:7E-3.4, does not reduce the high fishery productivity of these areas; and

iv. Measures are implemented to minimize and compensate for impacts to marine fish and fisheries; and

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, dredging activities will minimize impacts to marine fish and fisheries located in the Pennsylvania Coastal Zone, and any permanent impacts have been thoroughly assessed and will be mitigated pursuant to the NEPA process.

The establishment of Aquaculture Development Zones in accordance with N.J.S.A. 4:27-1 et seq. and any regulations developed and adopted pursuant thereto.

N/A

7:7E-8.4 – Water Quality

(a) As required by Section 307(f) of the Federal Coastal Zone Management Act (P.L. 92-583), Federal, State and local water quality requirements established under the Clean Water Act (33 U.S.C. 1251) shall be the water resource standards of the coastal management program. These requirements include not only the minimum requirements imposed under the Clean Water Act but also the additional requirements adopted by states, localities, and interstate agencies pursuant to Section 510 of the Clean Water Act and such statutes as the New Jersey Water Pollution Control Act. In the Delaware River Basin, the requirements include the prevailing "Basin Regulations-Water Quality" adopted by the Delaware River Basin Commission as part of its Comprehensive Plan. In the waters under the jurisdiction of the Interstate Sanitation Commission in the New Jersey-New York metropolitan area, the requirements include the Interstate Sanitation Commission's Water Quality Regulations. Department rules regulated to water pollution control and applicable throughout the entire coastal zone include, for example, the Surface Water Quality Standards (N.J.A.C. 7:9-4), the rules concerning the Wastewater Discharge Requirements (N.J.A.C. 7:9-5), the Ground-Water Quality Standards (N.J.A.C. 7:9-6), and the Regulations Concerning the New Jersey Pollutant Discharge Elimination System (N.J.A.C. 7:14A).

(b) Coastal development which would violate the Federal Clean Water Act, or State laws, rules and regulations enacted or promulgated pursuant thereto, is prohibited. In accordance with N.J.A.C. 7:15 concerning the Water Quality Management Planning and Implementation process, coastal development that is inconsistent with an approved Water Quality Management (208) Plan under the New Jersey Water Quality Planning Act, N.J.S.A. 58:11A-1 et seq., is prohibited.

Dredging activities will not occur in the New Jersey coastal zone. Nonetheless, the chemical analysis of the material and elutriate did not reveal contamination that would lead to compromise of water quality for the proposed handling of the dredged material. Therefore, the maintenance dredging of the Southport Facility dock areas will not violate applicable water quality regulations. Discharge of decant water from the disposal site is subject to an existing, approved NPDES for Fort Mifflin. In the case of Fort Mifflin CDF, this permit is held by USACE. For further information, please review the Southport Environmental Assessment and the Southport Sediment Characterization Report.

7:7E-8.5 Surface water use

(a) Surface water is water in lakes, ponds, streams, rivers, bogs, wetlands, bays, and ocean that is visible on land.

No evaluation called for here

(b) Coastal development shall demonstrate that the anticipated surface water demand of the facility will not exceed the capacity, including phased planned increases, of the local potable water supply system or reserve capacity, and that construction of the facility will not cause unacceptable surface water disturbances, such as drawdown, bottom scour, or alteration of flow patterns.

Dredging activities will not occur in the New Jersey coastal zone. No surface water diversions of the Delaware River will occur.

1. Coastal development shall conform with all applicable Department and, in the Delaware River Area, Delaware River Basin Commission requirements for surface water diversions.

   Dredging activities will not occur in the New Jersey coastal zone. No surface water diversions of the Delaware River will occur.

APPENDIX C

MACROBENTHIC AND FINFISH SURVEYS

SPRING 2010 FISH AND MACROBENTHIC INVERTEBRATE STUDY
PROPOSED SOUTHPORT DEVELOPMENT PROJECT
PHILADELPHIA, PENNSYLVANIA

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June 2010

Spring 2010 Fish and Macrobenthic Invertebrate Survey
Southport, Philadelphia, PA

BACKGROUND

The Commonwealth, in conjunction with PRPA, is evaluating the construction of a new marine cargo terminal to be located on approximately 116 acres along the banks of the Delaware River in Philadelphia County, Pennsylvania. This project—known as Southport—would provide expansion opportunities necessary to meet market demands. The Commonwealth has committed funding for specific aspects of this project; however, proceeding with the project is dependent on an array of diverse factors, as well as completion of the National Environmental Policy Act (NEPA) process.

The conceptual plan for Southport consists of the construction of a multi-berth marine container terminal sited on a land at the southeastern end of the former Philadelphia Naval Shipyard. The proposed project would include construction of berthing areas, a container yard, new access roadway and existing roadway improvements, installation of utilities, various buildings to support the operations of the terminal, creation of an access channel, and the placement of dredged material from the Southport project in a confined disposal facility (CDF).

To augment existing data from past studies in this reach of the Delaware River, fish sampling was performed on April 27 through 29, 2010, to characterize seasonal utilization of aquatic habitats in the immediate vicinity of the project area. On May 13 and 14, 2010, macrobenthic invertebrate samples were collected to evaluate that community as a food source for fish species utilizing the habitats for foraging. Additional fish sampling was performed between June 1 and 3, 2010, to complete the survey field effort. Prior to the spring 2010 sampling activities, the Philadelphia Water Department (PWD) conducted electrofishing in the interpier areas in November 2009 to provide more recent data on fall fish utilization of the project site than the 2003 Normandeau study (Normandeau, 2004). Results of the PWD study are provided as Attachment 1. The principal objective of the survey was to obtain additional site-specific data to evaluate potential impacts to the fish and benthic community associated with the potential

construction and operation of Southport. The survey also supports the determination of mitigation for unavoidable impacts to aquatic habitats.

An overview of Southport and planned sampling activities was provided to the National Marine Fisheries Service (NMFS), the Pennsylvania Fish and Boat Commission (PFBC), and other regulatory agencies in an initial meeting on October 29, 2009, at the Philadelphia District, U.S. Army Corps of Engineers (CENAP) office in Philadelphia. Following this initial meeting, the scope of fish collection was further discussed by telephone with Mike Kaufmann of PFBC on October 30, 2009, and with Karen Greene and Brian May of NMFS during a December 1, 2009, meeting at the NMFS Sandy Hook facility.

Since the two meetings described above, the Commonwealth commenced a reevaluation of potential alignments of the Southport facility in the interest of minimizing or eliminating potential impacts to the aquatic community in the interpier area associated with Piers 122 and 124. The preferred design alternative chosen will reduce the footprint of the facility (see attached figure) relative to the original alignment presented and discussed at the December 1 meeting. This revised alignment will vastly minimize filling the interpier vicinity.

The draft Technical Plan, 2010 Fish and Macrobenthic Invertebrate Survey, Southport, Philadelphia (draft *Technical Plan*) describing the materials and methods for the conduct of the aquatic survey and the rationale for selection was reviewed by PFBC and NMFS representatives. A teleconference was held on March 8, 2010, with NMFS and PFBC reviewers to receive input on the draft *Technical Plan* and to finalize the scope and timing of sampling activities. The final *Technical Plan* of March 24, 2010, reflected agency comments including the addition of trawling as a gear type to develop data on fish utilizing deeper portions of the project area, clarification of the rationale for benthic sampling location selection on the basis of substrate types encountered, and the establishment of the time periods of mid-April and late May/early June for the collection efforts (WESTON, 2010). At the request of the resource agencies, trawling was added as gear type for the second round of sampling in June to allow characterization of the fish

community in deeper areas not amenable to electrofishing or other effective gear types. The recommended gear consisted of an 8-ft Mini-Missouri trawl, also known as the Herzog Armadillo Trawl (HAT), which was designed to capture smaller benthic lithophil fish species typically undersampled in larger rivers (Herzog et al., 2005). Prior to field collections, Scientific Collection Permit (SCP) No. 389 was obtained from PFBC (Attachment 2).

METHODS AND MATERIALS

Fish Sampling

To adequately characterize the fish community associated with the Southport area, multiple habitats both within the footprint of construction activities and adjacent areas were sampled. Fish sampling was performed at the intertidal and subtidal habitat along the shoreline in the southern and eastern portion of the proposed site, the stormwater channel that enters the area between Pier 124 and the former Philadelphia Naval Shipyard. Although not included in the footprint of the design, the intertidal and subtidal habitat in the vicinity of Piers 122 and 124 was also sampled to provide additional data.

Two fish collection rounds were proposed. The initial round was performed from April 25 through 27, 2010, and the second round was performed from June 1 through 3, 2010, to maximize the potential for capturing fish utilizing the area during the spring and early summer spawning and migration period.

A combination of fish sampling methods was employed to characterize each area. These methods included boat-mounted and backpack electrofishing electrofisher, seining, and trotlining in the April sampling round. An 8-ft Mini-Missouri trawl was added as a gear type in the June sampling round. Past sampling gear types included boat-mounted and backpack electrofishing, seining, and gillnetting (Normandeau, 2004 and Versar, 2007). Other potential gear types including fyke/trap nets and gillnets were considered but eliminated for the 2010 fish sampling effort. Fyke/trap netting was eliminated due to concerns of limited or uncertain effectiveness. Gillnetting was eliminated due to concerns of potential lethality.

Electrofishing is an efficient capture method that can be used to obtain reliable information on species composition and fish abundance. It can also be used to sample areas unsuitable for other capture methods (i.e., dense vegetation, pilings, and rocky shorelines) (EPA, 1993 and Reynolds, 1996). Electrofishing in open water areas was conducted using a boat-mounted Smith-Root Model VI-A 5KW electrofisher. Electrofishing was performed within the project area with emphasis on areas containing structure (i.e., rock piles, SAV, piles). The stormwater channel was sampled using a backpack-mounted Smith-Root LR-24 400W battery-powered electrofisher fitted with a hand-held wand. Electrofishing time was recorded for each of the runs.

A 50-ft-long by 5-ft-deep 3/16" mesh bag seine was used to collect fish in the shallow water areas of project area where sampling with a boat was not practicable. Much of the shoreline in the project area has rubble and rock shoreline that precluded use of a seine due to entanglements or obstructions. Seine sampling was conducted during high tide to collect fish species typical of the nearshore and shallow mudflat habitat and the stormwater channel near confluence with the river. During June sampling, the seine length was reduced to approximately 10 ft to minimize overcatch of young of the year (YOY) fish.

Trotlines consisting of long, heavy cordage with multiple baited hooks attached by sections of monofilament line were also deployed. Trotlining is an effective gear type for capturing ictalurids such as channel catfish (*Ictalurus punctatus*) and bullheads (*Ameiurus spp.*) that are generally undersampled by electrofishing and shallow water seining. Trotlines of 25 hooks each spaced at approximately 6-ft intervals were set during daytime hours with set times ranging from 1 hour 10 minutes to 6 hours 40 minutes. Trotline hooks ranged in size from #8 to #4 and were baited with chicken livers.

An 8-ft headrope Mini-Missouri trawl was deployed to sample deeper waters that are not conducive to electrofishing during the second sampling round in June 2010. The Mini-Missouri trawl utilizes an outer mesh bag to increase catch of smaller-bodied species relative to conventional larger mesh otter trawls, especially benthic lithophils that are

typically under-sampled in larger river systems, and is based on a design by Herzog et al. (2005). Trawling was performed for approximately 1-to 5-minute intervals along transects running parallel to the shore and current. Tow cable lengths were adjusted to correspond with water depth and a float was attached by a line to the cod end of the trawl to permit recovery in the event of snagging.

At the completion of each sampling activity, processing of fish samples was initiated. Specimens captured during boat-mounted electrofishing were identified, measured, and released during the individual runs. All efforts were made to minimize handling stress and all fish were returned to the water body alive, except for voucher specimens or small/juvenile fish requiring laboratory identification. Fish were identified to species, counted, and the total length (cm) measured for the largest and smallest specimens. General data were recorded on all specimens captured, including species identification, number of specimens (per species), approximate size (length), anomalies displayed such as deformities, eroded fins, lesions, exterior tumors (DELTs), and general condition of fish. Voucher specimens of each species were preserved and retained for identification to the lowest practicable taxon by a qualified ichthyologist. Species catch are reported for each sampling method.

Macrobenthic Invertebrate Sampling

Macrobenthic invertebrate sampling was performed on May 13 and 14, 2010. A standard (6 inch by 6 inch) stainless-steel petite ponar dredge grab sample of sediment was collected from a total of 30 macrobenthic invertebrate sampling locations. A total of 13 samples were collected from the river off the interpier area and off the southern and southeastern shoreline below the interpier area. A total of 15 samples were collected from the interpier area and 2 samples were collected from the stormwater channel. The ponar was operated from the work boat except for the two stormwater channel locations where the ponar was operated while wading. While the *Technical Plan* approach intended that each sample would consist of one successful ponar grab in which the dredge was recovered with a full receptacle of sediment, substrate conditions in river channel and shoal area along the southern shore precluded this. In areas where partial grabs occurred

due to the presence of hard-packed sand and/or cobble, samples were obtained from multiple grabs (i.e., up to 10 partial grabs). As a result, sediment volumes were highly variable between samples. At location SCTB27, a single large cobble (approximately 14 x 13 x 4 cm) was retrieved in the ponar and, due to the presence of gammarid amphipods, was retained as a sample. At location SCTB24, only leaf pack was retrieved and, after confirming the presence of the leaf pack substrate with a second grab sample, the initial leaf pack grab was retained as a sample.

Sediment samples were preserved in the field with 70% isopropanol and transferred to Normandeau Associates laboratory in Stowe, Pennsylvania, for sieving, preservation, taxonomic identification to the lowest practicable taxon, enumeration, and calculation of macrobenthic invertebrate community richness, tolerance, diversity, dominance, and evenness metrics.

Concurrent with sampling biota, routine water quality parameters including dissolved oxygen, pH, temperature, conductivity, and Secchi depth were measured and recorded at selected locations.

RESULTS

Fish Survey Results

Fish collected during the April sampling round are tabulated by gear type, deployment, and location in Table 1. April sampling locations are shown in Figure 1. June fish collections are similarly tabulated in Table 2 and the sampling locations are shown in Figure 2. Table 3 contains a summary of all fish captured within the project area and fish captured within subareas of the site defined as the stormwater channel, the interpier area, and the river (consisting of the channel and southern/southeastern shorelines below the interpier area). Community metrics for the overall collection and by area for the combined April and June rounds are also provided in Table 3.

A total of approximately 6,000 fish representing 27 different species were collected during the study. A total of 1,387 fish representing 15 different species were collected

during the April round. The banded killifish (*Fundulus diaphanus*) was the dominant species in the stormwater channel followed by the mummichog (*F. heteroclitus*). American eel (*Anguilla rostrata*) were also abundant in the stormwater channel with sizes ranging from 4.5 to 37.5 cm. Banded killifish were also dominant in the interpier area followed by channel catfish in the April sampling round. Channel catfish were the dominant species in the river sampling areas during April. No YOY fish were captured during the April sampling round.

In the June sampling round, the eastern silvery minnow (*Hybognathus regius*) was dominant in the stormwater channel followed by banded killifish. The reduction in the number of individuals captured in the stormwater channel is likely a consequence of shortening the beach bag seine from 50 ft to 10 ft long to reduce overcatch and excessive mortality of YOY species. In the interpier area, mummichog was the dominant species in the June sampling round followed by white perch (*Morone americana*). In June sampling in the river area, a single beach seine pull at a gravel beach area along the southeastern shoreline yielded approximately 4,000 YOY alosids. Although preserved in the field in 70% isopropanol, a subsample of the alosids could not be identified due to deterioration and could have been blueback herring (*Alosa aestivalis*), alewife (*A. pseudoharengus*), American shad (*A. sapidissima*), or hickory shad (*A. mediocris*). Other than YOY alosids, the dominant species in the river area was eastern silvery minnow closely followed by channel catfish in the June sampling round. Striped bass (*Morone saxatilis*) adults were present in both the April and June sampling rounds and YOY striped bass were present in the June sampling round.

Fish species common throughout the areas sampled included brown bullhead (*Ameiurus nebulosus*), American eel, tessellated darter (*Etheostoma olmstedi*), eastern silvery minnow, channel catfish, and white perch. Adult fish species present in the study area with low abundances (i.e., less than 5 specimens captured) included white catfish (*A. catus*), yellow bullhead (*A. natalis*), brown bullhead, the non-indigenous goldfish (*Carassius auratus*), white sucker (*Catostomus commersoni*), redbreast sunfish (*Lepomis auritus*), bluegill sunfish (*L. macrochirus*), largemouth bass (*Micropterus salmoides*),

spottail shiner (*Notropis hudsonius*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), and hogchoker (*Trinectes maculatus*).

Macrobenthic Invertebrate Survey Results

Sediment sample physical characteristics are provided in Table 4 and locations are shown in Figure 3. As discussed above, sediment volumes obtained were variable due to the hard-packed substrate, especially in locations in the river off of the southern and southeastern shorelines. The smallest sample was the single large cobble with an estimated volume of <50 cubic centimeters (cm^3) from location SCTB27. Sediment sample volumes from areas with finer substrate ranged from 350 cm^3 to 2,800 cm^3. Macrobenthic invertebrate taxa and metrics are presented in Table 5 on an "as received" basis (i.e., taxa counts based on actual sample volume). An alternate tabulation of the macrobenthic invertebrate data in which the counts are normalized to 1 liter (1000 cm^3) of sample is provided in Table 6. The following discussion of the results is based on the non-normalized data in Table 5.

A total of 65 taxa were collected and identified from the study area. Taxa richness in the samples ranged from 2 to 17 in the samples from the river off the interpier area and southeastern and southern shorelines, from 1 to 16 in the interpier area, and from 13 to 18 in the stormwater channel. It is notable that the river sample with 17 taxa was the single large cobble sample. Examination of this cobble and other smaller cobbles collected in the river samples indicated low embeddedness. Shannon diversity (base e) values ranged from 0.66 to 2.13 in the river samples, from 0 to 2.13 in the interpier area samples, and from 1.79 to 1.99 in the stormwater channel samples. Shannon evenness (equitability) values ranged from 0.37 to 1.0 (complete equitability) in the river samples, from 0.35 to 0.87 in the interpier area samples, and from 0.62 to 0.67 in the stormwater channel samples. At most locations, tubificids of the genus *Limnodrilus* were the dominant taxon.

Modified Hilsenhoff Biotic Integrity (HBI) index values ranged from 4.4 (in the leaf pack sample) to 9.5 in the river samples, from 6.6 to 10.0 in the interpier area samples, and from 6.7 to 7.3 in the stormwater channel samples. In the interpier area which was

characterized by soft fine unconsolidated substrate, most (11 of 15) samples had HBI values greater than 9. As expected for the upper Delaware River estuary, Ephemeroptera (mayflies) and Trichoptera (caddisflies) were poorly represented with the mayfly *Caenis* sp. present in a stormwater channel sample and the caddisfly *Ceraclea* sp. present in a single river sample. The amphipod crustacean *Gammarus fasciatus* was present at a number of samples from the river and interpier areas and in a stormwater channel sample. The isopod crustacea *Cyathura polita* and *Exosphaeroma papillae* were present in some river locations with only limited occurrence in the interpier area.

Water Quality Data

Water quality data are provided in Table 7.

Conclusion

Based on the range of substrate type and the diversity and abundance of macrobenthic invertebrates present in the study area and the results of fish survey, the macrobenthic invertebrate community at the proposed Southport Development Project provides a significant source of forage for fish utilizing the site. In conclusion, the study area supports a diverse fish community typical of the tidal freshwater Delaware River. Most of the fish encountered in the Spring 2010 survey are freshwater species but euryhaline species such as the hogchoker are also present. Habitat types within the study area are also diverse with substrate types ranging from unconsolidated sandy silt through hard packed sand and cobble substrates with some areas containing leaf pack. Overhanging brush and coarse rubble provide structure for fish along the southeastern and southern shoreline. The stormwater channel is shallow and the presence of the stone weir near confluence with the Delaware River at the lowermost interpier area appears to exclude most large predator fish species, thus providing a refuge for smaller fish species. No rare, threatened, or endangered species were encountered during the aquatic survey.

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Table 1

April Fish Data

Sample Area:	E1	Stormwater channel reach above stone weir			E1	Southern and southeastern shoreline		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.599	75° 08.559			39° 53.577	75° 08.376		
End Coordinates	39° 53.574	75° 08.605			39° 53.299	75° 09.094		
Gear Type / Method:	Electrofishing				Electrofishing			
Date:	April 29, 2010				April 29, 2010			
Start Time:	9:46				12:43			
End Time:	10:16				1:45			
Elapsed Time:	30 minutes				52 minutes	(62 minutes less 10 min intermediate sample processing)		
Tide:	Low slack				Flood			
	861 seconds on timer; 3 crayfish in addition to fish species				1477 seconds on timer			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	46	4.5	37.5					
Goldfish (*Carassius auratus*)					1	34.5 (37.5)		
White sucker (*Catostomus commersonii*)					1	40.0 (42.5)		
Common carp (*Cyprinus carpio*)					1	80.0 (84.0)		
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)	4	(5.5)	(8)					
Banded killifish (*Fundulus diaphanus*)	28	3.0	8.5					
Mummichog (*Fundulus heteroclitus*)	7	5.0	9.0					
Eastern silvery minnow (*Hybognathus regius*)	14	6.5 (7,0)	11.5 (12.5)					
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)	2	8.5 (9)	19.5 (21.0)					
Striped bass (*Morone saxatilis*)					2	38.0 (40.5)	54.0 (55.0)	
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	6				4			
Number of individuals (N)	101				5			

Table 1

April Fish Data

Sample Area:	E2	Interpier areas			S1	Mudflat at stormwater channel mouth		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.849	75° 09.094			Need to pull coordinates from figure			
End Coordinates								
Gear Type / Method:	Electrofishing				Seining			
Date:	April 29, 2010				April 28, 2010			
Start Time:	14:05				10:45			
End Time:	15:10							
Elapsed Time:	50 minutes	(65 minutes less 15 min intermediate sample processing / running)			5 minutes			
Tide:	Flood				Flood			
	1379 seconds on timer							
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	1	(38.0)						
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)	4	66.0 (71.0)	nr					
Gizzard shad (*Dorosoma cepedianum*)	2	32.5 (37.0)	35.5 (40.0)					
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)					155	(3.0)	(9.6)	
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	4	39.0 (45.0)	47.0 (52.0)					
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)	1	20.5 (22.0)						
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	5				1			
Number of individuals (N)	12				155			

Table 1

April Fish Data

Sample Area:	S2	Stormwater channel above stone weir			T1	Interpier area adjacent to mudflat		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.599	75° 08.559			39° 53.619	75° 08.420		
End Coordinates								
Gear Type / Method:	Seining				Trotlining - 25 hook set			
Date:	April 28, 2010				April 27, 2010			
Start Time:	11:10				13:35			
End Time:					14:45			
Elapsed Time:	5 minutes				1 hour 10 minutes			
Tide:	Flood				Flood			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)	3	(6.6)	(8.1)					
Banded killifish (*Fundulus diaphanus*)	877	(3.3)	(10.3)					
Mummichog (*Fundulus heteroclitus*)	169	(4.3)	(11.3)					
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)					1	(48.5)		
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)	3	(4.5)	(5.0)					
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)	11	(7.5)	(9.9)					
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)	2	(5.0)	(13.0)					
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	6				1			
Number of individuals (N)	1065				1			

Table 1

April Fish Data

Sample Area:	T2	Interpier area adjacent to mudflat			T3-1	Southeastern shoreline below interpier area		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.619	75° 08.0411			39° 53.534	75° 08.416		
End Coordinates					39° 53.540	75° 08.418		
Gear Type / Method:	Trotlining - 25 hook set				Trotlining - 25 hook set			
Date:	April 27, 2010				April 27, 2010			
Start Time:	1:15pm				12:45pm			
End Time:	3:15pm				14:45pm			
Elapsed Time:	2 hours				2 hours			
Tide:	High/Slack				High/Slack			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	1	41.0 (44.0)			5	37.5 (42.0)	49.0 (53.0)	eroded tail fin (1)
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	1				1			
Number of individuals (N)	1				5			

Table 1

April Fish Data

Sample Area:	T4-1	Southern shoreline above former seaplane hangar			T3-2	Southeastern shoreline below interpier area		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.315	75° 08.869			39° 53.534	75° 08.416		
End Coordinates	39° 53.285	75° 08.823			39° 53.540	75° 08.418		
Gear Type / Method:	Trotlining - 25 hook set				Trotlining - 25 hook set			
Date:	April 27, 2010				April 28, 2010			
Start Time:	13:30pm				9:20			
End Time:	15:00pm				12:50			
Elapsed Time:	1 hour 30 minutes				3 hours 30 minutes			
Tide:	High/Slack				Slack/Flood			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	1	est.30in			1	est.30in		
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	6	35.5 (38.5)	39.5 (43.5)	short barbels (1)	6	43.0 (48.0)	56.0 (61.0)	parasites (1)
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)	1	(19.0)						
Striped bass (*Morone saxatilis*)					1	23.0 (25.0)		
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	3				3			
Number of individuals (N)	8				8			

Table 1

April Fish Data

Sample Area:	T4-2	Southern shoreline above former seaplane hangar			T5	Interpier area between Piers 123 and 124		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.315	75° 08.869			39° 53.697	39° 53.557		
End Coordinates	39° 53.285	75° 08.823			75° 08.433	75° 08.399		
Gear Type / Method:	Trotlining - 25 hook set				Trotlining - 25 hook set			
Date:	April 28, 2010				April 28, 2010			
Start Time:	9:40				9:20			
End Time:	14:20				12:50			
Elapsed Time:	3 hours 40 minutes				3 hours 30 minutes			
Tide:	Low slack/Flood				Low slack/Flood			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	1	est.30in			1	est.30in		
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	6	37.0 (41.5)	46.0 (51.0)		14	36.0 (39.5)	49.5 (54.0)	two observed w/ leeches attached
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	2				2			
Number of individuals (N)	7				15			

Table 1

April Fish Data

					All Locations	Stormwater Channel	Interpier	River
Sample Area:	T6	Interpier area between Pier 124 and sheetpile						
	Northing	**Easting**						
Start Coordinates:	39° 53.642	39° 53.626						
End Coordinates	75° 08.37	75° 08.377						
Gear Type / Method:	Trotlining - 25 hook set							
Date:	April 28, 2010							
Start Time:	9:40							
End Time:	1:15							
Elapsed Time:	3 hours 35 minutes							
Tide:	Low slack/Flood							
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**				
Blueback herring (*Alosa aestivalis*)					0	0	0	0
Alewife (*Alosa pseudoharengus*)					0	0	0	0
American shad (*Alosa sapidissima*)					0	0	0	0
Alosid Young of Year (*Alosa* sp. YOY)					0	0	0	0
White catfish (*Ameiurus catus*)					0	0	0	0
Yellow bullhead (*Ameiurus natalis*)	3	(37.0)	(42.5)		3	0	3	0
Brown bullhead (*Ameiurus nebulosus*)					0	0	0	0
American eel (*Anguilla rostrata*)					51	46	2	3
Goldfish (*Carassius auratus*)					1	0	0	1
White sucker (*Catostomus commersonii*)					1	0	0	1
Common carp (*Cyprinus carpio*)					5	0	4	1
Gizzard shad (*Dorosoma cepedianum*)					2	0	2	0
Tessellated darter (*Etheostoma olmstedi*)					7	7	0	0
Banded killifish (*Fundulus diaphanus*)					1060	905	155	0
Mummichog (*Fundulus heteroclitus*)					176	176	0	0
Eastern silvery minnow (*Hybognathus regius*)					14	14	0	0
Channel catfish (*Ictalurus punctatus*)		35.0 (39.0)	57.0 (61.0)		43	0	20	23
Redbreast sunfish (*Lepomis auritus*)					0	0	0	0
Pumpkinseed sunfish (*Lepomis gibbosus*)					0	0	0	0
Bluegill sunfish (*Lepomis macrochirus*)					3	3	0	0
Largemouth bass (*Micropterus salmoides*)					0	0	0	0
White perch (*Morone americana*)					14	13	0	1
Striped bass (*Morone saxatilis*)	1	43.0 (46.0)			5	0	2	3
Morone sp. YOY					0	0	0	0
Spottail shiner (*Notropis hudsonius*)					2	2	0	0
Yellow perch (*Perca flavescens*)					0	0	0	0
Black crappie (*Pomoxis nigromaculatus*)					0	0	0	0
Hogchoker (*Trinectes maculatus*)					0	0	0	0
Number of species (s)	2				15	8	7	7
Number of individuals (N)	4				1387	1166	188	33

Note: Print Area should exclude these columns (A through BA only)

Table 2

June Fish Data

Sample Area:	E1	Stormwater channel above stone weir			E1	Southeastern and southern shorelines		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.599	75° 08.559			39° 53.599	75° 08.559		
End Coordinates	39° 53.574	75° 08.605			39° 53.574	75° 08.605		
Gear Type / Method:	Electrofishing (backpack)				Electrofishing (boat-mounted)			
Date:	June 1, 2010				June 1, 2010			
Start Time:	13:40				13:20			
End Time:	14:30				14:25			
Elapsed Time:	50 minutes				45 minutes	(less 20 minutes processing)		
Tide:	Ebb				Ebb			
					1629 seconds on timer			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)	1	(32.0)		Numerous lesions	1	(35.5)		
American eel (*Anguilla rostrata*)	11	(11.0)	(29.0}		2	observed but not netted		
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)					6	56.0 (60.0)	63 (70.5)	
Gizzard shad (*Dorosoma cepedianum*)					2	34.0 (38,0)	42.5 (48.0)	
Tessellated darter (*Etheostoma olmstedi*)	6	nr	(7.0)					
Banded killifish (*Fundulus diaphanus*)	15	(4.0)	(9.0)	Lesions				
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)	3	nr	9.0 (10.0)					
Channel catfish (*Ictalurus punctatus*)	1	48.0 (53.0)			8	33.5 (38.0)	43.0 (48.0)	
Redbreast sunfish (*Lepomis auritus*)	1	17.0 (18.0)						
Pumpkinseed sunfish (*Lepomis gibbosus*)	11	12.0 (13.0)	16.5 (17.0)					
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)	2	31.0 (33.0)	35.0 (36.0)	Dorsal fin lesion				
White perch (*Morone americana*)	3	7.5 (8.0)	20.0 (21.0)		5	16.0 (17.0)	16.0 (17.5)	
Striped bass (*Morone saxatilis*)					3	19.5 (21.5)	54.0 (57.0)	
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	10				7			
Number of individuals (N)	54				27			

Table 2

June Fish Data

Sample Area:	E2	Interpier area			S1	Stormwater channel above stone weir		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	Pull from figure (Northern most point)				39° 53.599	75° 08.559		
End Coordinates	Pull from figure (Southeastern most point)							
Gear Type / Method:	Electrofishing (boat-mounted)				Beach seine (10 ft)			
Date:	June 1, 2010				June 3, 2010			
Start Time:	15:20				9:15			
End Time:	16:30							
Elapsed Time:	50 minutes	(less 20 minutes processing / running)						
Tide:	Ebb				Ebb			
					Beach seine shortened to 10 ft to reduce overcatch			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)	1	82.0 (87.0)		?				
Gizzard shad (*Dorosoma cepedianum*)	2	nr	nr	?				
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)					1	(7.0)		
Mummichog (*Fundulus heteroclitus*)					3	(5.5)	(8.0)	
Eastern silvery minnow (*Hybognathus regius*)	2	8.0 (8.5)	10.5 (11.5)		20	(6.5)	(9.5)	
Channel catfish (*Ictalurus punctatus*)	1	40.0 (45.0)						
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)	1	13.0 (13.5)						
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)	4	8.0 (8.5)	16.0 (17.0)					
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	6				3			
Number of individuals (N)	11				24			

Table 2

June Fish Data

Sample Area:	S2	Mudflat at stormwater channel			S3	Shoreline at upper interpier area (above Pier 123)		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	Pull from figure				39° 53.814	75° 08.461		
End Coordinates					39° 53.825	75° 8.463		
Gear Type / Method:	Beach seine (10 ft)				50' beach seine			
Date:	June 3, 2010				June 2, 2010			
Start Time:	09:45am				10:45am			
End Time:								
Elapsed Time:								
Tide:	Ebb				Ebb			
	Beach seine shortened to 10 ft to reduce overcatch							
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)					2 (YOY)	(3.4)	(3.6)	
Alewife (*Alosa pseudoharengus*)					1 (YOY)	(3.3)		
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)					5 (YOY)	(3.2)	(3.5)	
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)					1	(10.0)		
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)					3	(6.5)	(7.0)	
Banded killifish (*Fundulus diaphanus*)	2	(5.7)	(7.4)		34	(5.0)	(10.5)	
Mummichog (*Fundulus heteroclitus*)	16	(4.6)	(6.6)		182	(4.7)	(9.5)	
Eastern silvery minnow (*Hybognathus regius*)					9	8.5 (9)	12.5 (13.5)	
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)					4 (3 YOY)	(1.9)	(2.9 YOY) 8.5 (9.0)	
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	2				9			
Number of individuals (N)	18				241			

Table 2

June Fish Data

Sample Area:	S4	Gravel beach along southeastern shoreline			T1	Interpier area off mudflat		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.525	75° 08.433			39° 53.690	75° 08.382		
End Coordinates					39° 53.668	75° 08.387		
Gear Type / Method:	50' beach seine				Trotlining - 25 hook set			
Date:	June 2, 2010				June 1, 2010			
Start Time:	11:35				11:45			
End Time:					17:00			
Elapsed Time:					5 hours 15 minutes			
Tide:	Ebb				Low slack/flood			
	Y-O-Y subsample retained for ID; Total count estimate based on subsample count							
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)	est. 4000 (YOY)	(3.2)	(3.8)					
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)	2	6.7	7.5					
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)	29	6.2	14.5					
Channel catfish (*Ictalurus punctatus*)					8	34.0 (38.0)	44 (49)	Lesions around mouth
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)	4	8.7	9.2					
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	4				1			
Number of individuals (N)	4035				8			

Table 2

June Fish Data

Sample Area:	T2	Interpier area between sheetpile and Pier 124			T3	Southeastern shoreline		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.655	75° 08.410			39° 53.534	75° 08.416		
End Coordinates	39° 53.627	75° 08.390			39° 53.540	75° 08.418		
Gear Type / Method:	Trotlining - 25 hook set				Trotlining - 25 hook set			
Date:	June 1, 2010				June 1, 2010			
Start Time:	11:30				11:30			
End Time:	16:45				17:30			
Elapsed Time:	5 hours 15 minutes				6 hours			
Tide:	Low slack/flood				Flood			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)					1	42.0 (48.0)		
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	4	36.5 (37.5)	51.0 (56.0)		12	36.0 (40.0)	60.0 (65.5)	
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	1				2			
Number of individuals (N)	4				13			

Table 2

June Fish Data

Sample Area:	T4 Southern Shoreline				T5	Western end of upper interpier area		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.315	75° 08.869			39° 53' 50.1"	75° 08' 26.4"		
End Coordinates	39° 53.285	75° 08.823			39° 53' 50.0"	75° 08' 25.2"		
Gear Type / Method:	Trotlining - 25 hook set				Trotlining - 25 hook set			
Date:	June 1, 2010				June 2, 2010			
Start Time:	12:00				9:45			
End Time:	17:00				16:15			
Elapsed Time:	5 hours				6 hours 30 minutes			
Tide:	Flood				Ebb/Flood			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**				
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	8	36.0 (40.0)	45.0 (49)		3	43 .0(47.0)	51.0 (56.0)	
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)	1	50.0 (57.0)						
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	2				1			
Number of individuals (N)	9				3			

Table 2

June Fish Data

Sample Area:	T6	Eastern end of upper interpier area			T7	Below green buoy in channel off interpier area at Piers 123 and 124		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53.781	75° 08.281			39° 53' 21.0"	75° 08' 34.4"		
End Coordinates	39° 53.798	75° 08.267						
Gear Type / Method:	Trotlining - 25 hook set				Trotlining - 25 hook set			
Date:	June 2, 2010				June 2, 2010			
Start Time:	10:00				9:20			
End Time:	16:25				16:00			
Elapsed Time:	6 hours 25 minutes				6 hours 40 minutes			
Tide:	Ebb/Flood				Ebb/Flood			
	No fish captured							
Species:					**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)					2	25.0 (27.5)	45.0 (48.0)	
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)					1	20.0 (21.0)		
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	0				2			
Number of individuals (N)	0				3			

Table 2

June Fish Data

Sample Area:	T8	Off end of Pier 124			MMT0	Off end of Pier 124		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53' 40.0"	75° 08' 18.3"						
End Coordinates								
Gear Type / Method:	Trotlining - 25 hook set				Mini-Missouri Trawl			
Date:	June 2, 2010				June 2, 2010			
Start Time:	9:45				14:00			
End Time:	16:15				14:01			
Elapsed Time:	6 hours 30 minutes				1 minute			
Tide:	Ebb/Flood				Flood			
					First trial trawl; terminated due to snagging. Hogchokers absent in subsequent trawls.			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	1	(60.5)						
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)	2	40.5 (44.0)	54.0 (57.0)					
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)					3	(4.6)	(6.0)	
Number of species (s)	2				1			
Number of individuals (N)	3				3			

Table 2

June Fish Data

Sample Area:	MMT1	Interpier area off sheet pile			MMT3	Western reach along southern shoreline		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53' 41.4"	75° 08' 32.8"			39° 53' 16.17"	75° 09' 2.10"		
End Coordinates	39° 53' 40.3"	75° 08' 21.7"			39° 53 17.17	75° 08' 54.1"		
Gear Type / Method:	Mini-Missouri Trawl				Mini-Missouri Trawl			
Date:	June 2, 2010				June 3, 2010			
Start Time:	14:40				10:41			
End Time:	14:45				10:44			
Elapsed Time:	5 minutes				3 minutes			
Tide:	Flood				Ebb			
					An estuarine mud crab, *Rhithropanopeus harrisii*, with a carapace width of 20 mm was also captured			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)	1 (YOY)	(1.7)						
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)	2	(10.4)	(12.5)					
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)	1 (YOY)	(2.1)			9 (7 YOY)	(1.6 YOY)	(2.7 YOY) (7.0)	
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)	4	7.5 (8.5)	8.5 (9.5)					
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)	103 (49 YOY)	(1.7 YOY) 6.0 (6.5)	(2.2 YOY) 21.0 (23.0)		1 (YOY)	(1.6)		
Striped bass (*Morone saxatilis*)	20 (YOY)	(1.2)	(2.0)		15 (YOY)	(1.2)	(2.0)	
Morone sp. YOY	8 (YOY)	(1.0)	(1.3)					
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)	1	(12)						
Black crappie (*Pomoxis nigromaculatus*)	1		12.0					
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	9				3			
Number of individuals (N)	141				25			

Table 2

June Fish Data

Sample Area:	MMT4	Central reach along southern shoreline			MMT5	Eastern reach along southern shoreline		
	Northing	**Easting**			**Northing**	**Easting**		
Start Coordinates:	39° 53' 17.4"	75° 08' 50.4"			39° 53' 18.1"	75° 08' 42.3"		
End Coordinates	39° 53' 18.0"	75° 08' 48.0"			39° 53' 18.9"	75° 08' 40.6"		
Gear Type / Method:	Mini-Missouri Trawl				Mini Missouri Trawl			
Date:	June 3, 2010				June 3, 2010			
Start Time:	11:04				11:43am			
End Time:	11:07				11:46am			
Elapsed Time:	3 minutes				3 minutes			
Tide:	Ebb				Ebb			
					No fish captured; cod end contained approximately 6 ft of leafpack			
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
Alewife (*Alosa pseudoharengus*)								
American shad (*Alosa sapidissima*)								
Alosid Young of Year (*Alosa* sp. YOY)								
White catfish (*Ameiurus catus*)								
Yellow bullhead (*Ameiurus natalis*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	2	(16.0)	(18.0)					
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Gizzard shad (*Dorosoma cepedianum*)								
Tessellated darter (*Etheostoma olmstedi*)	2	(6.0)	(8.5)					
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Pumpkinseed sunfish (*Lepomis gibbosus*)								
Bluegill sunfish (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Morone sp. YOY								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
Black crappie (*Pomoxis nigromaculatus*)								
Hogchoker (*Trinectes maculatus*)								
Number of species (s)	2				0			
Number of individuals (N)	4				0			

Table 2

June Fish Data

					All locations	Stormwater Channel	Interpier	River
Sample Area:	MMT6	Channel off mouth of mudflat						
	Northing	**Easting**						
Start Coordinates:	39° 53' 35.3"'	75° 08' 21.8"			Note: Print Area should exclude these columns (A through GC only)			
End Coordinates	39° 53' 38.7"	75° 08' 19.4"'						
Gear Type / Method:	Mini-Missouri Trawl							
Date:	June 3, 2010							
Start Time:	13:13							
End Time:	16:16							
Elapsed Time:	3 minutes							
Tide:	Ebb							
Species:	**Total No.**	**Min. Length (cm) FL (TL)**	**Max. Length (cm) FL (TL)**	**Anomalies (DELTs)**				
Blueback herring (*Alosa aestivalis*)					2	0	2	0
Alewife (*Alosa pseudoharengus*)					1	0	1	0
American shad (*Alosa sapidissima*)					0	0	0	0
Alosid Young of Year (*Alosa* sp. YOY)					4006	0	6	4000
White catfish (*Ameiurus catus*)					1	0	0	1
Yellow bullhead (*Ameiurus natalis*)					0	0	0	0
Brown bullhead (*Ameiurus nebulosus*)					4	1	2	1
American eel (*Anguilla rostrata*)					17	11	1	5
Goldfish (*Carassius auratus*)					0	0	0	0
White sucker (*Catostomus commersonii*)					0	0	0	0
Common carp (*Cyprinus carpio*)					7	0	1	6
Gizzard shad (*Dorosoma cepedianum*)					4	0	2	2
Tessellated darter (*Etheostoma olmstedi*)					23	6	4	13
Banded killifish (*Fundulus diaphanus*)					52	16	36	0
Mummichog (*Fundulus heteroclitus*)					201	3	198	0
Eastern silvery minnow (*Hybognathus regius*)					67	23	15	29
Channel catfish (*Ictalurus punctatus*)					47	1	16	30
Redbreast sunfish (*Lepomis auritus*)					1	1	0	0
Pumpkinseed sunfish (*Lepomis gibbosus*)					12	11	1	0
Bluegill sunfish (*Lepomis macrochirus*)					0	0	0	0
Largemouth bass (*Micropterus salmoides*)					2	2	0	0
White perch (*Morone americana*)	1	16.0 (17.0)			126	3	111	12
Striped bass (*Morone saxatilis*)					41	0	20	21
Morone sp. YOY					8	0	8	0
Spottail shiner (*Notropis hudsonius*)					0	0	0	0
Yellow perch (*Perca flavescens*)					1	0	1	0
Black crappie (*Pomoxis nigromaculatus*)					1	0	1	0
Hogchoker (*Trinectes maculatus*)					3	0	0	3
Number of species (s)	1				22	11	18	12
Number of individuals (N)	1				4627	78	426	4123

Table 3
Summary of Spring 2010 Fish Collections

Species	All Locations			Stormwater Channel			Interpier Area			River		
	April	June	Combined	April	June	Combined	April	June	Combined	April	June	Combined
Blueback herring (*Alosa aestivalis*)	0	2	2	0	0	0	0	2	2	0	0	0
Alewife (*Alosa pseudoharengus*)	0	1	1	0	0	0	0	1	1	0	0	0
Alosid Young of Year (*Alosa* sp. YOY)[1]	0	4006	4006	0	0	0	0	6	6	0	4000	4000
White catfish (*Ameiurus catus*)	0	1	1	0	0	0	0	0	0	0	1	1
Yellow bullhead (*Ameiurus natalis*)	3	0	3	0	0	0	3	0	3	0	0	0
Brown bullhead (*Ameiurus nebulosus*)	0	4	4	0	1	1	0	2	2	0	1	1
American eel (*Anguilla rostrata*)	51	17	68	46	11	57	2	1	3	3	5	8
Goldfish (*Carassius auratus*)	1	0	1	0	0	0	0	0	0	1	0	1
White sucker (*Catostomus commersonii*)	1	0	1	0	0	0	0	0	0	1	0	1
Common carp (*Cyprinus carpio*)	5	7	12	0	0	0	4	1	5	1	6	7
Gizzard shad (*Dorosoma cepedianum*)	2	4	6	0	0	0	2	2	4	0	2	2
Tessellated darter (*Etheostoma olmstedi*)	7	23	30	7	6	13	0	4	4	0	13	13
Banded killifish (*Fundulus diaphanus*)	1060	52	1112	905	16	921	155	36	191	0	0	0
Mummichog (*Fundulus heteroclitus*)	176	201	377	176	3	179	0	198	198	0	0	0
Eastern silvery minnow (*Hybognathus regius*)	14	67	81	14	23	37	0	15	15	0	29	29
Channel catfish (*Ictalurus punctatus*)	43	47	90	0	1	1	20	16	36	23	30	53
Redbreast sunfish (*Lepomis auritus*)	0	1	1	0	1	1	0	0	0	0	0	0
Pumpkinseed sunfish (*Lepomis gibbosus*)	0	12	12	0	11	11	0	1	1	0	0	0
Bluegill sunfish (*Lepomis macrochirus*)	3	0	3	3	0	3	0	0	0	0	0	0
Largemouth bass (*Micropterus salmoides*)	0	2	2	0	2	2	0	0	0	0	0	0
White perch (*Morone americana*)	14	126	140	13	3	16	0	111	111	1	12	13
Striped bass (*Morone saxatilis*)	5	41	46	0	0	0	2	20	22	3	21	24
Morone sp. YOY	0	8	8	0	0	0	0	8	8	0	0	0
Spottail shiner (*Notropis hudsonius*)	2	0	2	2	0	2	0	0	0	0	0	0
Yellow perch (*Perca flavescens*)	0	1	1	0	0	0	0	1	1	0	0	0
Black crappie (*Pomoxis nigromaculatus*)	0	1	1	0	0	0	0	1	1	0	0	0
Hogchoker (*Trinectes maculatus*)	0	3	3	0	0	0	0	0	0	0	3	3
Taxa richness (number of species; s)	15	22	27	8	11	13	7	18	19	7	12	14
Number of individuals (N)	1387	4627	6014	1166	78	1244	188	426	614	33	4123	4156
Shannon diversity, base e			1.15			0.52			0.41			0.42
Shannon equitability (evenness), base e			0.35			0.20			0.14			0.16
Simpson's dominance			0.48			0.57			0.86			0.93
Percent dominant taxon			66.6%			74.0%			32.2%			96.2%

[1]Alosid YOY may be blueback herring, alewife, American shad, or hickory shad

Table 4

Benthic Macroinvertebrate Sample Descriptions

Sample ID	Northing	Easting	Date	Time	Depth (ft)	Sample Description
SCTB01	39° 53' 17.4"	75° 09' 00.5"	5/13/10	11:35	19	sandy silt
SCTB02	39° 53' 18.2"	75° 08' 56.6"	5/13/10	11:50	17.6	modest amount of *Corbicula fluminea* shell, sandy silt
SCTB03	39° 53' 16.4"	75° 08' 53.9"	5/13/10	12:15	32	multiple grabs (4x) needed to retrieve sample, silty sand, isolated *Corbicula* shell, petroleum odor
SCTB04	39° 53' 38.2"	75° 08' 34.4"	5/13/10	13:05	5.4	silty organic, dark gray
SCTB05	39° 53' 39.2"	75° 08' 32.6"	5/13/10	13:15	4.8	silty organic, dark gray
SCTB06	39° 53' 39.4"	75° 08' 29.9"	5/13/10	13:20	7.1	silty organic, dark gray
SCTB07	39° 53' 38.4"	75° 08' 28.7"	5/13/10	13:30	7.1	silty organic, gray-orange
SCTB08	39° 53' 37.3"	75° 08' 25.7"	5/13/10	13:35	8.6	silty organic, gray-brown, SAV fragment
SCTB09	39° 53' 38.0"	75° 08' 23.9"	5/13/10	13:40	9.1	very fine sand, dark brown
SCTB10	39° 53' 40.7"	75° 08' 32.8"	5/13/10	14:00	21	silt, dark brown
SCTB11	39° 53' 41.9"	75° 08' 30.2"	5/13/10	14:05	32.1	very fine silty sand
SCTB12	39° 53' 40.1"	75° 08' 27.0"	5/13/10	14:15	25.1	fine silty sand
SCTB13	39° 53' 40.1"	75° 08' 20.3"	5/13/10	14:30	29.9	fine silty sand
SCTB14	39° 53' 45.5"	75° 08' 27.0"	5/13/10	14:40	33.4	fine silty sand
SCTB15	39° 53' 45.2"	75° 08' 22.3"	5/13/10	14:45	32.9	fine silty sand
SCTB16	39° 53' 49.9"	75° 08' 24.7"	5/13/10	14:55	9.3	fine silty sand
SCTB17	39° 53' 49.3"	75° 08' 20.6"	5/13/10	15:05	36.9	3 grabs, silt with fine sand, dark gray
SCTB18	39° 53' 47.3"	75° 08' 14.1"	5/13/10	15:15	45.8	low volume, slightly consolidated, sandy silt, dark brown
SCTB19	39° 53' 41.0"	75° 08' 14.2"	5/13/10	15:40	50.6	4 grabs, sandy, slightly consolidated, dark brown, fine silt
SCTB20	39° 53' 38.2"	75° 08' 17.0"	5/13/10	16:50	41.1	10 attempts, composited multiple grabs, low volume sample, silty consolidated sediment, dark brown with cobble
SCTB21	39° 53' 36.4"	75° 08' 21.3"	5/14/10	11:30	24.9	composite of multiple grabs (8x), sandy silt, brown to dark gray
SCTB22	39° 53' 30.8"	75° 08' 25.2"	5/14/10	11:40	17.1	2 grabs composited, slight petroleum odor, consolidated sandy silt, dark gray
SCTB23	39° 53' 29.5"	75° 08' 24.3"	5/14/10	12:00	44.1	multiple grabs composited, consolidated silt and coarse sand, organic with leafy detritus, dark gray to silver, slight petroleum odo
SCTB24	39° 53' 21.0"	75° 08' 34.4"	5/14/10	12:15	32.4	coarse leaf pack including oak, 2nd grab obtained to confirm presence of leaf pack, trash and rubber material, gammarids presen
SCTB25	39° 53' 20.0"	75° 08' 32.6"	5/14/10	13:20	46.5	multiple grabs required, low sample volume, coarse sand with moderate amount of *Corbicula* shell
SCTB26	39° 53' 17.6"	75° 08' 43.2"	5/14/10	13:50	25.3	multiple grabs required (8+), low sample volume, fine sand and gravel, some cobble to 3", *Corbicula* shell
SCTB27	39° 53' 17.8"	75° 08' 41.8"	5/14/10	14:25	32.4	multiple grabs, rocky substrate one large cobble stone (~ 14 × 13 × 4 cm) retrieved and retained due to presence of gammarid
SCTB28	39° 53' 15.7"	75° 08' 55.6"	5/14/10	15:05	30.1	composites of multiple grabs, low sample volume, coarse to fine sand and silt , orange to brown, dark gray
SCTB29	39° 53' 35.5"	75° 08' 33.8"	5/14/10	15:30	2.5	stormwater channel, composite of two grabs, fine sandy silt, some gravel, discarded large cobbles
SCTB30	39° 53' 34.1"	75° 08' 34.9"	5/14/10	15:40	2.5	stormwater channel, fine sandy silt, organic root materia

Table 5. Benthic macroinvertebrate data (numbers per sample) collected at Southport by Weston Solutions, Inc. on 13 and 14 May 2010.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-01 No.	SCTB-01 Percent	SCTB-02 No.	SCTB-02 Percent	SCTB-03 No.	SCTB-03 Percent	SCTB-04 No.	SCTB-04 Percent
Amphipoda										
Gammarus fasciatus	4	CG	1	0.6	3	2.0	1	5.6	2	2.8
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	2	1.3	1	0.7	1	5.6	26	36.1
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG							1	1.4
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG	1	0.6						
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG							1	1.4
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	14	8.9	12	7.9	8	44.4	17	23.6
Procladius sp.	6	CG	1	0.6	4	2.6				
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR							3	4.2
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG							1	1.4
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG	3	1.9	11	7.3	3	16.7	4	5.6
Exosphaeroma papillae[4]	5	CG								
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC			2	1.3				
Nematoda	9	CG					1	5.6	5	6.9

Table 5. Benthic macroinvertebrate data (numbers per sample) collected at Southport by Weston Solutions, Inc. on 13 and 14 May 2010.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-01 No.	SCTB-01 Percent	SCTB-02 No.	SCTB-02 Percent	SCTB-03 No.	SCTB-03 Percent	SCTB-04 No.	SCTB-04 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG							1	1.4
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG								
Aulodrilus limnobius	10	CG							3	4.2
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG							1	1.4
Ilyodrilus templetoni	10	CG	12	7.6	8	5.3				
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG	26	16.5	35	23.2				
Limnodrilus sp.	10	CG	26	16.5	35	23.2	3	16.7	3	4.2
Limnodrilus udekemianus	10	CG			18	11.9				
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG	60	38.0	16	10.6			1	1.4
Quistadrilus multisetosus	10	CG	12	7.6	4	2.6				
Turbellaria										
Hydrolimax grisea	8	PR			2	1.3	1	5.6	3	4.2
Total Number			158	100.0	151	100.0	18	100.0	72	100.0
Total sample volume (cm^3)[5]			1,200		1,350		1,150		1,050	
Metrics										
Taxa Richness			11		13		7		15	
Modified Hilsenhoff Biotic Index			9.4		9.0		6.7		6.6	
Percent Dominant Taxon			38.0		23.2		44.4		36.1	
(Identity)			*(Paranais frici)*		*(Limnodrilus)*		(*Polypedilum halterale* gr.)		*(Chironomus riporius)*	
Menhinick's Diversity Index			0.88		1.06		1.65		1.77	
Simpson's Dominance Index			0.22		0.15		0.27		0.20	
Shannon Diversity, base e			1.79		2.13		1.60		2.04	
Shannon Evenness, base e			0.75		0.83		0.82		0.75	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-05 No.	SCTB-05 Percent	SCTB-06 No.	SCTB-06 Percent	SCTB-07 No.	SCTB-07 Percent	SCTB-08 No.	SCTB-08 Percent
Amphipoda										
Gammarus fasciatus	4	CG							3	1.8
Cumacea										
Almyracuma proximoculi[4]	5	CG							2	1.2
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	31	44.9	1	1.0	3	6.5	2	1.2
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG					4	8.7		
Cryptotendipes sp.	6	CG					1	2.2	4	2.4
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG							2	1.2
Nanocladius distinctus	6	CG							2	1.2
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG							2	1.2
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	9	13.0	9	9.1	2	4.3	48	28.2
Procladius sp.	6	CG	6	8.7	3	3.0	1	2.2		
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR							1	0.6
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG	1	1.4						
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]								
Exosphaeroma papillae[4]	5	CG[4]								
Mollusca										
Corbicula fluminea	4	FC							9	5.3
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC	1	1.4			4	8.7		
Nematoda	9	CG			1	1.0	1	2.2	50	29.4

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-05 No.	SCTB-05 Percent	SCTB-06 No.	SCTB-06 Percent	SCTB-07 No.	SCTB-07 Percent	SCTB-08 No.	SCTB-08 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG					9	19.6		
Aulodrilus limnobius	10	CG	4	5.8	9	9.1	4	8.7	23	13.5
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG	1	1.4	4	4.0			4	2.4
Ilyodrilus templetoni	10	CG	2	2.9	8	8.1				
Limnodrilus cervix	10	CG	8	11.6	9	9.1				
Limnodrilus hoffmeisteri	10	CG			26	26.3	4	8.7		
Limnodrilus sp.	10	CG	6	8.7	16	16.2	13	28.3	12	7.1
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG			12	12.1			2	1.2
Quistadrilus multisetosus	10	CG								
Turbellaria										
Hydrolimax grisea	8	PR			1	1.0			4	2.4
Total Number			69	100.0	99	100.0	46	100.0	170	100.0
Total sample volume (cm^3)			1,300		1,600		1,800		1,050	
Metrics										
Taxa Richness			10		12		11		16	
Modified Hilsenhoff Biotic Index			7.2		9.4		8.8		7.7	
Percent Dominant Taxon			44.9		26.3		28.3		29.4	
(Identity)			*(Chironomus riporius)*		*(Limnodrilus hoffmeistri)*		*(Limnodrilus* sp.*)*		Nematoda	
Menhinick's Diversity Index			1.20		1.21		1.6		1.23	
Simpson's Dominance Index			0.25		0.14		0.16		0.20	
Shannon Diversity, base e			1.75		2.13		2.09		2.01	
Shannon Evenness, base e			0.76		0.86		0.87		0.72	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-09 No.	SCTB-09 Percent	SCTB-10 No.	SCTB-10 Percent	SCTB-11 No.	SCTB-11 Percent	SCTB-12 No.	SCTB-12 Percent
Amphipoda										
Gammarus fasciatus	4	CG							2	2.2
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	4	1.9						
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG	3	1.4	2	1.5			1	1.1
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG			1	0.8				
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	8	3.7	1	0.8				
Procladius sp.	6	CG	3	1.4	2	1.5			1	1.1
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR			1	0.8				
Isopoda										
Cyathura polita[4]	5	CG[4]	1	0.5						
Exosphaeroma papillae[4]	5	CG[4]								
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC								
Nematoda	9	CG	7	3.3	3	2.3	45	32.8	2	2.2

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-09 No.	SCTB-09 Percent	SCTB-10 No.	SCTB-10 Percent	SCTB-11 No.	SCTB-11 Percent	SCTB-12 No.	SCTB-12 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG	44	20.6					4	4.4
Aulodrilus limnobius	10	CG	20	9.3	24	18.5				
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG	4	1.9						
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG					16	11.7	12	13.3
Limnodrilus cervix	10	CG							20	22.2
Limnodrilus hoffmeisteri	10	CG	60	28.0	19	14.6				
Limnodrilus sp.	10	CG	60	28.0	77	59.2	68	49.6	40	44.4
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG							4	4.4
Quistadrilus multisetosus	10	CG					8	5.8	4	4.4
Turbellaria										
Hydrolimax grisea	8	PR								
Total Number			214	100.0	130	100.0	137	100.0	90	100.0
Total sample volume (cm^3)			1,300		2,200		2,800		2,700	
Metrics										
Taxa Richness			11		9		4		10	
Modified Hilsenhoff Biotic Index			9.6		9.8		9.7		9.8	
Percent Dominant Taxon			28.0		59.2		49.6		44.4	
(Identity)			(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)	
Menhinick's Diversity Index			0.75		0.79		0.34		1.05	
Simpson's Dominance Index			0.21		0.41		0.37		0.27	
Shannon Diversity, base e			1.79		1.23		1.13		1.65	
Shannon Evenness, base e			0.75		0.56		0.82		0.72	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-13 No.	SCTB-13 Percent	SCTB-14 No.	SCTB-14 Percent	SCTB-15 No.	SCTB-15 Percent	SCTB-16 No.	SCTB-16 Percent
Amphipoda										
Gammarus fasciatus	4	CG			3	4.9	2	1.5		
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	2	6.9	1	1.6	1	0.7	1	0.6
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG								
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR			1	1.6				
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG			1	1.6				
Procladius sp.	6	CG	3	10.3					2	1.1
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]								
Exosphaeroma papillae[4]	5	CG[4]								
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC					1	0.7		
Nematoda	9	CG	2	6.9	3	4.9			1	0.6

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-13 No.	SCTB-13 Percent	SCTB-14 No.	SCTB-14 Percent	SCTB-15 No.	SCTB-15 Percent	SCTB-16 No.	SCTB-16 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG	4	13.8	4	6.6	24	17.6		
Aulodrilus limnobius	10	CG								
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG							4	2.3
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG			13	21.3			84	47.7
Limnodrilus sp.	10	CG	12	41.4	21	34.4	64	47.1	84	47.7
Limnodrilus udekemianus	10	CG			8	13.1	16	11.8		
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG	5	17.2	5	8.2	16	11.8		
Quistadrilus multisetosus	10	CG	1	3.4	1	1.6	12	8.8		
Turbellaria										
Hydrolimax grisea	8	PR								
Total Number			29	100.0	61	100.0	136	100.0	176	100.0
Total sample volume (cm^3)			1,700		1,400		2,450		1,650	
Metrics										
Taxa Richness			7		11		8		6	
Modified Hilsenhoff Biotic Index			9.2		9.5		9.9		9.9	
Percent Dominant Taxon			41.4		34.4		47.1		47.7	
(Identity)			(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)	
Menhinick's Diversity Index			1.30		1.41		0.69		0.45	
Simpson's Dominance Index			0.24		0.20		0.29		0.46	
Shannon Diversity, base e			1.66		1.91		1.51		0.90	
Shannon Evenness, base e			0.85		0.80		0.73		0.50	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-17 No.	SCTB-17 Percent	SCTB-18 No.	SCTB-18 Percent	SCTB-19 No.	SCTB-19 Percent	SCTB-20 No.	SCTB-20 Percent
Amphipoda										
Gammarus fasciatus	4	CG							2	3.9
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG			8	6.8	4	1.2	2	3.9
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG								
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG							1	2.0
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG			1	0.9	27	8.2	9	17.6
Procladius sp.	6	CG					1	0.3		
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]					1	0.3	21	41.2
Exosphaeroma papillae[4]	5	CG[4]							2	3.9
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC			1	0.9				
Pisidium sp.	8	FC			7	6.0	8	2.4	8	15.7
Nematoda	9	CG					3	0.9		

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-17 No.	SCTB-17 Percent	SCTB-18 No.	SCTB-18 Percent	SCTB-19 No.	SCTB-19 Percent	SCTB-20 No.	SCTB-20 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG								
Aulodrilus limnobius	10	CG								
Aulodrilus piqueti	10	CG					4	1.2		
Aulodrilus pluriseta	10	CG							1	2.0
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG					6	1.8		
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG			100	85.5				
Limnodrilus sp.	10	CG	3	100.0			248	75.2	4	7.8
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG					16	4.8		
Quistadrilus multisetosus	10	CG					12	3.6		
Turbellaria										
Hydrolimax grisea	8	PR							1	2.0
Total Number			3	100.0	117	100.0	330	100.0	51	100.0
Total sample volume (cm^3)			1,050		650		950		650	
Metrics										
Taxa Richness			1		5		11		10	
Modified Hilsenhoff Biotic Index			10.0		9.6		9.5		6.2	
Percent Dominant Taxon			100.0		85.5		75.2		41.2	
(Identity)			*(Limnodrilus* sp.*)*		*(Limnodrilus hoffmeisteri)*		*(Limnodrilus* sp.*)*		*(Cyathura polita)*	
Menhinick's Diversity Index			0.58		0.46		0.61		1.40	
Simpson's Dominance Index			1.00		0.74		0.58		0.24	
Shannon Diversity, base e			0.00		0.57		1.03		1.77	
Shannon Evenness, base e			N/A[6]		0.35		0.43		0.77	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-21 No.	SCTB-21 Percent	SCTB-22 No.	SCTB-22 Percent	SCTB-23 No.	SCTB-23 Percent	SCTB-24 No.	SCTB-24 Percent
Amphipoda										
Gammarus fasciatus	4	CG	4	11.8	1	0.8	2	50.0	62	91.2
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG	4	11.8						
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG			4	3.1				
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG								
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG							1	1.5
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	2	5.9	7	5.5				
Procladius sp.	6	CG			3	2.3				
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]	23	67.6	2	1.6	2	50.0	1	1.5
Exosphaeroma papillae[4]	5	CG[4]	1	2.9						
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC								
Nematoda	9	CG			7	5.5				

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-21 No.	SCTB-21 Percent	SCTB-22 No.	SCTB-22 Percent	SCTB-23 No.	SCTB-23 Percent	SCTB-24 No.	SCTB-24 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG								
Aulodrilus limnobius	10	CG								
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG								
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG								
Limnodrilus sp.	10	CG			56	43.8				
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG							4	5.9
Paranais frici	10	CG			48	37.5				
Quistadrilus multisetosus	10	CG								
Turbellaria										
Hydrolimax grisea	8	PR								
Total Number			34	100.0	128	100.0	4	100.0	68	100.0
Total sample volume (cm^3)			500		1,550		1,300		1,000	
Metrics										
Taxa Richness			5		8		2		4	
Modified Hilsenhoff Biotic Index			5.1		9.4		4.5		4.4	
Percent Dominant Taxon			67.6		43.8		50.0		91.2	
(Identity)			*(Cyathura polita)*		*(Limnodrilus* sp.*)*		*(Cyathura polita)*		*(Gammarus fasciatus)*	
Menhinick's Diversity Index			0.86		0.71		1.00		0.49	
Simpson's Dominance Index			0.49		0.34		0.50		0.84	
Shannon Diversity, base e			1.04		1.35		0.69		0.37	
Shannon Evenness, base e			0.65		0.65		1.00		0.27	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-25 No.	SCTB-25 Percent	SCTB-26 No.	SCTB-26 Percent	SCTB-27 No.	SCTB-27 Percent
Amphipoda								
Gammarus fasciatus	4	CG	4	4.7	4	3.8	21	11.4
Cumacea								
Almyracuma proximoculi[4]	5	CG						
Diptera								
Axarus sp.	6	CG						
Ceratopogon sp.	6	PR						
Chironomus decorus gr.	6	CG						
Chironomus riparius	6	CG	2	2.4				
Chironomus sp.	6	CG						
Clinotanypus pinguis	6	CG						
Cricotopus bicinctus gr.	6	CG					2	1.1
Cricotopus sp.	6	CG					2	1.1
Cricotopus triannulatus gr.	6	CG					13	7.0
Cryptochironomus fulvus gr.	6	CG						
Cryptotendipes sp.	6	CG						
Culicoides sp.	10	PR						
Dicrotendipes neomodestus	6	CG					1	0.5
Dicrotendipes sp.	6	CG			1	0.9		
Eukiefferiella claripennis gr.	6	CG					1	0.5
Micropsectra sp.	6	CG						
Nanocladius distinctus	6	CG					10	5.4
Nanocladius sp.	6	CG						
Orthocladiinae	6	CG	1	1.2				
Orthocladius dentifer	6	CG						
Orthocladius sp.	6	CG						
Paracladopelma undine	6	CG						
Paratanytarsus sp.	6	CG						
Polypedilum flavum	6	CG					5	2.7
Polypedilum halterale gr.	6	CG	38	44.7	10	9.4		
Procladius sp.	6	CG						
Psectrocladius psilopterus gr.	6	CG						
Rheotanytarsus exiguus gr.	6	CG			1	0.9	107	57.8
Rheotanytarsus sp.	6	CG	1	1.2				
Sphaeromias sp.	6	PR						
Synorthocladius sp.	6	CG					1	0.5
Tanytarsini	6	CG	1	1.2				
Tvetenia vitracies	6	CG					1	0.5
Ephemeroptera								
Caenis sp.	7	CG						
Hirudinida								
Mooreobdella sp.	8	PR						
Hydracarina	7	PR						
Hydrachnidia sp.	7	PR						
Isopoda								
Cyathura polita[4]	5	CG[4]	1	1.2	7	6.6		
Exosphaeroma papillae[4]	5	CG[4]	2	2.4			11	5.9
Mollusca								
Corbicula fluminea	4	FC						
Ferrissia rivularis	7	SC	1	1.2				
Laevapex fuscus	7	SC			3	2.8		
Musculium securus	8	FC						
Physa sp.	8	SC	2	2.4			4	2.2
Pisidium sp.	8	FC	1	1.2				
Nematoda	9	CG	2	2.4	3	2.8	1	0.5

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-25 No.	SCTB-25 Percent	SCTB-26 No.	SCTB-26 Percent	SCTB-27 No.	SCTB-27 Percent
Polychaeta								
Marenzellaria viridis[4]	6	CG[4]	2	2.4				
Trichoptera								
Ceraclea sp.	3	CG					2	1.1
Tubificida								
Arcteonias lomondi	10	CG						
Aulodrilus limnobius	10	CG	1	1.2				
Aulodrilus piqueti	10	CG						
Aulodrilus pluriseta	10	CG						
Bothrioneurum vejdovskyanum	10	CG						
Branchiura sowerbyi	10	CG						
Ilyodrilus templetoni	10	CG			12	11.3		
Limnodrilus cervix	10	CG						
Limnodrilus hoffmeisteri	10	CG			64	60.4		
Limnodrilus sp.	10	CG	25	29.4				
Limnodrilus udekemianus	10	CG						
Nais behningi	10	CG					2	1.1
Nais sp.	10	CG						
Paranais frici	10	CG						
Quistadrilus multisetosus	10	CG					1	0.5
Turbellaria								
Hydrolimax grisea	8	PR	1	1.2	1	0.9		
Total Number			85	100.0	106	100.0	185	100.0
Total sample volume (cm^3)			950		350		< 50	
Metrics								
Taxa Richness			16		10		17	
Modified Hilsenhoff Biotic Index			7.3		8.9		5.8	
Percent Dominant Taxon			44.7		60.4		57.8	
(Identity)			*(Polypedilum halterale* gr.*)*		*(Limnodrilus hoffmeisteri)*		*(Rheotanytarsus exiguus* gr.*)*	
Menhinick's Diversity Index			1.74		0.97		1.25	
Simpson's Dominance Index			0.29		0.39		0.36	
Shannon Diversity, base e			1.72		1.41		1.62	
Shannon Evenness, base e			0.62		0.61		0.57	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protectio for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division o Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-28 No.	SCTB-28 Percent	SCTB-29 No.	SCTB-29 Percent	SCTB-30 No.	SCTB-30 Percent	All Samples Mean No.	All Samples Mean Percent
Amphipoda										
Gammarus fasciatus	4	CG	6	5.7			10	1.8	4.4	3.5
Cumacea										
Almyracuma proximoculi[4]	5	CG							0.1	0.1
Diptera										
Axarus sp.	6	CG							0.1	0.1
Ceratopogon sp.	6	PR			2	0.7			0.1	0.1
Chironomus decorus gr.	6	CG			38	13.4	100	17.6	4.6	3.6
Chironomus riparius	6	CG			40	14.1	28	4.9	5.5	4.3
Chironomus sp.	6	CG			100	35.3	192	33.8	9.7	7.6
Clinotanypus pinguis	6	CG			8	2.8			0.3	0.2
Cricotopus bicinctus gr.	6	CG					20	3.5	0.8	0.6
Cricotopus sp.	6	CG							0.1	0.1
Cricotopus triannulatus gr.	6	CG							0.4	0.3
Cryptochironomus fulvus gr.	6	CG							0.4	0.3
Cryptotendipes sp.	6	CG							0.2	0.1
Culicoides sp.	10	PR					1	0.2	0.1	0.1
Dicrotendipes neomodestus	6	CG							0.0	0.0
Dicrotendipes sp.	6	CG			2	0.7	8	1.4	0.4	0.3
Eukiefferiella claripennis gr.	6	CG							0.0	0.0
Micropsectra sp.	6	CG							0.1	0.1
Nanocladius distinctus	6	CG							0.4	0.3
Nanocladius sp.	6	CG							0.0	0.0
Orthocladiinae	6	CG							0.0	0.0
Orthocladius dentifer	6	CG							0.0	0.0
Orthocladius sp.	6	CG					6	1.1	0.2	0.2
Paracladopelma undine	6	CG							0.0	0.0
Paratanytarsus sp.	6	CG							0.1	0.1
Polypedilum flavum	6	CG							0.2	0.1
Polypedilum halterale gr.	6	CG	88	83.8	18	6.4			11.0	8.6
Procladius sp.	6	CG			8	2.8			1.3	1.0
Psectrocladius psilopterus gr.	6	CG					6	1.1	0.2	0.2
Rheotanytarsus exiguus gr.	6	CG							3.6	2.8
Rheotanytarsus sp.	6	CG							0.0	0.0
Sphaeromias sp.	6	PR			14	4.9	1	0.2	0.6	0.5
Synorthocladius sp.	6	CG							0.0	0.0
Tanytarsini	6	CG							0.1	0.1
Tvetenia vitracies	6	CG							0.0	0.0
Ephemeroptera										
Caenis sp.	7	CG					4	0.7	0.1	0.1
Hirudinida										
Mooreobdella sp.	8	PR			1	0.4			0.0	0.0
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR							0.0	0.0
Isopoda										
Cyathura polita[4]	5	CG[4]	7	6.7					2.9	2.3
Exosphaeroma papillae[4]	5	CG[4]							0.5	0.4
Mollusca										
Corbicula fluminea	4	FC	1	1.0			1	0.2	0.4	0.3
Ferrissia rivularis	7	SC							0.0	0.0
Laevapex fuscus	7	SC							0.1	0.1
Musculium securus	8	FC					3	0.5	0.1	0.1
Physa sp.	8	SC					1	0.2	0.3	0.2
Pisidium sp.	8	FC			2	0.7			1.1	0.9
Nematoda	9	CG	1	1.0			7	1.2	4.8	3.8

Table 5. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] SCTB-28 No.	SCTB-28 Percent	SCTB-29 No.	SCTB-29 Percent	SCTB-30 No.	SCTB-30 Percent	Mean No.	Mean Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]							0.1	0.1
Trichoptera										
Ceraclea sp.	3	CG							0.1	0.1
Tubificida										
Arcteonias lomondi	10	CG							3.0	2.3
Aulodrilus limnobius	10	CG							2.9	2.3
Aulodrilus piqueti	10	CG					8	1.4	0.4	0.3
Aulodrilus pluriseta	10	CG							0.0	0.0
Bothrioneurum vejdovskyanum	10	CG							0.1	0.1
Branchiura sowerbyi	10	CG							0.3	0.3
Ilyodrilus templetoni	10	CG							2.7	2.1
Limnodrilus cervix	10	CG							1.2	1.0
Limnodrilus hoffmeisteri	10	CG			18	6.4	6	1.1	15.2	11.9
Limnodrilus sp.	10	CG	2	1.9	32	11.3	166	29.2	35.9	28.1
Limnodrilus udekemianus	10	CG							1.4	1.1
Nais behningi	10	CG							0.1	0.1
Nais sp.	10	CG							0.1	0.1
Paranais frici	10	CG							6.2	4.8
Quistadrilus multisetosus	10	CG							1.8	1.4
Turbellaria										
Hydrolimax grisea	8	PR							0.5	0.4
Total Number			105	100.0	283	100.0	568	100.0	127.4	100.0
Total sample volume (cm^3)			600		1,550		2,400			
Metrics										
Taxa Richness			6		13		18		65	
Modified Hilsenhoff Biotic Index			5.9		6.7		7.3		8.3	
Percent Dominant Taxon			83.8		35.3		33.8		28.1	
(Identity)			*(Polypedilum halterale* gr.*)*		*(Chironomus* sp.*)*		*(Chironomus* sp.*)*		*(Limnodrilus* sp.*)*	
Menhinick's Diversity Index			0.59		0.77		0.76		5.76	
Simpson's Dominance Index			0.71		0.19		0.24		0.12	
Shannon Diversity, base e			0.66		1.99		1.79		2.74	
Shannon Evenness, base e			0.37		0.77		0.62		0.66	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Benthic macroinvertebrate data (numbers per liter of sediment) collected at Southport by Weston Solutions, Inc. on 13 and 14 May 2010.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1							
			SCTB-01		SCTB-02		SCTB-03		SCTB-04	
			No.	Percent	No.	Percent	No.	Percent	No.	Percent
Amphipoda										
Gammarus fasciatus	4	CG	0.8	0.6	2.2	2.0	0.9	5.6	1.9	2.8
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	1.7	1.3	0.7	0.7	0.9	5.6	24.8	36.1
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG							1.0	1.4
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG	0.8	0.6						
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG							1.0	1.4
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	11.7	8.9	8.9	7.9	7.0	44.4	16.2	23.6
Procladius sp.	6	CG	0.8	0.6	3.0	2.6				
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR							2.9	4.2
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG							1.0	1.4
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG	2.5	1.9	8.1	7.3	2.6	16.7	3.8	5.6
Exosphaeroma papillae[4]	5	CG								
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC			1.5	1.3				
Nematoda	9	CG					0.9	5.6	4.8	6.9

Table 6. Benthic macroinvertebrate data (numbers per liter of sediment) collected at Southport by Weston Solutions, Inc. on 13 and 14 May 2010.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-01 No.	SCTB-01 Percent	SCTB-02 No.	SCTB-02 Percent	SCTB-03 No.	SCTB-03 Percent	SCTB-04 No.	SCTB-04 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG							1.0	1.4
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG								
Aulodrilus limnobius	10	CG							2.9	4.2
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG							1.0	1.4
Ilyodrilus templetoni	10	CG	10.0	7.6	5.9	5.3				
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG	21.7	16.5	25.9	23.2				
Limnodrilus sp.	10	CG	21.7	16.5	25.9	23.2	2.6	16.7	2.9	4.2
Limnodrilus udekemianus	10	CG			13.3	11.9				
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG	50.0	38.0	11.9	10.6			1.0	1.4
Quistadrilus multisetosus	10	CG	10.0	7.6	3.0	2.6				
Turbellaria										
Hydrolimax grisea	8	PR			1.5	1.3	0.9	5.6	2.9	4.2
Total Number			131.7	100.0	111.9	100.0	15.7	100.0	68.6	100.0
Total sample volume (cm^3)[5]			1,200		1,350		1,150		1,050	
Metrics										
Taxa Richness			11		13		7		15	
Modified Hilsenhoff Biotic Index			9.4		9.0		6.7		6.6	
Percent Dominant Taxon			38.0		23.2		44.4		36.1	
(Identity)			*(Paranais frici)*		*(Limnodrilus)*		(*Polypedilum halterale* gr.)		*(Chironomus riporius)*	
Menhinick's Diversity Index			0.88		1.06		1.65		1.77	
Simpson's Dominance Index			0.22		0.15		0.27		0.20	
Shannon Diversity, base e			1.79		2.13		1.60		2.04	
Shannon Evenness, base e			0.75		0.83		0.82		0.75	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-05 No.	SCTB-05 Percent	SCTB-06 No.	SCTB-06 Percent	SCTB-07 No.	SCTB-07 Percent	SCTB-08 No.	SCTB-08 Percent
Amphipoda										
Gammarus fasciatus	4	CG							2.9	1.8
Cumacea										
Almyracuma proximoculi[4]	5	CG							1.9	1.2
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	23.8	44.9	0.6	1.0	1.7	6.5	1.9	1.2
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG					2.2	8.7		
Cryptotendipes sp.	6	CG					0.6	2.2	3.8	2.4
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG							1.9	1.2
Nanocladius distinctus	6	CG							1.9	1.2
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG							1.9	1.2
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	6.9	13.0	5.6	9.1	1.1	4.3	45.7	28.2
Procladius sp.	6	CG	4.6	8.7	1.9	3.0	0.6	2.2		
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR							1.0	0.6
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG	0.8	1.4						
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]								
Exosphaeroma papillae[4]	5	CG[4]								
Mollusca										
Corbicula fluminea	4	FC							8.6	5.3
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC	0.8	1.4			2.2	8.7		
Nematoda	9	CG			0.6	1.0	0.6	2.2	47.6	29.4

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-05 No.	SCTB-05 Percent	SCTB-06 No.	SCTB-06 Percent	SCTB-07 No.	SCTB-07 Percent	SCTB-08 No.	SCTB-08 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG					5.0	19.6		
Aulodrilus limnobius	10	CG	3.1	5.8	5.6	9.1	2.2	8.7	21.9	13.5
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG	0.8	1.4	2.5	4.0			3.8	2.4
Ilyodrilus templetoni	10	CG	1.5	2.9	5.0	8.1				
Limnodrilus cervix	10	CG	6.2	11.6	5.6	9.1				
Limnodrilus hoffmeisteri	10	CG			16.3	26.3	2.2	8.7		
Limnodrilus sp.	10	CG	4.6	8.7	10.0	16.2	7.2	28.3	11.4	7.1
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG			7.5	12.1			1.9	1.2
Quistadrilus multisetosus	10	CG								
Turbellaria										
Hydrolimax grisea	8	PR			0.6	1.0			3.8	2.4
Total Number			53.1	100.0	61.9	100.0	25.6	100.0	161.9	100.0
Total sample volume (cm^3)			1,300		1,600		1,800		1,050	
Metrics										
Taxa Richness			10		12		11		16	
Modified Hilsenhoff Biotic Index			7.2		9.4		8.8		7.7	
Percent Dominant Taxon			44.9		26.3		28.3		29.4	
(Identity)			*(Chironomus riporius)*		*(Limnodrilus hoffmeistri)*		*(Limnodrilus* sp.*)*		Nematoda	
Menhinick's Diversity Index			1.20		1.21		1.6		1.23	
Simpson's Dominance Index			0.25		0.14		0.16		0.20	
Shannon Diversity, base e			1.75		2.13		2.09		2.01	
Shannon Evenness, base e			0.76		0.86		0.87		0.72	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-09 No.	SCTB-09 Percent	SCTB-10 No.	SCTB-10 Percent	SCTB-11 No.	SCTB-11 Percent	SCTB-12 No.	SCTB-12 Percent
Amphipoda										
Gammarus fasciatus	4	CG							0.7	2.2
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	3.1	1.9						
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG	2.3	1.4	0.9	1.5			0.4	1.1
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG			0.5	0.8				
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	6.2	3.7	0.5	0.8				
Procladius sp.	6	CG	2.3	1.4	0.9	1.5			0.4	1.1
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR			0.5	0.8				
Isopoda										
Cyathura polita[4]	5	CG[4]	0.8	0.5						
Exosphaeroma papillae[4]	5	CG[4]								
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC								
Nematoda	9	CG	5.4	3.3	1.4	2.3	16.1	32.8	0.7	2.2

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-09 No.	SCTB-09 Percent	SCTB-10 No.	SCTB-10 Percent	SCTB-11 No.	SCTB-11 Percent	SCTB-12 No.	SCTB-12 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG	33.8	20.6					1.5	4.4
Aulodrilus limnobius	10	CG	15.4	9.3	10.9	18.5				
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG	3.1	1.9						
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG					5.7	11.7	4.4	13.3
Limnodrilus cervix	10	CG							7.4	22.2
Limnodrilus hoffmeisteri	10	CG	46.2	28.0	8.6	14.6				
Limnodrilus sp.	10	CG	46.2	28.0	35.0	59.2	24.3	49.6	14.8	44.4
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG							1.5	4.4
Quistadrilus multisetosus	10	CG					2.9	5.8	1.5	4.4
Turbellaria										
Hydrolimax grisea	8	PR								
Total Number			164.6	100.0	59.1	100.0	48.9	100.0	33.3	100.0
Total sample volume (cm^3)			1,300		2,200		2,800		2,700	
Metrics										
Taxa Richness			11		9		4		10	
Modified Hilsenhoff Biotic Index			9.6		9.8		9.7		9.8	
Percent Dominant Taxon			28.0		59.2		49.6		44.4	
(Identity)			(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)	
Menhinick's Diversity Index			0.75		0.79		0.34		1.05	
Simpson's Dominance Index			0.21		0.41		0.37		0.27	
Shannon Diversity, base e			1.79		1.23		1.13		1.65	
Shannon Evenness, base e			0.75		0.56		0.82		0.72	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-13 No.	SCTB-13 Percent	SCTB-14 No.	SCTB-14 Percent	SCTB-15 No.	SCTB-15 Percent	SCTB-16 No.	SCTB-16 Percent
Amphipoda										
Gammarus fasciatus	4	CG			2.1	4.9	0.8	1.5		
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG	1.2	6.9	0.7	1.6	0.4	0.7	0.6	0.6
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG								
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR			0.7	1.6				
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG			0.7	1.6				
Procladius sp.	6	CG	1.8	10.3					1.2	1.1
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]								
Exosphaeroma papillae[4]	5	CG[4]								
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC					0.4	0.7		
Nematoda	9	CG	1.2	6.9	2.1	4.9			0.6	0.6

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-13 No.	SCTB-13 Percent	SCTB-14 No.	SCTB-14 Percent	SCTB-15 No.	SCTB-15 Percent	SCTB-16 No.	SCTB-16 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG	2.4	13.8	2.9	6.6	9.8	17.6		
Aulodrilus limnobius	10	CG								
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG							2.4	2.3
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG			9.3	21.3			50.9	47.7
Limnodrilus sp.	10	CG	7.1	41.4	15.0	34.4	26.1	47.1	50.9	47.7
Limnodrilus udekemianus	10	CG			5.7	13.1	6.5	11.8		
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG	2.9	17.2	3.6	8.2	6.5	11.8		
Quistadrilus multisetosus	10	CG	0.6	3.4	0.7	1.6	4.9	8.8		
Turbellaria										
Hydrolimax grisea	8	PR								
Total Number			17.1	100.0	43.6	100.0	55.5	100.0	106.7	100.0
Total sample volume (cm^3)			1,700		1,400		2,450		1,650	
Metrics										
Taxa Richness			7		11		8		6	
Modified Hilsenhoff Biotic Index			9.2		9.5		9.9		9.9	
Percent Dominant Taxon			41.4		34.4		47.1		47.7	
(Identity)			(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)		(*Limnodrilus* sp.)	
Menhinick's Diversity Index			1.30		1.41		0.69		0.45	
Simpson's Dominance Index			0.24		0.20		0.29		0.46	
Shannon Diversity, base e			1.66		1.91		1.51		0.90	
Shannon Evenness, base e			0.85		0.80		0.73		0.50	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-17 No.	SCTB-17 Percent	SCTB-18 No.	SCTB-18 Percent	SCTB-19 No.	SCTB-19 Percent	SCTB-20 No.	SCTB-20 Percent
Amphipoda										
Gammarus fasciatus	4	CG							3.1	3.9
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG								
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG			12.3	6.8	4.2	1.2	3.1	3.9
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG								
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG							1.5	2.0
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG								
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG			1.5	0.9	28.4	8.2	13.8	17.6
Procladius sp.	6	CG					1.1	0.3		
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]					1.1	0.3	32.3	41.2
Exosphaeroma papillae[4]	5	CG[4]							3.1	3.9
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC			1.5	0.9				
Pisidium sp.	8	FC			10.8	6.0	8.4	2.4	12.3	15.7
Nematoda	9	CG					3.2	0.9		

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-17 No.	SCTB-17 Percent	SCTB-18 No.	SCTB-18 Percent	SCTB-19 No.	SCTB-19 Percent	SCTB-20 No.	SCTB-20 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG								
Aulodrilus limnobius	10	CG								
Aulodrilus piqueti	10	CG					4.2	1.2		
Aulodrilus pluriseta	10	CG							1.5	2.0
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG					6.3	1.8		
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG			153.8	85.5				
Limnodrilus sp.	10	CG	2.9	100.0			261.1	75.2	6.2	7.8
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG								
Paranais frici	10	CG					16.8	4.8		
Quistadrilus multisetosus	10	CG					12.6	3.6		
Turbellaria										
Hydrolimax grisea	8	PR							1.5	2.0
Total Number			2.9	100.0	180.0	100.0	347.4	100.0	78.5	100.0
Total sample volume (cm^3)			1,050		650		950		650	
Metrics										
Taxa Richness			1		5		11		10	
Modified Hilsenhoff Biotic Index			10.0		9.6		9.5		6.2	
Percent Dominant Taxon			100.0		85.5		75.2		41.2	
(Identity)			*(Limnodrilus* sp.*)*		*(Limnodrilus hoffmeisteri)*		*(Limnodrilus* sp.*)*		*(Cyathura polita)*	
Menhinick's Diversity Index			0.58		0.46		0.61		1.40	
Simpson's Dominance Index			1.00		0.74		0.58		0.24	
Shannon Diversity, base e			0.00		0.57		1.03		1.77	
Shannon Evenness, base e			N/A[6]		0.35		0.43		0.77	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-21 No.	SCTB-21 Percent	SCTB-22 No.	SCTB-22 Percent	SCTB-23 No.	SCTB-23 Percent	SCTB-24 No.	SCTB-24 Percent
Amphipoda										
Gammarus fasciatus	4	CG	8.0	11.8	0.6	0.8	1.5	50.0	62.0	91.2
Cumacea										
Almyracuma proximoculi[4]	5	CG								
Diptera										
Axarus sp.	6	CG	8.0	11.8						
Ceratopogon sp.	6	PR								
Chironomus decorus gr.	6	CG								
Chironomus riparius	6	CG			2.6	3.1				
Chironomus sp.	6	CG								
Clinotanypus pinguis	6	CG								
Cricotopus bicinctus gr.	6	CG								
Cricotopus sp.	6	CG								
Cricotopus triannulatus gr.	6	CG								
Cryptochironomus fulvus gr.	6	CG								
Cryptotendipes sp.	6	CG								
Culicoides sp.	10	PR								
Dicrotendipes neomodestus	6	CG								
Dicrotendipes sp.	6	CG								
Eukiefferiella claripennis gr.	6	CG								
Micropsectra sp.	6	CG								
Nanocladius distinctus	6	CG								
Nanocladius sp.	6	CG							1.0	1.5
Orthocladiinae	6	CG								
Orthocladius dentifer	6	CG								
Orthocladius sp.	6	CG								
Paracladopelma undine	6	CG								
Paratanytarsus sp.	6	CG								
Polypedilum flavum	6	CG								
Polypedilum halterale gr.	6	CG	4.0	5.9	4.5	5.5				
Procladius sp.	6	CG			1.9	2.3				
Psectrocladius psilopterus gr.	6	CG								
Rheotanytarsus exiguus gr.	6	CG								
Rheotanytarsus sp.	6	CG								
Sphaeromias sp.	6	PR								
Synorthocladius sp.	6	CG								
Tanytarsini	6	CG								
Tvetenia vitracies	6	CG								
Ephemeroptera										
Caenis sp.	7	CG								
Hirudinida										
Mooreobdella sp.	8	PR								
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR								
Isopoda										
Cyathura polita[4]	5	CG[4]	46.0	67.6	1.3	1.6	1.5	50.0	1.0	1.5
Exosphaeroma papillae[4]	5	CG[4]	2.0	2.9						
Mollusca										
Corbicula fluminea	4	FC								
Ferrissia rivularis	7	SC								
Laevapex fuscus	7	SC								
Musculium securus	8	FC								
Physa sp.	8	SC								
Pisidium sp.	8	FC								
Nematoda	9	CG			4.5	5.5				

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample1 SCTB-21 No.	SCTB-21 Percent	SCTB-22 No.	SCTB-22 Percent	SCTB-23 No.	SCTB-23 Percent	SCTB-24 No.	SCTB-24 Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]								
Trichoptera										
Ceraclea sp.	3	CG								
Tubificida										
Arcteonias lomondi	10	CG								
Aulodrilus limnobius	10	CG								
Aulodrilus piqueti	10	CG								
Aulodrilus pluriseta	10	CG								
Bothrioneurum vejdovskyanum	10	CG								
Branchiura sowerbyi	10	CG								
Ilyodrilus templetoni	10	CG								
Limnodrilus cervix	10	CG								
Limnodrilus hoffmeisteri	10	CG								
Limnodrilus sp.	10	CG			36.1	43.8				
Limnodrilus udekemianus	10	CG								
Nais behningi	10	CG								
Nais sp.	10	CG							4.0	5.9
Paranais frici	10	CG			31.0	37.5				
Quistadrilus multisetosus	10	CG								
Turbellaria										
Hydrolimax grisea	8	PR								
Total Number			68.0	100.0	82.6	100.0	3.1	100.0	68.0	100.0
Total sample volume (cm^3)			500		1,550		1,300		1,000	
Metrics										
Taxa Richness			5		8		2		4	
Modified Hilsenhoff Biotic Index			5.1		9.4		4.5		4.4	
Percent Dominant Taxon			67.6		43.8		50.0		91.2	
(Identity)			*(Cyathura polita)*		*(Limnodrilus* sp.*)*		*(Cyathura polita)*		*(Gammarus fasciatus)*	
Menhinick's Diversity Index			0.86		0.71		1.00		0.49	
Simpson's Dominance Index			0.49		0.34		0.50		0.84	
Shannon Diversity, base e			1.04		1.35		0.69		0.37	
Shannon Evenness, base e			0.65		0.65		1.00		0.27	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample[1] SCTB-25 No.	SCTB-25 Percent	SCTB-26 No.	SCTB-26 Percent	SCTB-27 No.	SCTB-27 Percent
Amphipoda								
Gammarus fasciatus	4	CG	4.2	4.7	11.4	3.8	420.0	11.4
Cumacea								
Almyracuma proximoculi[4]	5	CG						
Diptera								
Axarus sp.	6	CG						
Ceratopogon sp.	6	PR						
Chironomus decorus gr.	6	CG						
Chironomus riparius	6	CG	2.1	2.4				
Chironomus sp.	6	CG						
Clinotanypus pinguis	6	CG						
Cricotopus bicinctus gr.	6	CG					40.0	1.1
Cricotopus sp.	6	CG					40.0	1.1
Cricotopus triannulatus gr.	6	CG					260.0	7.0
Cryptochironomus fulvus gr.	6	CG						
Cryptotendipes sp.	6	CG						
Culicoides sp.	10	PR						
Dicrotendipes neomodestus	6	CG					20.0	0.5
Dicrotendipes sp.	6	CG			2.9	0.9		
Eukiefferiella claripennis gr.	6	CG					20.0	0.5
Micropsectra sp.	6	CG						
Nanocladius distinctus	6	CG					200.0	5.4
Nanocladius sp.	6	CG						
Orthocladiinae	6	CG	1.1	1.2				
Orthocladius dentifer	6	CG						
Orthocladius sp.	6	CG						
Paracladopelma undine	6	CG						
Paratanytarsus sp.	6	CG						
Polypedilum flavum	6	CG					100.0	2.7
Polypedilum halterale gr.	6	CG	40.0	44.7	28.6	9.4		
Procladius sp.	6	CG						
Psectrocladius psilopterus gr.	6	CG						
Rheotanytarsus exiguus gr.	6	CG			2.9	0.9	2140.0	57.8
Rheotanytarsus sp.	6	CG	1.1	1.2				
Sphaeromias sp.	6	PR						
Synorthocladius sp.	6	CG					20.0	0.5
Tanytarsini	6	CG	1.1	1.2				
Tvetenia vitracies	6	CG					20.0	0.5
Ephemeroptera								
Caenis sp.	7	CG						
Hirudinida								
Mooreobdella sp.	8	PR						
Hydracarina	7	PR						
Hydrachnidia sp.	7	PR						
Isopoda								
Cyathura polita[4]	5	CG[4]	1.1	1.2	20.0	6.6		
Exosphaeroma papillae[4]	5	CG[4]	2.1	2.4			220.0	5.9
Mollusca								
Corbicula fluminea	4	FC						
Ferrissia rivularis	7	SC	1.1	1.2				
Laevapex fuscus	7	SC			8.6	2.8		
Musculium securus	8	FC						
Physa sp.	8	SC	2.1	2.4			80.0	2.2
Pisidium sp.	8	FC	1.1	1.2				
Nematoda	9	CG	2.1	2.4	8.6	2.8	20.0	0.5

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample[1] SCTB-25 No.	SCTB-25 Percent	SCTB-26 No.	SCTB-26 Percent	SCTB-27 No.	SCTB-27 Percent
Polychaeta								
Marenzellaria viridis[4]	6	CG[4]	2.1	2.4				
Trichoptera								
Ceraclea sp.	3	CG					40.0	1.1
Tubificida								
Arcteonias lomondi	10	CG						
Aulodrilus limnobius	10	CG	1.1	1.2				
Aulodrilus piqueti	10	CG						
Aulodrilus pluriseta	10	CG						
Bothrioneurum vejdovskyanum	10	CG						
Branchiura sowerbyi	10	CG						
Ilyodrilus templetoni	10	CG			34.3	11.3		
Limnodrilus cervix	10	CG						
Limnodrilus hoffmeisteri	10	CG			182.9	60.4		
Limnodrilus sp.	10	CG	26.3	29.4				
Limnodrilus udekemianus	10	CG						
Nais behningi	10	CG					40.0	1.1
Nais sp.	10	CG						
Paranais frici	10	CG						
Quistadrilus multisetosus	10	CG					20.0	0.5
Turbellaria								
Hydrolimax grisea	8	PR	1.1	1.2	2.9	0.9		
Total Number			89.5	100.0	302.9	100.0	<3,700.0	100.0
Total sample volume (cm^3)			950		350		50	
Metrics								
Taxa Richness			16		10		17	
Modified Hilsenhoff Biotic Index			7.3		8.9		5.8	
Percent Dominant Taxon			44.7		60.4		57.8	
(Identity)			*(Polypedilum halterale* gr.*)*		*(Limnodrilus hoffmeisteri)*		*(Rheotanytarsus exiguus* gr.*)*	
Menhinick's Diversity Index			1.74		0.97		1.25	
Simpson's Dominance Index			0.29		0.39		0.36	
Shannon Diversity, base e			1.72		1.41		1.62	
Shannon Evenness, base e			0.62		0.61		0.57	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protectio for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division o Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample[1] SCTB-28 No.	SCTB-28 Percent	SCTB-29 No.	SCTB-29 Percent	SCTB-30 No.	SCTB-30 Percent	All Samples Mean No. Per Liter	All Samples Percent
Amphipoda										
Gammarus fasciatus	4	CG	10.0	5.7			4.2	1.8	3.5	3.5
Cumacea										
Almyracuma proximoculi[4]	5	CG							0.1	0.1
Diptera										
Axarus sp.	6	CG							0.1	0.1
Ceratopogon sp.	6	PR			1.3	0.7			0.1	0.1
Chironomus decorus gr.	6	CG			24.5	13.4	41.7	17.6	3.6	3.6
Chironomus riparius	6	CG			25.8	14.1	11.7	4.9	4.3	4.3
Chironomus sp.	6	CG			64.5	35.3	80.0	33.8	7.7	7.6
Clinotanypus pinguis	6	CG			5.2	2.8			0.2	0.2
Cricotopus bicinctus gr.	6	CG					8.3	3.5	0.6	0.6
Cricotopus sp.	6	CG							0.1	0.1
Cricotopus triannulatus gr.	6	CG							0.3	0.3
Cryptochironomus fulvus gr.	6	CG							0.3	0.3
Cryptotendipes sp.	6	CG							0.1	0.1
Culicoides sp.	10	PR					0.4	0.2	0.1	0.1
Dicrotendipes neomodestus	6	CG							0.0	0.0
Dicrotendipes sp.	6	CG			1.3	0.7	3.3	1.4	0.3	0.3
Eukiefferiella claripennis gr.	6	CG							0.0	0.0
Micropsectra sp.	6	CG							0.1	0.1
Nanocladius distinctus	6	CG							0.3	0.3
Nanocladius sp.	6	CG							0.0	0.0
Orthocladiinae	6	CG							0.0	0.0
Orthocladius dentifer	6	CG							0.0	0.0
Orthocladius sp.	6	CG					2.5	1.1	0.2	0.2
Paracladopelma undine	6	CG							0.0	0.0
Paratanytarsus sp.	6	CG							0.1	0.1
Polypedilum flavum	6	CG							0.1	0.1
Polypedilum halterale gr.	6	CG	146.7	83.8	11.6	6.4			8.7	8.6
Procladius sp.	6	CG			5.2	2.8			1.0	1.0
Psectrocladius psilopterus gr.	6	CG						1.1	0.2	0.2
Rheotanytarsus exiguus gr.	6	CG							2.9	2.8
Rheotanytarsus sp.	6	CG							0.0	0.0
Sphaeromias sp.	6	PR			9.0	4.9		0.2	0.5	0.5
Synorthocladius sp.	6	CG							0.0	0.0
Tanytarsini	6	CG							0.1	0.1
Tvetenia vitracies	6	CG							0.0	0.0
Ephemeroptera										
Caenis sp.	7	CG						0.7	0.1	0.1
Hirudinida										
Mooreobdella sp.	8	PR			0.6	0.4			0.0	0.0
Hydracarina	7	PR								
Hydrachnidia sp.	7	PR							0.0	0.0
Isopoda										
Cyathura polita[4]	5	CG[4]	11.7	6.7					2.3	2.3
Exosphaeroma papillae[4]	5	CG[4]							0.4	0.4
Mollusca										
Corbicula fluminea	4	FC	1.7	1.0				0.2	0.3	0.3
Ferrissia rivularis	7	SC							0.0	0.0
Laevapex fuscus	7	SC							0.1	0.1
Musculium securus	8	FC						0.5	0.1	0.1
Physa sp.	8	SC						0.2	0.2	0.2
Pisidium sp.	8	FC			1.3	0.7			0.9	0.9
Nematoda	9	CG	1.7	1.0				1.2	3.8	3.8

Table 6. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected per Liter of Sediment in Sample[1] SCTB-28 No.	SCTB-28 Percent	SCTB-29 No.	SCTB-29 Percent	SCTB-30 No.	SCTB-30 Percent	All Samples Mean No. Per Liter	All Samples Percent
Polychaeta										
Marenzellaria viridis[4]	6	CG[4]							0.1	0.1
Trichoptera										
Ceraclea sp.	3	CG							0.1	0.1
Tubificida										
Arcteonias lomondi	10	CG							2.3	2.3
Aulodrilus limnobius	10	CG							2.3	2.3
Aulodrilus piqueti	10	CG					3.3	1.4	0.3	0.3
Aulodrilus pluriseta	10	CG							0.0	0.0
Bothrioneurum vejdovskyanum	10	CG							0.1	0.1
Branchiura sowerbyi	10	CG							0.3	0.3
Ilyodrilus templetoni	10	CG							2.1	2.1
Limnodrilus cervix	10	CG							1.0	1.0
Limnodrilus hoffmeisteri	10	CG			11.6	6.4	2.5	1.1	12.0	11.9
Limnodrilus sp.	10	CG	3.3	1.9	20.6	11.3	69.2	29.2	28.4	28.1
Limnodrilus udekemianus	10	CG							1.1	1.1
Nais behningi	10	CG							0.1	0.1
Nais sp.	10	CG							0.1	0.1
Paranais frici	10	CG							4.9	4.8
Quistadrilus multisetosus	10	CG							1.5	1.4
Turbellaria										
Hydrolimax grisea	8	PR							0.4	0.4
Total Number			175.0	100.0	182.6	100.0	227.1	100.0	100.9	100.0
Total sample volume (cm^3)			600		1,550		2,400		1,263	
Metrics										
Taxa Richness			6		13		18		65	
Modified Hilsenhoff Biotic Index			5.9		6.7		7.3		8.3	
Percent Dominant Taxon			83.8		35.3		33.8		28.1	
(Identity)			*(Polypedilum halterale* gr.*)*		*(Chironomus* sp.*)*		*(Chironomus* sp.*)*		*(Limnodrilus* sp.*)*	
Menhinick's Diversity Index			0.59		0.77		0.76		5.76	
Simpson's Dominance Index			0.71		0.19		0.24		0.12	
Shannon Diversity, base e			0.66		1.99		1.79		2.74	
Shannon Evenness, base e			0.37		0.77		0.62		0.66	

[1] Petite Ponar grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection for most taxa. The exceptions are noted.
[4] Source: Bode, R.W. et. al. 2002. Quality Assurance Workplan for Biological Stream Monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233. 115 pp.
[5] Each sample represents a composite of several petite Ponar grabs.
[6] No value because the computation for this sample required division by zero.

Table 7
Water Quality Data

Location	**Stormwater channel**	**Interpier area off mudflat**	**Interpier area off mudflat near channel**	**Channel at Buoy #9 off Interpier area**	**Stormwater channel**	**Channel near seaplane hangar (MMT3)**	**Channel (MMT4)**
Date	4/29/2010	4/29/2010	4/29/2010	4/29/2010	6/3/2010	6/3/2010	6/3/2010
Temperature (°C)	12.03	14.89	14.85	14.29	25.0	24.0	24.0
Conductivity (µS/cm)	648	242	243	232	nr	nr	nr
Dissolved Oxygen (mg/L)	9.82	11.69	10.97	10.47	nr	nr	nr
pH (s.u.)	7.33	7.82	7.69	7.65	nr	nr	nr
Secchi depth (cm)	79	84	114	81	nr	137	143

nr = not recorded

Legend

- Southport
- Backpack Electrofishing E1
- Boat-mounted Electrofishing E1
- Boat-mounted Electrofishing E2
- Beach Seine Pull
- Trotline Set

N
W E
S

0 700 Feet

Figure 1
April 2010 Fish Sampling Locations
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\fish_samps_april2010.mxd, 18-Jun-10 16:08, ricksc

Legend

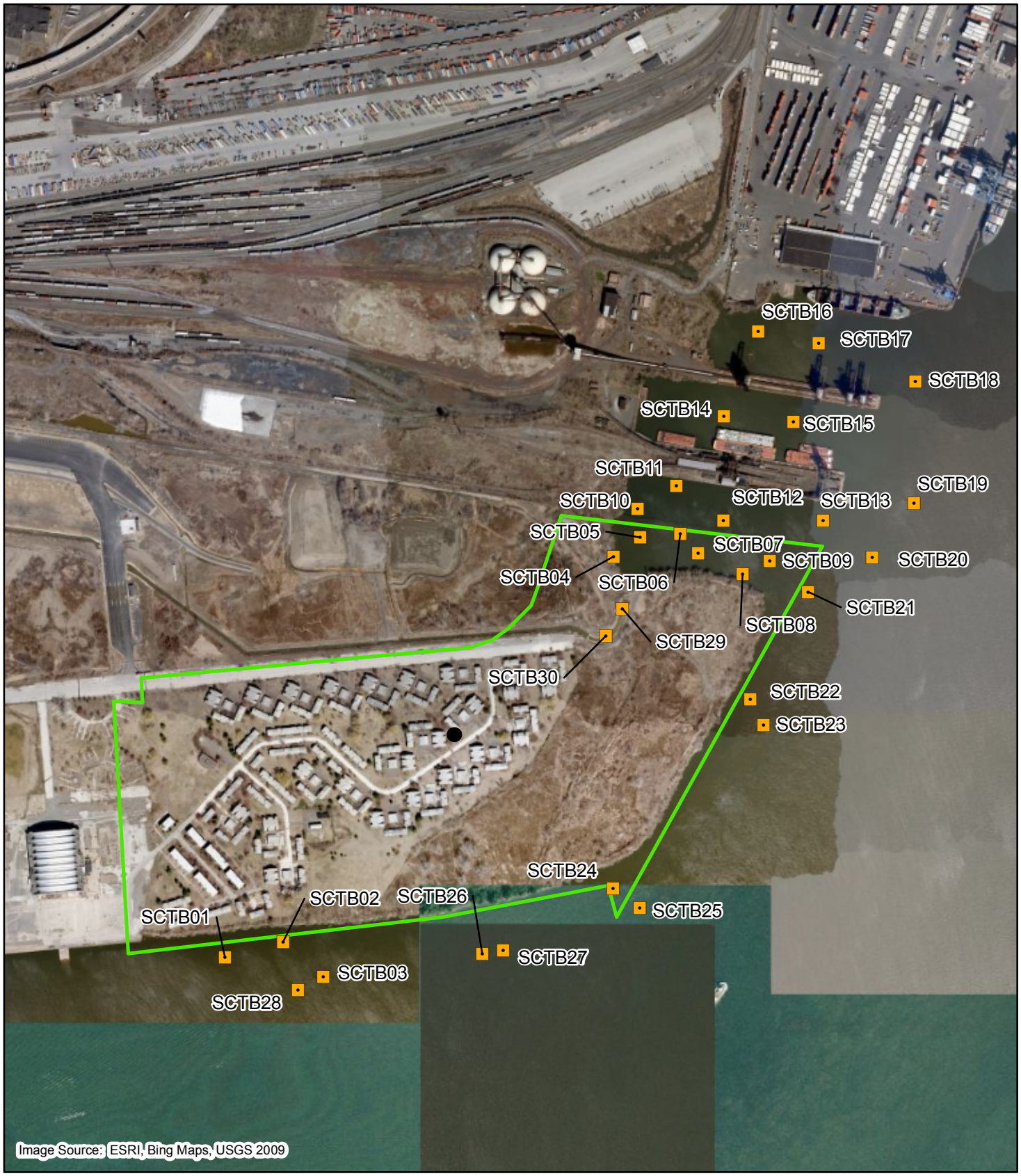
- Southport
- Backpack Electrofishing E1
- Boat-mounted Electrofishing E1
- Boat-mounted Electrofishing E2
- Beach Seine Pull
- Trotline Set
- Mini Missouri Trawl (MMT)

N W E S

0 700 Feet

Figure 2
June 2010 Fish Sampling Locations
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\fish_samps_june2010.mxd, 22-Jun-10 16:32, ricksc



Legend

Southport

Macrobenthic Sample Locations

N
W E
S

0 700 Feet

Figure 3
Macrobenthic Sample Locations
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\macrobenthic_samps_may2010.mxd, 28-May-10 13:44, ricksc

Delaware River at South Port Area: Fish Assessment Data Collected by Daytime Boat Electrofishing

Data Provided By:

Joseph Perillo
Aquatic Biologist Supervisor
Philadelphia Water Department
1500 E. Hunting Park Ave.
Philadelphia, PA 19124
joe.perillo@phila.gov

Table1. Fish species collected November 4, 2009 along the Delaware River from the South Port Area using daytime boat electrofishing.

Common Name	Scientific Name	Number Collected	Percent Contribution
blueback herring	*Alosa aestivalis*	302*	53.7%
American shad	*Alosa sapidissima*	202*	35.9%
white catfish	*Ameiurus catus*	1	0.2%
American eel	*Anguilla rostrata*	1	0.2%
common carp	*Cyprinus carpio*	7	1.2%
gizzard shad	*Dorosoma cepedianum*	4	0.7%
banded killifish	*Fundulus diaphanus*	35	6.2%
channel catfish	*Ictalurus punctatus*	1	0.2%
pumpkinseed sunfish	*Lepomis gibbosus*	8	1.4%
striped bass	*Morone saxatilis*	1	0.2%
TOTAL		562	100%

*Denotes young-of-year (juvenile) fish

NC/NE/NW/SC/SE/SW

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA FISH AND BOAT COMMISSION

Bureau of Fisheries - Envirnomental Services Division - Natural Diversity Section
450 Robinson Lane
Belllefonte, PA 16823

April 09, 2010 | Permit Fee of $240 | Page 1 - PERMIT NO. 389 TYPE 3 (New)

THIS IS TO CERTIFY THAT ACTING UNDER THE PROVISIONS OF THE FISH AND BOAT CODE, ACT 1980-175 AMENDED:

Name and Town of Permit Owner	Age,	Height,	Weight,	Eyes,	Hair,	PA Fishing License #
Charles T Young , Technical Director Honey Brook, PA	56,	5ft. 10In.,	175,	Blue,	Brown,	010-472-348

APPROVED ASSISTANTS TO THE ABOVE PERMIT OWNER:

Name and Address	Age,	Height,	Weight,	Eyes,	Hair,	PA Fishing License #
Charles W Rapone	32,	5ft. 8In.,	195,	Blue,	Blond,	002-341-345
Robert W Wagner	33,	6ft. 0In.,	220,	Hazel,	Brown,	016-279-549
Thomas P Dakin	30,	5ft. 10In.,	175,	NotSelected,	NotEntered,	008-812-125

AND ASSISTANTS LISTED, ARE HEREBY AUTHORIZED TO COLLECT FISH OR OTHER AQUATIC LIFE FOR SCIENTIFIC PURPOSES AND IS LIMITED TO THOSE ACTIVITIES AS DESCRIBED IN RESPONSE TO THE APPLICATION PROJECT DETAILS SECTION. THIS PERMIT IS VALID FOR COLLECTION PROJECTS: (SEE ATTACHED SHEET)

UNLESS OTHERWISE PERMITTED, ALL SPECIES MUST BE RELEASED UNHARMED AT SITE OF CAPTURE. A SCIENTIFIC COLLECTOR'S PERMIT DOES NOT GRANT THE PERSONS THE AUTHORITY TO TRESPASS ON PRIVATE PROPERTY.

THIS PERMIT IS GOOD FOR THE CALENDAR YEAR **2010** OR DATE SPECIFIED IN PERMIT CONDITIONS, WHICHEVER COMES FIRST.

THE OWNER OF THIS PERMIT AND LISTED ASSISTANTS MUST BE THE HOLDERS OF A RESIDENT OR NONRESIDENT FISHING LICENSE WHICH MUST BE CARRIED WITH THEM AT ALL TIMES, ALONG WITH THIS PERMIT, OR A COPY THEREOF. PROPER NOTIFICATION MUST BE GIVEN TO THE REGIONAL LAW ENFORCEMENT OFFICE COVERING THE COUNTY IN WHICH COLLECTIONS ARE BEING CONDUCTED. OFFICES ARE OPEN MONDAY THRU FRIDAY BETWEEN 8:00AM AND 4:00PM.

IN WITNESS THEREOF, I HAVE HEREUNTO SET MY HAND AND AFFIXED THE OFFICAL SEAL OF THE COMMISSION THE DAY AND DATE FIRST ABOVE WRITTEN.

EXECUTIVE DIRECTOR OR DESIGNEE

Permit Conditions/Comments From PFBC Natural Diversity Section Staff

ANY THREATENED OR ENDANGERED SPECIES, AS LISTED IN 58 PA CODE CHAPTERS 73 AND 75, CAPTURED BY THE PERMITTEE OR ANY ASISTANT SHALL BE IMMEDIATELY RETURNED TO THE ENVIRONMENT FROM WHICH IT WAS COLLECTED. PERSONS COLLECTING FISH, REPTILES, OR AMPHIBIANS ON STATE GAME LANDS MUST NOTIFY THE APPROPRIATE PENNSYLVANIA GAME COMMISSION (WWW.PGC.STATE.PA.US) REGIONAL OFFICE BY PHONE AT LEAST 24 HOURS PRIOR TO COMMENCING THOSE ACTIVITIES. ANY OTHER AREA MUST BE APPROVED BY THE PENNSYLVANIA FISH AND BOAT COMMISSION.

Authorized Collection Projects:

PROJECT NAME: **Southport Marine Terminal Aquatic Biota Survey - Delaware River**.
PROJECT COLLECTION JUSTIFICATION: Pre/Post Development Bioassessment.
SAMPLE SIZE APPROVED: X-Small Sample: 1 Individual Per Species.
PROJECT DETAILS: Collections to be performed in the Delaware River and an unnamed stormwater channel at the Southport project site. Experimental design based on input from T. Shervinskie and M. Kauffman of PFBC and is intended to develop fish community data for evaluating impacts associated with port development. Except for select voucher specimens, captured fish will be identified, enumerated and promptly released. While Eckmann dredge was selected, a petite Ponar dredge will be used to collect macroinvertebrates. Beach seine will be 50 ft long with 3/8 inch mesh.

APPROVED FOR FISH AND AQUATIC MACROINVERTEBRATE COLLECTIONS FOR Southport Marine Terminal Aquatic Biota Survey - Delaware River, PHILADELPHIA
TAXONS COLLECTED: Fish And Aquatic Invertebrates
CRITTER DISPOSITION: C and R Keep 1 Voucher Specimen Per Species
PROJECT COUNTIES: PHILADELPHIA, PROJECT WATERS:

NETS LARGER THAN 4 FEET SQUARE OR 4 FEET IN DIAMETER LISTED ON THIS PERMIT HAVE BEEN APPROVED FOR USE BY THE PERMIT HOLDER. THE REQUIREMENT FOR ADDITIONAL NETTING PERMITS FOR ANY OF THE BELOW LISTED NETS EXCEEDING MAXIMUM SIZE HAS BEEN WAIVED

THIS IS TO CERTIFY THAT ACTING UNDER THE PROVISIONS OF CHAPTER 29 OF THE FISH AND BOAT CODE, ACT 1980-175 AMENDED, 30 PA. C.SS CH29, THE OWNER OF THIS PERMIT IS HEREBY AUTHORIZED TO POSSESS THE FOLLOWING NET/NETS/ELECTROFISHING GEAR. ALL NETS SET WITHIN A COLLECTION DAY MUST BE TENDED DAILY.

Permit Authorized Gears Listed By User Project Name

Project Name	Gear Type	Number Each:	Gear Details
Southport Marine Terminal Aquatic Biota Survey - Delaware River	Eckman Dredge		
Southport Marine Terminal Aquatic Biota Survey - Delaware River	EF, Day Electroboat and Backpack		
Southport Marine Terminal Aquatic Biota Survey - Delaware River	Seine / Blocking Net (length height mesh required)		
Southport Marine Terminal Aquatic Biota Survey - Delaware River	Trotline - Variable hook spacing and leader length		

APPENDIX D

RARE, THREATENED, AND ENDANGERED SPECIES STUDIES

APPENDIX D.1

JOSEPH R. ARSENAULT BOTANICAL SURVEY

Joseph R. Arsenault
961 Clark Avenue
Franklinville, NJ 08322
856-697-6044; fax 697-6050,
NJPlants@Aol.com

Memo

To: Dr. Barry Dubinski, Weston Solutions

From: Joe Arsenault, 697-6044, 697-6050 fax, NJPlants@AOL.COM

CC:

Date: 12/24/2009

Re: Navy Yard Botanical Survey Response

Barry:

Attached are two copies of a botanical survey response to the recent PDNR letter. I followed the checklist and augmented the info with various lists, maps and photos. Keep one copy for the file and send the second to the state for their review. Let's hope they ask for no additional information. If they do, we'll have to wait 2010.

Call if you have any questions.

Thanks,
Joe Arsenault

Botanical Survey Results
Checklist Materials

For:

Philadelphia Navy Yard: Eastern End
City of Philadelphia
Philadelphia County, Pennsylvania

Contents:

- Survey Method
- Navy Yard Habitats
- Botanical Field Survey Forms
- Species of Special Concern Documentation
- Botanist Resume'

December 2009

Survey Method

Desk Audit
Field Inspection

Survey Methods

Desk Review

Prior to site inspections, a desk audit provided a review of the existing information known about the Navy Yard. The following maps and photographic sources were consulted:

- USGS Topographic Quadrangle, Philadelphia, Pa
- 1995, 2002 False Color Infrared Photos
- 2006 and Historic Air Photos available on Google Earth
- Approximate Location of State-Listed Rare Plan Species at the Philadelphia Naval Base Map, Weston Solutions dated September 30, 1994
- Environmental Constraints map developed by DMJM Harris/AECOM dated 9/18/2008

A review of the suspected species with suitable habitat was made using the following sources:

- Pennsylvania Natural Heritage List for Pennsylvania
- DCNR Information Letter dated February 9, 2004
- Species list from EA Engineering documenting 1991 Nature Conservancy Site Inspection
- A Natural Heritage Inventory of Philadelphia County, Pennsylvania prepared by the Pennsylvania Natural Heritage Program, dated December 2008

The following target species list was created from this existing data, annotated with typical habitat:

- Amaranthus cannabinus-tide marsh
- Andropogon gyrans-old field
- Aristida longespica var. geniculata-dry old field
- Baccharis halimifolia-disturbed areas
- Bidens bidentoides-tidal edges on rubble
- Bidens laevis-tide marsh
- Cirsium horridulum-old field, disturbed areas
- Cuscuta pentagona-upland old field
- Cyperus diandrus-freshwater wetland, puddles
- Echinochloa walteri-tide marsh
- Elatine Americana-lower tide mud flats
- Eleocharis obtusa var. peasei-tide marsh
- Eleocharis parvula-tide and freshwater edges
- Eupatorium rotundifolium-dry old field
- Euthamia tenuifolia-old field
- Heteranthera multiflora-tide mud flats
- Hypericum stragulum-uplands

- Juncus dichotomus-old field
- Lycopus rubellus-tide mud flats
- Panicum commonsianum var. commonsianum-upland
- Panicum polyanthes-moist old field
- Panicum scoparium-old field
- Physalis virginiana-old field
- Sagittaria calycina var. spongiosa
- Sagittaria subulata-tde mud flats
- Schoenoplectus fluviatilis-tide marsh
- Schoenoplectus smithii-pond edges, tide edges
- Strophostyles umbellate-upland old field
- Triplasis purpurea-dry disturbed habitats
- Tripsacum dactyloides-moist open areas
- Zizania aquatic-tide marsh

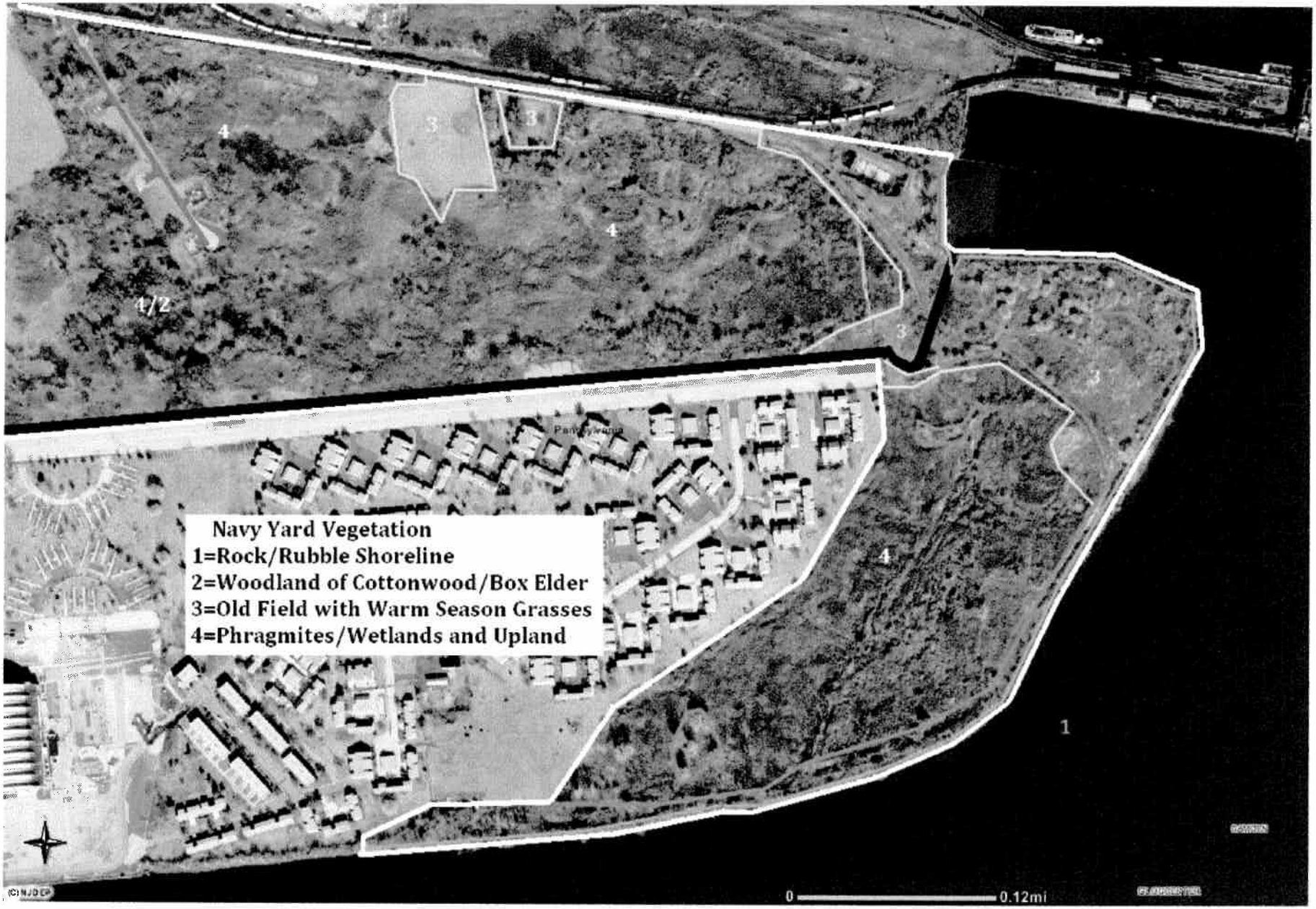
Field Method

The eastern edge of the Naval Yard was surveyed on October 6, 14; November 19, 2009. Using the habitat and species specific information obtained from State Natural Heritage lists and other sources, the inspection proceeded by reviewing the various vegetation communities on the Navy Yard. A running tally species list was made, recording all plants encountered.

Random (wander into available accessible areas) and regular (planned walking transects) inspections were made to locate suitable habitats. Field identifications supplied most of the records. Snippets of unknown plants were returned to the lab for positive identification using local and regional manuals (Fernald, 1950; Gleason, 1991; Flora of North America, 1999). Photos were taken to document species of special concern and to typify the existing conditions. The results are reported in this botanical survey summary.

Navy Yard Habitats

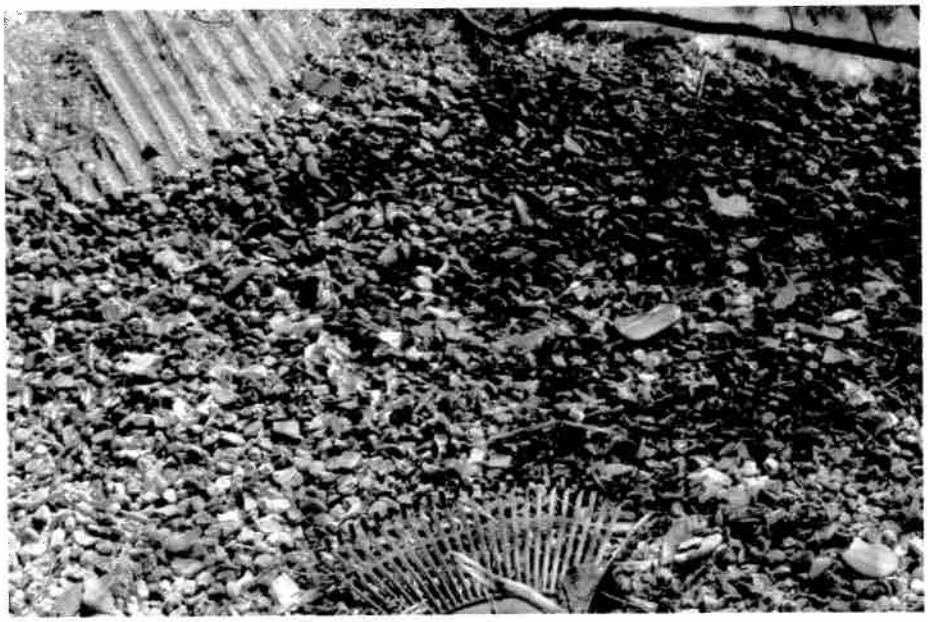
Generalized Vegetation Map
Plants Communities
Pennsylvania Natural Heritage Species List for Philadelphia Co.


Navy Yard Vegetation
1=Rock/Rubble Shoreline
2=Woodland of Cottonwood/Box Elder
3=Old Field with Warm Season Grasses
4=Phragmites/Wetlands and Upland
4/2
4
3
1
0
0.12mi

Navy Yard Vegetation

There are as many as seven plant communities on the eastern end of the Naval Base, ranging from tidal shores to upland woodlands.

Tidal Communities: High Energy, Rocky Shoreline and Mud Flats



Three distinct communities can be found below the tide line: high energy Delaware River shoreline, mud flats on the western end of the ship slip, and low energy rocky shoreline. Each area experiences tidal fluctuation. The Delaware shoreline is primarily a rock and rubble edge with little or no sand or organic substrate. Scour is an issue and the relative lack of any plants along this edge is a testament to the limits exhibited by the fast moving water.

The side channel and storm water ditch experience a slower mild undulation and provides habitat suitable for listed species such as *Bidens bidentoides, Lycopus rubellus* and *Sagittaria subulata*. The condition is found on the south bank of the ship slip and the tidal portion of the storm water ditch. The ditch is covered with 4' rip rap whereas the ship slip bank was created from land filled concrete and similar large fraction material. A significant fine and organic fractions fills the space between the larger rocks, creating suitable sediment conditions for plants. These conditions, however, have a northern aspect and are overshadowed by woody cover

during the growing season, limiting sun light by shade and likewise limiting available space for tidal plants.

The mud flat habitat is a narrow tidal edge on the west end of the ship slip. This provides a gentle slope and very fine silt sediment characteristic of slow moving tidal conditions. The habitat was observed to support only *Nuphar lutea* var. *advena*. The upper edge of the gentle slope is dominated by *Salix nigra* and other opportunistic woody species, reducing the exposed, low tide littoral zone to small fragments between tree cover.

Non-tidal Wetlands: Phragmites Dominated and Emergent Palustrine

Phragmites australis dominates a significant part of the undeveloped dredge spoil area. This is an area between the former base hosuing and the Delaware River shore line. Few plants are found in this monotypic stand.

On occasion, space opens and allows lower growing species such as *Juncus effusus, Lyrthum salicornia, Polygonum punctatum*, and *Eleocharis obtusa*. This emergent habitat occupies less than 10% of the available freshwater non tidal area; the remaining wetlands are reed grass dominated.

Upland Communities: Old Field and Seral Woodlands

Seral woodland community occupies the upper edge of filled along the Delaware River shoreline and scattered patches throughout the undeveloped part of the base. This community is identified by the presence of sapling and young trees of tree of heaven, mulberry, box elder maple, black cherry, princess tree and other opportunistic species. Bush honeysuckle, silky dogwood, Virginia creeper, Japanese honeysuckle and common black berry compete with aggressive perennials such as late goldenrod and common mugwort.

Old field community dominated by species tolerant of filled substrates occupies the open areas within and surrounding the woodland. Many parts of this community are dominated by invasive alien species. Common mugwort and sweet clover are everywhere, limiting space for many plants. Bush-clover dodder is found on the common mugwort in this part of the old field community. A few locations are recovering with common native coastal plain species such as *Andropogon virginicus, Juncus tenuis, Juncus dichotomus, Solidago altissima, Solidago canadensis* and *Tridens flavus*. It is within this native component that velvet rosette panic grass and forked rush are found.

Philadelphia County Plant Species: Local Suitable Habitat; Found on Site

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Aeschynomene virginica	Sensitive Joint-vetch	G2	SX	PX	PX	
Aletris farinosa	Colic-root	G5	S1	TU	PE	
Alopecurus aequalis	Short-awn Foxtail	G5	S3	N	PT	
Amaranthus cannabinus	Waterhemp Ragweed	G5	S3	PR	PR	
Ammannia coccinea	Scarlet Ammannia	G5	S2	PE	PT	
Andropogon gyrans	Elliott's Beardgrass	G5	S3	N	PR	
Aristida longespica var. geniculata	Spiked Needlegrass	G5T5?	SU	TU	WATCH	
Asclepias rubra	Red Milkweed	G4G5	SX	PX	PX	
Asclepias variegata	White Milkweed	G5	S1	TU	PE	
Asplenium pinnatifidum	Lobed Spleenwort	G4	S3	N	PR	
Baccharis halimifolia	Eastern Baccharis	G5	S3	PR	PR	
Bidens bidentoides	Swamp Beggar-ticks	G3G4	S1	PT	PE	
Bidens laevis	Beggar-ticks	G5	S1	N	PE	
Carex hyalinolepis	Shore-line Sedge	G4G5	SX	PX	PX	
Chamaesyce polygonifolia	Small Sea-side Spurge	G5?	S2	PT	PT	
Chasmanthium laxum	Slender Sea-oats	G5	S1	PE	PE	
Chrysopsis mariana	Maryland Golden-aster	G5	S1	PT	PE	
Cirsium horridulum	Horrible Thistle	G5	S1	PE	PE	
Cladium mariscoides	Twig Rush	G5	S2	PE	PE	
Clitoria mariana	Butterfly-pea	G5	S1	PE	PE	
Collinsia verna	Spring Blue-eyed Mary	G5	S4	PR	WATCH	
Cuscuta campestris	Dodder	G5	S2	N	PT	
Cuscuta pentagona	Field Dodder	G5	S2	N	PT	
Cyperus diandrus	Umbrella Flatsedge	G5	S2	PE	PE	
Cystopteris	Bladder Fern	G5	S1	N	TU	

tennesseensis					
Desmodium laevigatum	Smooth Tick-trefoil	G5	SU	N	TU
Desmodium nuttallii	Nuttalls' Tick-trefoil	G5	S2	TU	TU
Desmodium obtusum	Stiff Tick-trefoil	G4G5	SU	N	TU
Echinochloa walteri	Walter's Barnyard-grass	G5	S1	PE	PE
Elatine americana	Long-stemmed Water-wort	G4	SU	PX	PE
Eleocharis obtusa var. peasei	Wrights Spike Rush	G5TNR	S1	PE	PE
Eleocharis parvula	Little-spike Spike-rush	G5	S1	PE	PE
Elephantopus carolinianus	Elephant's Foot	G5	S3	PE	PR
Ellisia nyctelea	Ellisia	G5	S2	PT	PT
Epilobium strictum	Downy Willow-herb	G5?	S3	PE	PR
Erianthus giganteus	Sugar Cane Plumegrass	G5	SX	PX	PX
Eryngium aquaticum	Marsh Eryngo	G4	SX	PX	PX
Eupatorium rotundifolium	A Eupatorium	G5	S3	TU	TU
Eurybia spectabilis	Low Showy Aster	G5	S1	PE	PE
Euthamia tenuifolia	Grass-leaved Goldenrod	G5	S1	PT	PT
Fimbristylis annua	Annual Fimbry	G5	S2	PT	PT
Galactia regularis	Eastern Milk-pea	G5	SX	PX	PX
Galactia volubilis	Downy Milk-pea	G5	SX	PX	PX
Gentiana saponaria	Soapwort Gentian	G5	S1S2	TU	PE
Glyceria obtusa	Blunt Manna-grass	G5	S1	PE	PE
Gratiola aurea	Golden Hedge-hyssop	G5	S1	TU	PE
Heteranthera multiflora	Multiflowered Mud-plantain	G4	S1	PE	PE
Hydrocotyle umbellata	Many-flowered Pennywort	G5	SH	PX	PX
Hypericum densiflorum	Bushy St. John's-wort	G5	S3	PT	PR

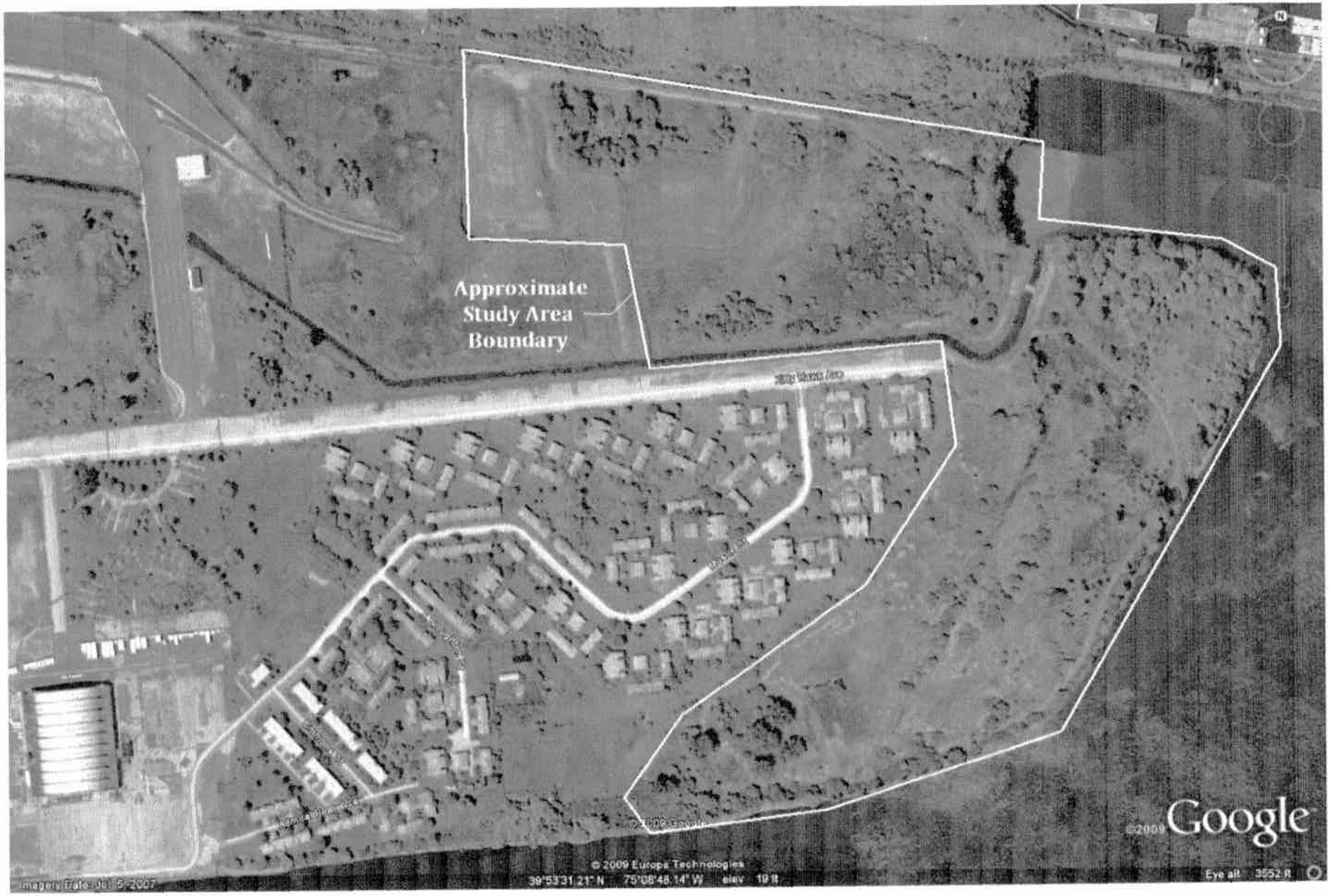
Hypericum stragulum	St Andrew's-cross	G4	S2	N	PT	
Isotria medeoloides	Small-whorled Pogonia	G2	S1	PE	PE	LT
Juncus biflorus	Grass-leaved Rush	G5	S2	TU	PT	
Juncus dichotomus	Forked Rush	G5	S1	PE	PE	
Juncus scirpoides	Scirpus-like Rush	G5	S1	PE	PE	
Juniperus communis	Common Juniper	G5	S2	N	TU	
Lathyrus palustris	Vetchling	G5	S1	TU	PE	
Lathyrus venosus	Veiny Pea	G5	S2	N	PE	
Lemna obscura	Little Water Duckweed	G5	SX	PX	PX	
Lemna perpusilla	Minute Duckweed	G5	S1S3	N	TU	
Lemna valdiviana	Pale Duckweed	G5	SH	PX	PX	
Leucothoe racemosa	Swamp Dog-hobble	G5	S2S3	TU	PT	
Limosella australis	Awl-shaped Mudwort	G4G5	SX	PX	PX	
Lycopodiella appressa	Southern Bog Clubmoss	G5	S2	PT	PT	
Lycopus rubellus	Bugleweed	G5	S1	PE	PE	
Lyonia mariana	Stagger-bush	G5	S1	PE	PE	
Lythrum alatum	Winged-loosestrife	G5	S1	TU	PE	
Matelea obliqua	Oblique Milkvine	G4?	S1	PE	PE	
Micranthemum micranthemoides	Nuttall's Mud-flower	GH	SX	PX	PX	
Monarda punctata	Spotted Bee-balm	G5	SH	PE	PE	
Muhlenbergia uniflora	Fall Dropseed Muhly	G5	S2	PE	PT	
Myriophyllum heterophyllum	Broad-leaved Water-milfoil	G5	S4	PE	SP	
Oenothera oakesiana	Evening-primrose	G4G5Q	S2	N	PT	
Opuntia humifusa	Prickly-pear Cactus	G5	S3	PR	PR	
Oxypolis rigidior	Stiff Cowbane	G5	S2	TU	PT	
Panicum commonsianum var. commonsianum	Commons' Panic-grass	G5TNR	SH	TU	PX	
Panicum polyanthes	Panic-grass	GNR	S4	N	WATCH	
Panicum scoparium	Velvety Panic-	G5	S1	PE	PE	

	grass				
Passiflora lutea	Passion-flower	G5	S2	PE	PT
Phaseolus polystachios	Wild Kidney Bean	G5	S1S2	N	PE
Phlox pilosa	Downy Phlox	G5	S1S2	TU	PE
Phyllanthus caroliniensis	Carolina Leaf-flower	G5	S1	PE	PE
Physalis virginiana	Virginia Ground-cherry	G5	S1S2	TU	PE
Pinus echinata	Short-leaf Pine	G5	S1S2	N	PT
Piptochaetium avenaceum	Blackseed Needlegrass	G5	S1	N	PE
Pluchea odorata	Shrubby Camphor-weed	G5	S1	TU	PE
Poa autumnalis	Autumn Bluegrass	G5	S1	PE	PE
Polygala cruciata	Cross-leaved Milkwort	G5	S1	PE	PE
Potamogeton vaseyi	Vasey's Pondweed	G4	S1	PE	PE
Prenanthes serpentaria	Lion's-foot	G5	S3	N	PT
Ptilimnium capillaceum	Mock Bishop-weed	G5	SX	PE	PX
Pycnanthemum verticillatum var. pilosum	Hairy Mountain-mint	G5T5	SH	TU	PX
Pyrola chlorantha		G5	S1	N	PE
Quercus falcata	Southern Red Oak	G5	S1	PE	PE
Quercus phellos	Willow Oak	G5	S2	PE	PE
Ranunculus aquatilis var. diffusus	White Water-crowfoot	G5T5	S3		PR
Ranunculus flammula	Lesser Spearwort	G5	SH	TU	PX
Ranunculus pusillus	Spearwort	G5	S1	N	PE
Sagittaria calycina var. spongiosa	Long-lobed Arrow-head	G5T4	S1	PE	PE
Sagittaria subulata	Subulate Arrowhead	G4	S3	PR	PR
Schoenoplectus fluviatilis	River Bulrush	G5	S3	PR	PR
Schoenoplectus smithii	Smith's Bulrush	G5?	S1	PE	PE

Scleria pauciflora	Few Flowered Nutrush	G5	S2	PT	PT
Senna marilandica	Wild Senna	G5	S3	TU	PR
Sericocarpus linifolius	Narrow-leaved White-topped Aster	G5	S1	PE	PE
Sisyrinchium fuscatum	Sand Blue-eyed Grass	G5?	SH	PX	PX
Solidago uliginosa	Bog Goldenrod	G4G5	S2	N	PT
Sparganium androcladum	Branching Bur-reed	G4G5	S1	PE	PE
Spiranthes lucida	Shining Ladies'-tresses	G5	S3	N	PT
Spiranthes vernalis	Spring Ladies'-tresses	G5	S1	PE	PE
Strophostyles umbellata	Wild Bean	G5	S2	N	PE
Stylosanthes biflora	Pencilflower	G5	S2	TU	PE
Symphyotrichum novi-belgii	New York Aster	G5	S2	PT	PT
Trichostema setaceum	Blue-curls	G5	S1	PE	PE
Triosteum angustifolium	Horse-gentian	G5	S1	TU	PE
Triphora trianthophora	Nodding Pogonia	G3G4	SH	PE	PE
Triplasis purpurea	Purple Sandgrass	G4G5	S1	PE	PE
Tripsacum dactyloides	Eastern Gamma-grass	G5	S1	TU	PE
Veratrum virginicum	Virginia Bunchflower	G5	S1	N	PE
Vernonia glauca	Tawny Ironweed	G5	S1	PE	PE
Viburnum trilobum	Highbush-cranberry	G5T5	S3S4	TU	PR
Viola brittoniana	Coast Violet	G4G5	S1	PE	PE
Woodwardia areolata	Netted Chainfern	G5	S2	N	PT
Zizania aquatica	Indian Wild Rice	G5	S3	PR	PR

Botanical Field Survey

Study Area Map
Philadelphia Navy Yard Species List
Field Survey Forms: Absence


Approximate
Study Area
Boundary
©2009 Google
© 2009 Europa Technologies
39°53'31.21" N 75°08'48.14" W elev 19 ft
Eye alt 3552 ft
Imagery Date: Jul 5, 2007

Cyperus difformis L. Variable Flat Sedge
Cyperus erythrorhizos Muhl. Red-Root Flat Sedge
Cyperus odoratus L. Rusty Flat Sedge
Cyperus squarrosus L. Awned Flat Sedge
Dactylis glomerata L. Orchard Grass
Daucus carota L. Queen Anne's-Lace
Dennstaedtia punctilobula (Michx.) T. Moore Eastern Hay-Scented Fern
Dianthus armeria L. Deptford Pink
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark Tapered Rosette Grass
Dichanthelium acuminatum var. *lindheimeri* (Nash) Gould & C.A. Clark
Dichanthelium scoparium (Lam.) Gould Velvet Rosette Panic Grass
Digitaria ischaemum (Schreb.) Schreb. Ex Muhl. Smooth Crab Grass
Digitaria sanguinalis (L.) Scop. Hairy Crab Grass
Eleocharis obtusa (Willd.) J.A. Schultes Blunt Spike-Rush
Elymus riparius Wieg. River-Bank Wild Rye
Eragrostis pectinacea (Michx.) Nees ex Steud. Purple Love Grass
Eragrostis spectabilis (Pursh) Steud. Petticoat-Climber
Erechtites hieraciifolia (L.) Raf. Ex DC. American Burnweed
Eupatorium hyssopifolium L. Hyssop-Leaf Thoroughwort
Eupatorium serotinum Michx. Late-Flowering Thoroughwort
Euthamia graminifolia (L.) Greene Flat-Top Goldentop
Forsythia x intermedia Zabel Showy Forsythia
Fraxinus americana L. White Ash
Gymnocladus dioicus (L.) K. Koch Kentucky Coffeetree
Helianthus tuberosus L. Jerusalem Artichoke
Helenium autumnale L. Common Sneezeweed
Hieracium pilosella L. Mouse-Ear Hawkweed
Hibiscus moscheutos L. Marsh Mallow
Hibiscus syricus L. Rose of Sharon
Hordeum jubatum L. Fox-Tail Barley
Hypericum punctatum Lam. Spotted St. John's-Wort
Impatiens capensis Meerb. Spotted Touch-Me-Not
Iris pseudoacorus L. Yellow Iria
Juncus dichotomus Elliot Forked Rush
Juncus effusus L. Lamp Rush
Juncus tenuis Willd. Poverty Rush
Latuca spp. Wild Lettuce
Lemna minor L.
Leersia oryzoides (L.) Sw. Rice Curt Grass
Lobelia chinensis Lour. Chinese Lobelia
Lolium arundinaceum (Schreb.) S.J. Darbyshire Tall Rye Grass
Lonicera japonica Thunb. Japanese Honeysuckle
Lonicera morrowii Gray Morrow's Honeysuckle
Lycopus americanus Muhl. Ex W. Bart. Cut-Leaf Water-Horehoud
Lycopus rubellus Moench. Taper-leaf Water horehound
Lythrum salicaria L. Purple Loosestrife
Melilotus officinalis (L.) Lam. Yellow Sweet-Clover

Morus alba L. White Mulberry
Nuphar lutea (L.) Sm. ssp. *advena* (Aiton) Kartesz & Gandhi Yellow Pond Lily
Oenothera biennis L. King's-Cureall
Onoclea sensibilis L. Sensitive Fern
Osmunda regalis L. Royal Fern
Oxalis stricta L. Upright Yellow Wood-Sorrel
Panicum capillare L. Common Panic Grass
Panicum dichotomiflorum Michx. Fall Panic Grass
Panicum virgatum L. Wand Panic Grass
Parthenocissus quinquefolia (L.) Planch. *Virginia*-Creeper
Paulownia tomentosa (Thunb.) Sieb. & Zucc. Ex Steud. Princesstree
Petrorhagia prolifera (L.) P.W. Ball & Heywood Childing-Pink
Phragmites austrais (Cav.) Trin. Ex Steud. Common Reed
Phytolacca americana L. American Pokeweed
Pilea pumila (L.) A. Gray Clearweed
Plantago lanceolata L. English Plantain
Platanus hybrida Brot. London Planetree
Polygonum cuspidatum Sieb. & Zucc. Japanese Knotweed
Polygonum hydropiperoides Michx. Swamp Smartweed
Polygonum lapathifolium L. Dock-Leaf Smartweed
Polygonum perfoliatum L. Asiatic Tearthumb
Polygonum punctatum Elliot Dotted Smartweed
Populus deltoids Bartr. Ex Marsh. Eastern Cottonwood
Potentilla erecta (L.) Raeusch. Erect Cinquefoil
Prunus serotina Erh. Black Cherry
Pseudognaphalium obtusifolium (L.) Hilliard & Burtt Blunt-Leaf Rabbit-Tobacco
Pyrus calleryana Dcne. Bradford Pear
Quercus palustris L. Pin Oak
Rhus copallinum L. Winged Sumac
Rhus typhina L. Stag-Horn Sumac
Robinia pseudoacacia L. Black Locust
Rudbeckia hirta L. Black Eyed Susan
Rubus allegheniensis Porter Allegheny Blackberry
Rubus flagellaris Willd. Northern Dewberry
Rubus laciniatus Willd. *Cut-Leaf Blackberry*
Rumex altissimus Alph. Wood Pale Dock
Rumex crispus L. Curly Dock
Rumex obtusifolius L. Bitter Dock
Salix fragilis L. Fragile Willow
Salix nigra Marsh. Black Willow
Sambucus nigra L. var. *Canadensis* (L.) R. Bolli American Elderberry
Scirpus cyperinus (L.) Kunth Cottongrass Bulrush
Setaria parviflora (Poir.) Kerguélen Marsh Bristle Grass
Setaria pumila (Poir.) Roemer & J.A. Schultes Yellow Bristle Grass
Sisyrinchium angustifolium P. Mill. Narrow-Leaf Blue-Eyed-Grass
Solidago altissima L. Tall Goldenrod
Solidago canadensis L. Canadian Goldenrod

Solidago gigantea Ait. Late Goldenrod
Solidago rugosa P. Mill. Wrinkle-Leaf Goldenrod
Solidago sempervirens L. Sea-Side Goldenrod
Sporobolus vaginiflorus (Torr. Ex Gray) Wood Poverty Dropseed
Symphyotrichum novae-angliae (L.) G.L. Nesom New England Aster
Symphyotrichum pilosum (Willd.) Nesom White Oldfield American-Aster
Thelypteris palustris Schott Eastern Marsh Fern
Toxicodendron radicans (L.) Kuntze Eastern Poison-Ivy
Tridens flavus (L.) A.S. Hitchc. Tall Redtop
Trifolium pratense L. Red Clover
Trifolium repens L. White Clover
Ulmus pumila L. Siberian Elm
Ulmus rubra Muhl. Slippery Elm
Urtica dioica L. Stinging Nettle
Vaccinium corymbosum L. Highbush Blueberry
Verbascum blattaria L. White Moth Mullein
Verbascum thapsus L. Great Mullein
Verbena urticifolia L. White Vervain

Approximately 158 species

Yellow Names are PA Listed Species

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

SPECIES ABSENCE FORM

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia
Survey Date/s 10/6, 14; 11/19/2009	Surveyor J.R. Arsenault
Amount of time spent surveying area 11.5 manhours	
Name of site owner Department of the Navy	
Directions to site Broad Street, Philadelphia to Navy Yard, access east end	
GPS (decimal degrees preferred) approximate center point of site N039.8913638 W075.1430851	
Scientific name/s of target species SEE ATTACHED TARGET SPECIES LIST	
Site habitat description Various: upland old field, woodland, tidal & non-tidal wetland	
Substrate/soil type Fill: Dredge spoil + land fill	
System: ✓ Terrestrial ✓ Palustrine ✓ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy	<25'	60%	BOX ELDER, TREE OF HEAVEN
Tree sub-canopy			
Tall shrub(>1 m)	<10	20%	SILKY DOGWOOD, ELDERBERRY
Short shrub(<1 m)	<5	20-50	Common + Cut Leaf Blackberry
Herbaceous		10-100	Phragmites, late Goldenrod
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

SEE ATTACHED TARGET SPECIES LIST

Estimate of immediate area that is potential habitat for target SOSC

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

FERNALD (1950) Gleason (1991) FNA (1999)

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	✓ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

✓ Elements may have never occurred here – 1st time area searched

Other: succession

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC

GPS coordinates (decimal degrees preferred)

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	Flat	Open	Crest	___ Inundated (hydric)	___ Min
E	0-10%	Partial	Upper slope		___ Max
S	10-35%	Filtered	Mid-slope	___ Saturated (wet-mesic)	
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	___ Moist (mesic)	
NW					
SE				___ Dry (mesic)	
SW					
None				___ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf		1-10	1 YD 2	Annuals	Very feeble
In bud		11-50	1-5 YD 2	% Seedlings	Feeble
In flower		51-100	5-10 YD 2	% Immature	Normal
Immature fruit		101-1000	10-100 YD 2	% 1st year	Vigorous
Mature fruit		1001-10K	100 YD 2 - 2 AC	% Mature	Exceptional vigor
Seed dispersing		10K+	2+ ACRES	% Senescent	
		EST #	EST AREA		

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Species of Special Concern: Absence and Rationale

The following species do not have habitat on the Navy Yard due to the lack of tide marsh:

- Amaranthus cannabinus-tide marsh
- Bidens laevis-tide marsh
- Echinochloa walteri-tide marsh
- Schoenoplectus fluviatilis-tide marsh
- Zizania aquatic-tide marsh

The following tidal mud flat species do not have suitable habitat on the Navy Yard Delaware River shoreline due to high energy tidal flow:

- Bidens bidentoides-tidal edges, plenty of rubble, no plnats
- Elatine Americana-lower tide mud flats
- Eleocharis obtusa var. peasei-tide marsh
- Eleocharis parvula-tide and freshwater edges
- Heteranthera multiflora-tide mud flats
- Lycopus rubellus-tide mud flats
- Sagittaria calycina var. spongiosa
- Sagittaria subulata-tde mud flats
- Schoenoplectus smithii-pond edges, tide edges

The following tidal mud flat species have very limited habitat in the ship slip on the northern edge of the Navy Yard, and were not found during the site inspections:

- Bidens bidentoides-tidal edges on rubble
- Elatine Americana-lower tide mud flats
- Eleocharis obtusa var. peasei-tide marsh
- Eleocharis parvula-tide and freshwater edges
- Heteranthera multiflora-tide mud flats
- Sagittaria calycina var. spongiosa
- Sagittaria subulata-tde mud flats
- Schoenoplectus smithii-pond edges, tide edges

The following old field species have limited habitat yet were not found during the site inspections:

- Andropogon gyrans-old field
- Aristida longespica var. geniculata-dry old field
- Baccharis halimifolia-disturbed areas
- Cirsium horridulum-old field, disturbed areas
- Euthamia tenuifolia-old field

- Hypericum stragulum-uplands
- Juncus dichotomus-old field
- Panicum commonsianum var. commonsianum-upland
- Panicum polyanthes-moist old field
- Physalis virginiana-old field
- Strophostyles umbellate-upland old field
- Triplasis purpurea-dry disturbed habitats
- Tripsacum dactyloides-moist open areas

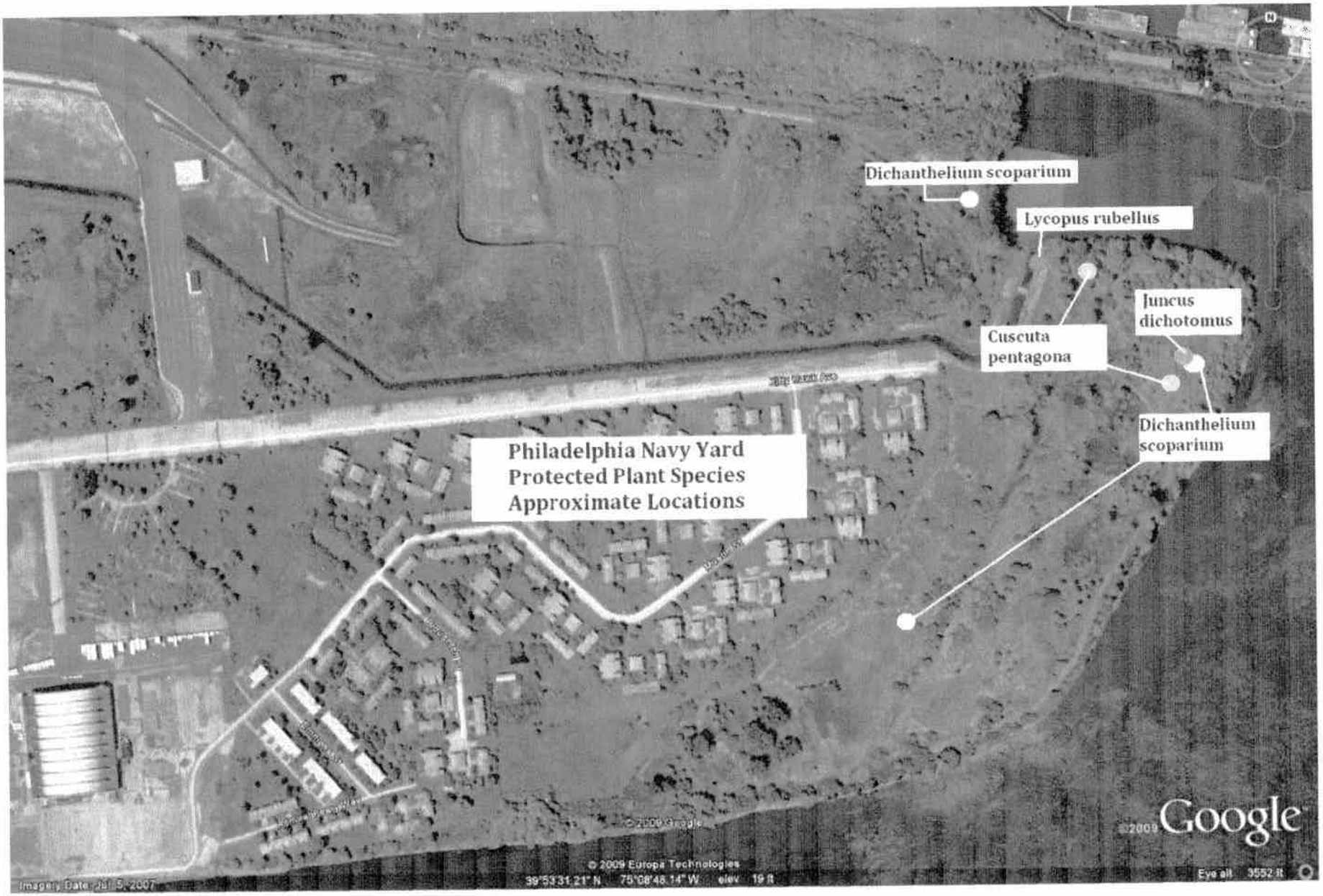
The following non-tidal wetland species were not discovered during the site inspections:

- Cyperus diandrus-freshwater wetland, puddles
- Tripsacum dactyloides-moist open areas

Navy Yard - October 6, 14, November 19, 2009
Acer negundo L. Ash-Leaf Maple
Acer rubrum L. Red Maple
Acer saccharinum L. Silver Maple
Achillea millefolium L. Common Yarrow
Ageratina altissima (L.) King & H.E. Robins. White Snakeroot
Agrimonia parviflora Aiton Harvest Lice
Agrostis perennans (Walt.) Tuckerman Upland Bent
Agrostis stolonifera L. Spreading Bent
Ailanthus altissima (P. Mill.) Swingle Tree-of-Heaven
Alliaria petiolata (M. Bieb.) Cavara & Grande Garlic mustard
Allium vineale L. Crow Garlic
Ambrosia artemisiifolia L. Annual Ragweed
Amorpha fruticosa L. False Indigo-Bush
Ampelopsis brevipedunculata (Maxim.) Trautv. Porcelainberry
Andropogon virginicus L. Broom-Sedge
Apocynum cannabinum L. Indian-Hemp
Aristida oligantha Michx. Prairie Three-Awn
Artemisia annua L. Annual Wormwood
Artemisia vulgaris L. Common Wormwood
Asclepias incarnata L. Swamp Milkweed
Asclepias syriaca L. Common Milkweed
Asplenium platyneuron (L.) B.S.P. Ebony Spleenwort
Barbarea vulgaris W.T. Aiton Yellow Rocket
Betula populifolia Marsh. Gray Birch
Bidens frondosa L. Devil's Beggartick
Boehmeria cylindrical (L.) Sw. Small-Spike False Nettle
Bromus japonicus Thunb. Ex Murr. Japanese Brome
Carex scoparia Schkuhr ex Willd. Pointed Broom Sedge
Carex sp. Unidentified river bank species
Carex annectens E.P. Bicknell Yellow Fruited Sedge
Carex frankii Kunth. Frank's Sedge
Carex longii Mackenzie Long's Sedge
Carex scoparium Schkuhr ex Willd. Broom Sedge
Celastrus orbiculata Thunb. Asian Bittersweet
Celtis occidentalis L. Common Hackberry
Cethalanthus occidentalis L. Buttonbush
Cirsium arvense L. Canada Thistle
Chamaesyce maculata (L.) Small Spotted Sandmat
Chenopodium album L. Lamb's-Quarters
Chenopodium ambrosioides L. Mexican-Tea
Clematis terniflora DC. Sweet Autumn Virgin's-Bower
Conyza canadensis (L.) Cronq. Canadian Horseweed
Cornus amomum P. Mill. Silky Dogwood
Coronilla varia L. Purple Crown-Vetch
Cuscuta pentagona Emgelm. Five Angle Dodder
Cyperus amuricus Maxim. Asian Flat Sedge

Species of Special Concern Descriptions

Approximate Species Location Graphic
Field Survey Forms: Presence
Species Specific Documentation


Philadelphia Navy Yard
Protected Plant Species
Approximate Locations
Dichanthelium scoparium
Lycopus rubellus
Cuscuta pentagona
Juncus dichotomus
Dichanthelium scoparium
© 2009 Google
© 2009 Europa Technologies
39°53'31.21" N 75°08'48.14" W elev 19 ft
Eye alt 3552 ft
Imagery Date: Jul 5, 2007

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County PHILADEPHIA	Quad PHILADELPHIA, PA
Survey Date/s 10/6, 14; 11/19/2009	Surveyor J. Arsenault
Amount of time spent surveying area 11.5 man hours	
Name of site owner Department of Navy	
Directions to site Follow Broad St. South into Navy Yard. ACCESS EAST END OF KITTY HAWK AVE.	
GPS (decimal degrees preferred) approximate center point of site 1) N39.8932270, W75.1425998 2) N39.8928308, W75.1421771	
Scientific name/s of target species Cuscuta pentagona Engelm.	
Site habitat description dry oldfield	
Substrate/soil type Fill: landfill	
System: ✓ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5'	80%	GOLDENRODS, warm/cool season grasses
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC < 1.5 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.) Plants database
Fernald (1950) G&C (1950; 1991) USDA (2009)

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Follow gravel road east from Kitty Hawk (approx 800'), turn left (N) into old field.

GPS coordinates (decimal degrees preferred) 2 separate sites.
1) N39.8932270 W75.1425982
2) N39.8928308 W75.1421771

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	✓ Flat	✓ Open	Crest	___ Inundated (hydric)	___ Min
E	✓ 0-10%	Partial	Upper slope		19 Max
✓ S	10-35%	Filtered	✓ Mid-slope	___ Saturated (wet-mesic)	(USGS)
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	___ Moist (mesic)	
NW					
SE				___ Dry (mesic)	
SW					
None				✓ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]		*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf	✓	1-10		1 YD 2	✓ Annuals	Very feeble
In bud		11-50		✓ 1-5 YD 2	% Seedlings	✓ Feeble
✓ In flower		51-100		✓ 5-10 YD 2	% Immature	✓ Normal
Immature fruit		101-1000		10-100 YD 2	% 1st year	Vigorous
Mature fruit		1001-10K		100 YD 2 – 2 AC	% Mature	Exceptional vigor
Seed dispersing		10K+		2+ ACRES	% Senescent	
		EST #		EST AREA		

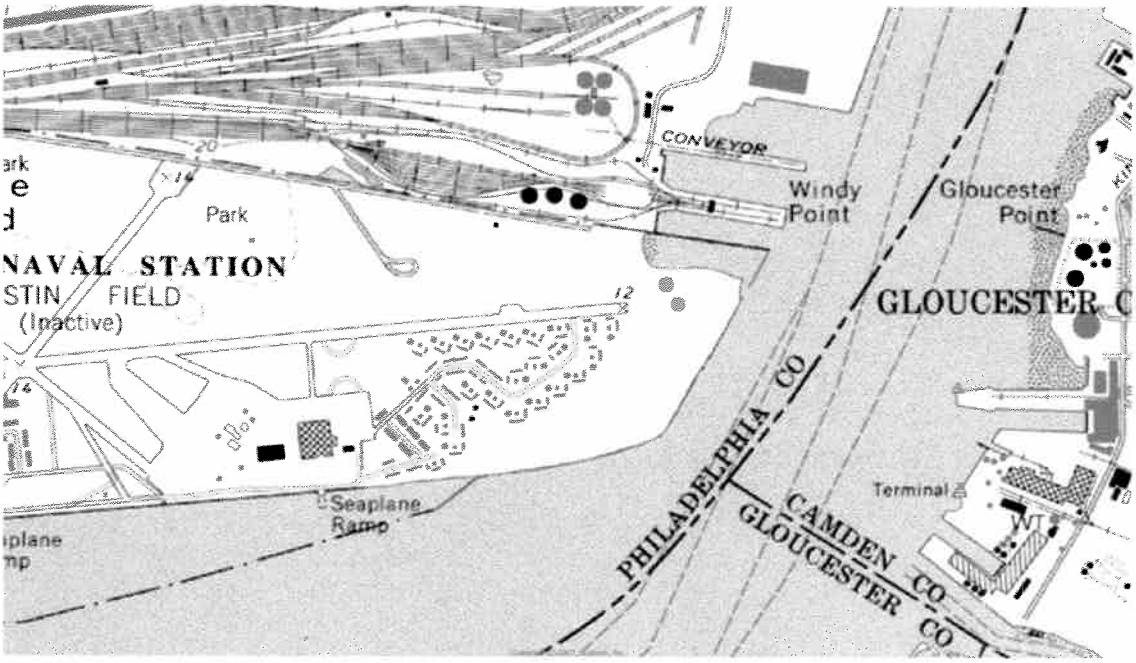
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) small, few individuals on small area
Age, successional stage of system oldfield, age 39 years +/- 7 years
____ Known or ____ Inferred land use history OPEN WATER IN 1963, filled by 1970, abandoned
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance Landfill & dredge spoil site
Integrity/fragmentation of community weakly connected to other old fields in the water front, otherwise fragmented
List of invasive species (alien or native) (see site species list) extensive invasive flora
Threats (on-site) development
Threats (off-site) industrial zoning
List other members of this genus that occur on site. Hybridization? none
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Cuscuta pentagona Engelm.

Bush-Clover Dodder

Location of 2 Populations on Philadelphia, PA USGS Topographic Map



1: 039.8932270N, 075.1425998W
2. 039.8928308N, 075.1421771W

Bush-clover dodder has two populations in the old field habitat, at east end of Navy Yard.

Population Size:

#1: One small intertwined cluster of plants near fence.

#2: Less than 5 twining clusters.

Navy Yard Habitat:

This species is found exclusively on common mugwort in an upland old field habitat.

Bush-Clover Dodder Photos

View of old field habitat. Mugwort in foreground supports population #2

Cuscuta pentagona on *Artemisia vulgaris* at population #2

Close view of *Cuscuta pentagona* showing 5-merous flowers.

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia, PA
Survey Date/s 10/6, 14; 11/19/2009	Surveyor J. Arseneault
Amount of time spent surveying area 11.5 man hours	
Name of site owner Department of the Navy	
Directions to site Broad Street south into Navy Yard, access east end of Kitty Hawk Avenue.	
GPS (decimal degrees preferred) approximate center point of site N 039.8913638 ; W075.1430851	
Scientific name/s of target species Dichanthelium scoparium (Lam) Gould	
Site habitat description old field	
Substrate/soil type fill: land fill	
System: ✓ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5	80%	warm/cool season grasses, goldenrods
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC < 3 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

Flora North America VOL 25

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Follow gravel road at east end Kitty Hawk Ave 800' east, plant found in numerous old field patches.

GPS coordinates (decimal degrees preferred) 3 SITES ESTIMATED AT:
1) 039.8929514N W 075.1414873 2) N 39.8940195 W 75.1435120 3) N 39.8905915 W 75.1432896

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	___ Flat	✓ Open	___ Crest	___ Inundated (hydric)	19 Min
E	✓ 0-10%	___ Partial	___ Upper slope		___ Max
✓ S	___ 10-35%	___ Filtered	✓ Mid-slope	___ Saturated (wet-mesic)	USGS
W	___ 35+%	___ Shaded	___ Lower slope		
NE	___ Vertical		___ Bottom	___ Moist (mesic)	
NW					
SE				✓ Dry (mesic)	
SW					
None				✓ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]		*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
✓ In leaf		1-10		1 YD 2	Annuals	Very feeble
In bud		11-50		1-5 YD 2	% Seedlings	Feeble
In flower	✓	51-100		5-10 YD 2	% Immature	Normal
Immature fruit		101-1000		✓ 10-100 YD 2	% 1st year	✓ Vigorous
✓ Mature fruit		1001-10K		100 YD 2 – 2 AC	100 % Mature	Exceptional vigor
Seed dispersing		10K+		2+ ACRES	% Senescent	
		EST #		EST AREA		

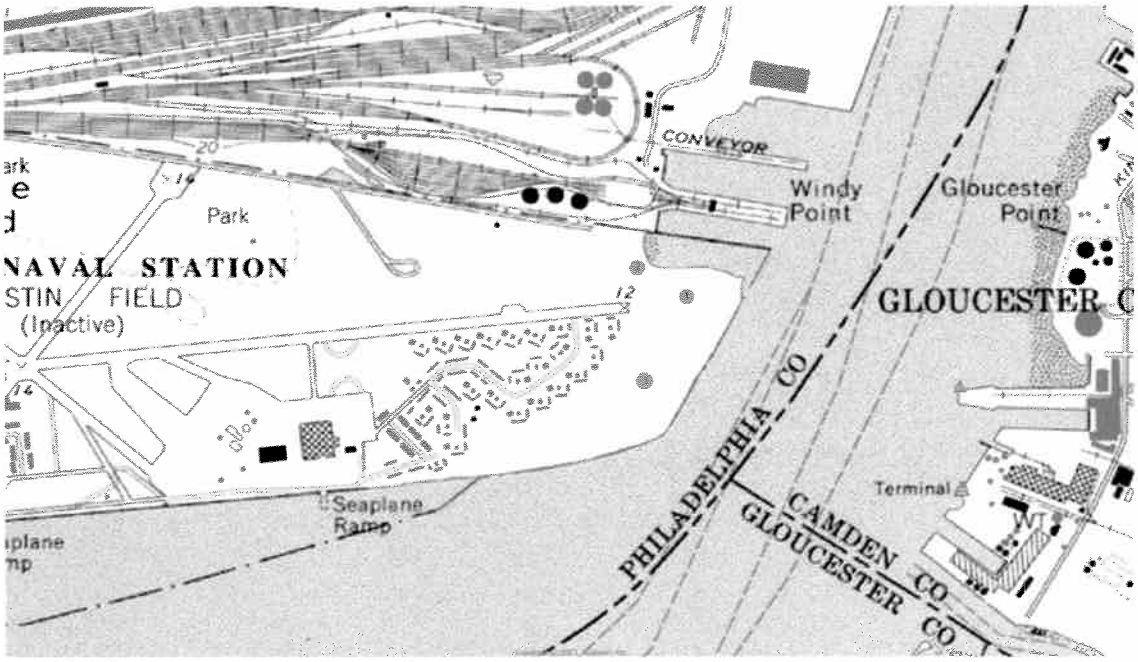
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) similar population size & distribution to others S&E on Coastal Plain
Age, successional stage of system old field, 39 years +/- 7 years
✓ Known or ____ Inferred land use history OPEN WATER in 1965, Filled by 1970, abandoned
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance Fill: Land Fill & dredge spoil
Integrity/fragmentation of community Fragmented by urban setting
List of invasive species (alien or native) many invasive species in flora, see attached species list.
Threats (on-site) development
Threats (off-site) industrial zoning
List other members of this genus that occur on site. Hybridization? Dichanthelium acuminatum, clandestinum
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Dichanthelium scoparium (Lam.) Gould

Velvet Rosette Panic Grass

Location of 3 Populations on Philadelphia, PA USGS Topographic Map



1: N039.8929514/W075.1414873 2: 039.8940195/075.1435120 3: 039.8905915/075.1432896

Three separate Velvet Rosette Panic Grass populations in open, old field habitats

Population Size:

#1: An unknown number of individual rosette scattered within a ~50' X 100' space at the northern end of the old field.

#2: Less than twenty individual clumps within a space of 4' X 10'. These plants occupy a narrow overgrown road cut, east of the Navy Yard's shooting range backstop.

#3: Small cluster of rosettes, multiple stems from a ~10' X 10' patch within an otherwise *Phragmites australis* dominated area.

Navy Yard Habitat:

Old field plant community dominated by *Andropogon virginicus, Dactylis glomerata, Melilotus officinalis, Artemisia vulgaris, Solidago altissima* established on a spoil and land fill substrates.

Velvet Rosette Panic Grass Habitat and Species Specific Photos

View of old field habitat located on east end of Navy Yard, north of gravel access road

Fall habit of *Dichanthelium scoparium*: multiple branches from an unknown number of plants

Close view of Velvet Rosette Panic Grass

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Botanical Field Survey Form for Environmental Review

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Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia, PA
Survey Date/s 10/6,14; 11/19/2009	Surveyor J. Arsenault
Amount of time spent surveying area 11.5 manhours	
Name of site owner Department of the Navy	
Directions to site Follow Broad Street south into Navy Yard, access east end Kitty Hawk Avenue.	
GPS (decimal degrees preferred) approximate center point of site N 039.8913638 W 075.1430851	
Scientific name/s of target species Juncus dichotomus Ell.	
Site habitat description old Field	
Substrate/soil type Fill	
System: ✓ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5	80	warm & cool season Grasses
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC <1.5 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

Fernald (1950) FNA vol 22

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Follow gravel road east 800' from Kitty Hawk Ave terminus, turn left (N) ~200' into old field, marked with orange ribbon

GPS coordinates (decimal degrees preferred)

N039.8929514 W075.141873

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
___ N	___ Flat	✓ Open	___ Crest	___ Inundated (hydric)	19 Min
___ E	✓ 0-10%	___ Partial	___ Upper slope		___ Max
✓ S	___ 10-35%	___ Filtered	✓ Mid-slope	___ Saturated (wet-mesic)	USGS
___ W	___ 35+%	___ Shaded	___ Lower slope		
___ NE	___ Vertical		___ Bottom	___ Moist (mesic)	
___ NW					
___ SE				___ Dry (mesic)	
___ SW					
___ None				✓ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]		*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
___ In leaf	✓	1-10		✓ 1 YD 2	___ Annuals	___ Very feeble
___ In bud		11-50		___ 1-5 YD 2	___ % Seedlings	✓ Feeble
___ In flower		51-100		___ 5-10 YD 2	___ % Immature	___ Normal
___ Immature fruit		101-1000		___ 10-100 YD 2	___ % 1st year	___ Vigorous
✓ Mature fruit		1001-10K		___ 100 YD 2 – 2 AC	100 % Mature	___ Exceptional vigor
✓ Seed dispersing		10K+		___ 2+ ACRES	___ % Senescent	
		EST #		EST AREA		

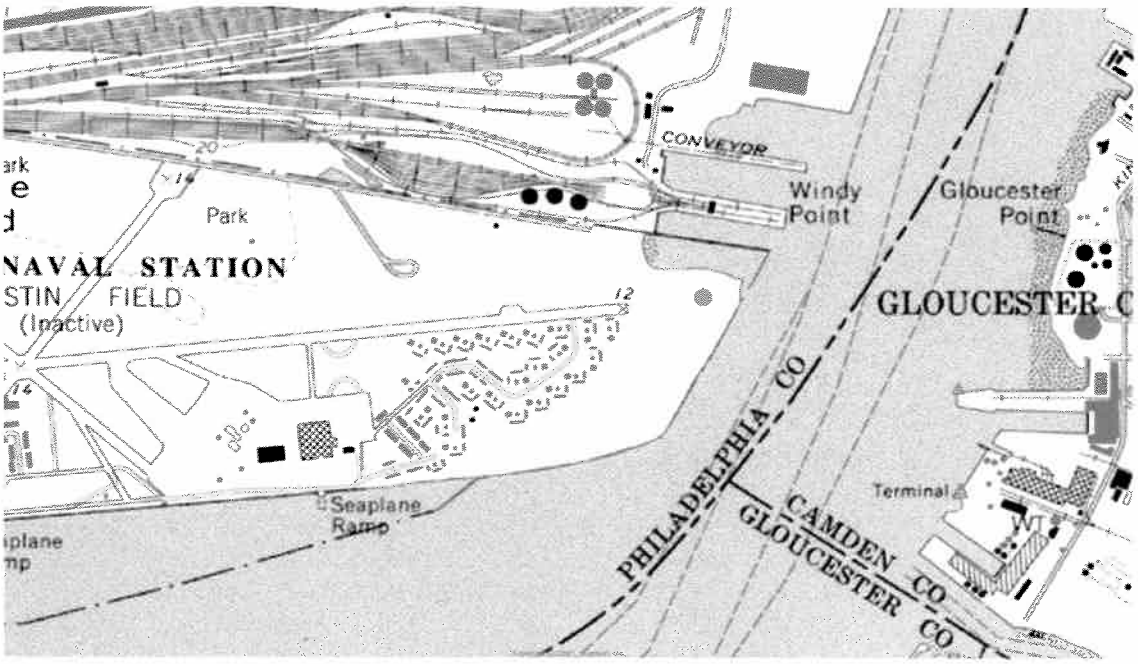
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) small, one 2'x2' clump.
Age, successional stage of system oldfield, 39 years +/- 7 years
✓ Known or ____ Inferred land use history OPEN WATER IN 1963; filled by 1970, abandoned
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance Fill
Integrity/fragmentation of community Fragmented
List of invasive species (alien or native) numerous invasive species in flora, see species list.
Threats (on-site) development
Threats (off-site) industrial zoning
List other members of this genus that occur on site. Hybridization? Juncus tenuis, J. effusus
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Juncus dichotomus Ell.

Forked Rush

Location of 1 Population on Philadelphia, PA USGS Topographic Map



1: N039.8929514/W075.1414873

Forked Rush population is in open, old field habitat at east end of Navy Yard

Population Size:

#1: A small cluster, found within a ~2' X 2' area within the Velvet Rosette Panic Grass colony #1. The number of plants is estimated under 10 plants.

Navy Yard Habitat:

Old field plant community dominated by *Andropogon virginicus, Dactylis glomerata*, *Melilotus officinalis, Artemisia vulgaris, Solidago altissima* established on a spoil and land fill substrates. The Forked Rush is located in the center of the *Dichanthelium scopariun* population #1.

Forked Rush Habitat and Species Specific Photos

View of old field habitat located on east end of Navy Yard, north of gravel access road

Fall view of *Juncus dichotomus* Ell., Forked Rush: Upright stems from a cluster of plants

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia, PA
Survey Date/s 10/6, 14, 11/19/2009	Surveyor J. Arsenault
Amount of time spent surveying area 11.5 man hours	
Name of site owner Department of the Navy	
Directions to site Follow Broad Street south into Navy Yard, access east end of Kitty Hawk Avenue.	
GPS (decimal degrees preferred) approximate center point of site N039.8913638 W075.1430851	
Scientific name/s of target species Lycopus rubellus Moench.	
Site habitat description low energy rock/rubble tidal shoreline.	
Substrate/soil type Fill	
System: ___ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5	<10%	smartweed, dock, false indigo
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC < 1.5 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

Fernald (1950) G&C (1950, 1991)

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Northern, down stream terminus of stormwater ditch N. Kittyhawk Ave.

GPS coordinates (decimal degrees preferred)

N039.8936577 W075.1428223

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	✓ Flat	Open	Crest	✓ Inundated (hydric)	3 Min
E	0-10%	✓ Partial	Upper slope		Max
S	10-35%	Filtered	Mid-slope	Saturated (wet-mesic)	
✓ W	35+%	Shaded	Lower slope		
NE	Vertical		✓ Bottom	Moist (mesic)	
NW					
SE				Dry (mesic)	
SW					
None				Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]		*Population Area*	*Age Structure*	*Vigor*
In leaf	✓	1-10		✓ 1 YD 2	Annuals	Very feeble
✓ In bud		11-50		1-5 YD 2	% Seedlings	✓ Feeble
✓ In flower		51-100		5-10 YD 2	% Immature	Normal
✓ Immature fruit		101-1000		10-100 YD 2	% 1st year	Vigorous
✓ Mature fruit		1001-10K		100 YD 2 – 2 AC	100 % Mature	Exceptional vigor
Seed dispersing		10K+		2+ ACRES	% Senescent	
		EST #		EST AREA		

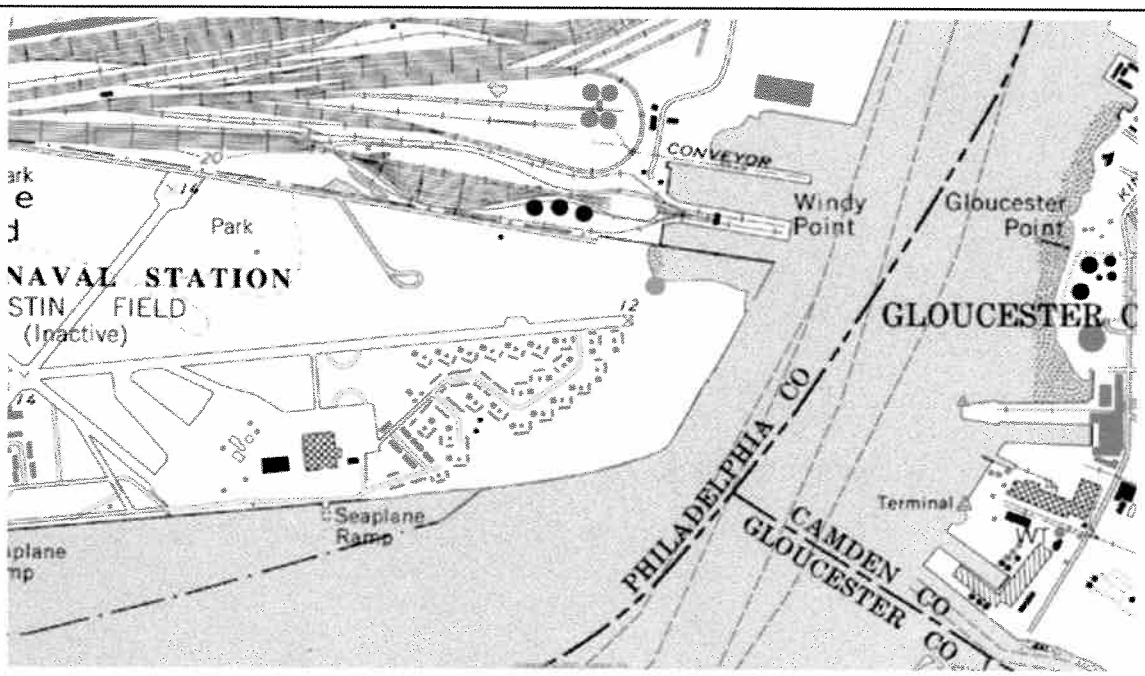
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) small, 1 plant
Age, successional stage of system 7 years, rock/riprap tiledge
✓ Known or ____ Inferred land use history ditch created open water 1965, fill by 1970, between 2003-2004
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance excavations
Integrity/fragmentation of community fragment
List of invasive species (alien or native) Amorpha fruticosa
Threats (on-site) scour
Threats (off-site) development
List other members of this genus that occur on site. Hybridization?
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Lycopus rubellus Moench.

Taper-leaf Water-Horehound

Location of 1 Population on Philadelphia, PA USGS Topographic Map



1: N039.8936577/W075.1428223

Water-horehound population at mouth of storm water ditch, on south bank, at east end of Navy Yard

Population Size:

#1: One small cluster, found within a 6" x 6" area. Two plants discovered at top of the high tide line, in a rip-rap rubble and mud substrate.

Navy Yard Habitat:

This species is found at the upper edge of the freshwater tide line on a muddy bank, with *Rumex altissima* and *Polygonum punctatum*.

Taper-leaf Water Horehound Photos

View of tidal habitat located in ditch on east end of Navy Yard. *Lycopus rubellus* was identified on bank in lower left of photo.

Most of the Navy Yard river shoreline is a high energy tidal system.

Substrate on river edge is scoured with few suitable sites for *Lycopus*

Botanist Resume'

Joseph Arsenault

2009 Summary Resume'

Joseph R. Arsenault

Environmental Consultant

961 Clark Avenue
Franklinville, New Jersey 08322
856-697-6044, facsimile 697-6050, e-Mail: NJ Plants@AOL.COM

Education

BA 1978, Rutgers-Camden College of Arts and Sciences: Biology
MS 1981, Graduate School -Rutgers University-New Brunswick: Biology

Experience

1980 to 1987 *NJ Department of Environmental Protection, Office of Environmental Analysis.* Position: Senior Environmental Specialist. Position required air photo interpretation, historical landscape reconstruction of New Jersey's tidelands, as well as natural resource identification, and estuarine wetland delineation.

1987 to 2009 *Environmental Consultant.* Provide professional ecological consultation for public and private concerns for projects requiring natural resource identification and environmental permitting. Wetland delineation, protected species inventory / survey, preliminary site assessment, historical site interpretations, natural resource analysis, and environmental regulation & permitting are some of the services rendered. My skills have been used for numerous projects under many circumstances across tens of thousands of acres in New Jersey and surrounding states of Pennsylvania, Delaware and Maryland.

Expertise & Skills

Aerial Photographic Interpretation: A basic tool to understand landscapes, change analysis and large-scale vegetation mapping, this skill has been applied to many projects to obtain crucial historic land use and natural resource data. I am skilled using high and low altitude photography, from panchromatic to digital color infrared on optics or computer based analytical systems.

Botany and Plant Sciences: Educated as a plant ecologist, botany plays a key role in community based decisions for projects impacting wide landscapes and specific sites. In this capacity I provided specimen identification, site-specific plant surveys, vegetation assessment, classification, plant propagation and other services related to the botanical sciences. Landscape restoration is one of the tasks that use my plant and ecosystem skills. I teach Rutgers University Continuing Education *Southern New Jersey Vegetation* developed for professional wetland certifications. I am the current chairperson for the *Flora of New Jersey Project*, a co-operative effort headquartered in Rutgers University's Chrysler Herbarium that gathers the State's botanical experts to create a modern record

of all plant distribution, modern nomenclature and rarity. Additionally, I am the honorary herbarium curator for the Philadelphia Botany Club.

Environmental Permitting Services: The intersection of science and regulation, environmental permitting is an integral part of the day-to-day activities as a consulting environmental specialist. Most permit and regulatory activities are associated with environmental regulations administered by New Jersey's Department of Environmental Protection. I have experience as well with federal and state agency regulations other than NJ DEP. In New Jersey, my skills are used for projects such as Freshwater Wetland Protection Act permits and waivers, Site Remediation activities, Coastal Area Facility Review Act (CZM), Waterfront Development, Pinelands Commission applications as well as county & township ordinance compliance.

Natural Resource Inventory Services: Natural resources inventories are an important segment of my environmental services. I provide detailed landscape analysis where I provide services to locate important natural resource characters, important issues when land use decisions are made. This includes investigations into site geology and soils, vegetation analysis as well as vertebrate wildlife studies. I provide protocol development and search efforts for threatened or endangered avian and amphibian species in addition to the general fauna characterizations.

Wetland Services: This specific landscape feature is one of the most far-reaching site conditions that affect land evaluation and uses. This requires specific skills to identify vegetation and soils, provide a correct delineate and defend wetland determinations. I provide wetland services that include overlapping topics such as education, delineation, documentation, mitigation, restoration, monitoring and permitting.

Professional Associations & Appointments (*) - Partial Listing

a) American Association for the Advancement of Science
b) American Institute of Biological Sciences
c) Archaeological Society of New Jersey
d) Eastern States Archaeological Federation
e) Ecological Society of America
f) Flora of NJ Project, *Chair*
g) Franklin Township Environmental Commission*
h) New Jersey Academy of Sciences
i) New Jersey Invasive Species Council*
j) New Jersey Natural Area Council*
k) Philadelphia Botanical Club, *Honorary Herbarium Curator*
l) Society of Wetland Scientists
m) Torrey Botanical Society

References Available Upon Request

APPENDIX D.2

HERPETOLOGICAL ASSOCIATES, INC. PHASE I HABITAT EVALUATION, NAVY YARD EAST

Herpetological Associates, Inc. - Environmental Consultants
- Plant and Wildlife Specialists -

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February 1, 2010

Mr. Sonny Rutkowski PE
Weston Solutions
1400 Weston Way
West Chester, PA 19380

Re: Phase I habitat evaluations for the Bog Turtle, Redbelly Turtle, Southern (Coastal Plain) Leopard Frog, and New Jersey Chorus Frog at the Southport Navy Yard East, City of Philadelphia, Pennsylvania HA File No. PA09.26.

Dear Mr. Rutkowski:

Herpetological Associates, Inc. (HA) conducted a Phase I Habitat Evaluation for threatened and endangered amphibian and reptile species on October 6, 2009 at the Southport Navy Yard East site. The species targeted in the investigation were the Redbelly Turtle (*Pseudemys rubriventris*), Southern (Coastal Plain) Leopard Frog (*Lithobates sphenocephala*), New Jersey Chorus Frog (*Pseudacris kalmi*), and Bog Turtle (*Glyptemys muhlenbergii*). Michael Torocco and Tessa Bickhart of HA conducted the habitat investigation. Barry Dubinski and Zack Keegan of Weston Solutions provided a site tour and accompanied HA during the Phase I survey, and Joe Arsenault (botanical consultant) was also present. The Southport Navy Yard East site is composed Lot 9A, the eastern edge of Lot 8A, the Pier 124 cove, a ditch, and the Delaware River, all of which were included in the investigation.

Wetland Areas A-C and R are located on Lot 9A and are relatively small wet depressions dominated by common reed (*Phragmites communis*). The largest wetland (Wetland Area B) had an area of persistent standing water (up to three feet deep), but the other wetlands were dry at the time of the survey. Although none of these wetlands provide the typical combination of hydrology and vegetation that is considered suitable habitat for either the Coastal Plain Leopard Frog or the New Jersey Chorus Frog, increased rainfall during the spring months may provide sufficient water for breeding habitat. Redbelly Turtles are not expected to inhabit these wetlands, although they are known from the Delaware River within the immediate vicinity of the study site and may occupy the wetlands periodically during the active season. None of the investigated wetlands provide suitable Bog Turtle habitat.

The Pier 124 cove has a fluctuating water depth based on the tide, but was inundated at the time of the Phase I survey. Spatterdock (*Nuphar lutea*) is present at the western edge of the cove, but no other aquatic vegetation was visible. The investigated portion of the ditch has rip-rapped, sloped banks and is fenced and lined with a thicket of trees, shrubs, and *Phragmites*. The cove and the ditch provide potential access to upland areas for Redbelly Turtles seeking nesting sites.

The eastern edge of a wetland located west of the Pier 124 cove and primarily on the adjacent Lot 8A was also included in the investigation. The majority of the investigated portion of the wetland was dry and dominated by common reed, although shrub-scrub wetland is present along the eastern fringe. Suitable conditions were not observed for any of the target species within the investigated portions of this wetland. The west bank of the Delaware River on Lot 9A is steeply sloped with a four to eight foot vertical, eroded

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bank, which is lined with trees and shrubs. The bank of the River is littered with concrete and construction debris, but a gently-sloped, pebble intertidal zone was present during the survey at low tide. In many places the steep bank forms a formidable barrier to Redbelly Turtles, which may limit their access to the site for nesting. The uplands on the site otherwise provide suitable nesting habitat in locations where tree and shrub cover is limited and sparse herbaceous vegetation and sandy soil dominate.

In summary, the Delaware River in the vicinity of the site provides suitable Redbelly Turtle aquatic habitat and is within the known range of the species. The cove and the ditch also provides suitable aquatic habitat, although turtles would be forced from these areas at low tide and during the overwintering months. Suitable turtle nesting habitat is available on the study site in the upland, dry fields where *Phragmites* is absent. However, due to the debris that lines the west bank of the River, access to the site by nesting turtles is likely limited to the cove and ditch. Nevertheless, surveys for nesting Redbelly Turtles may be requested by the Pennsylvania Fish and Boat Commission (PFBC). The creation of artificial nesting beaches may also be suggested as mitigation to offset the loss of any nesting habitat. Avoidance measures including seasonal restrictions on construction activities will likely be requested.

None of the investigated wetlands provide suitable Bog Turtle habitat. Surveys for Bog Turtles are not typically requested within the City of Philadelphia. Therefore HA anticipates that a review of this project is not necessary by the U.S. Fish and Wildlife Service concerning impacts to Bog Turtles.

The site is considered extremely marginal by HA for the targeted frog species, and none of the wetlands currently provide the typical combination of hydrology and vegetation that is considered suitable habitat for either species. The overall degraded conditions of the site, including the history of site disturbance and the current monoculture of common reed, limit the likelihood these species currently occur in the investigated wetlands.

Detailed searches for amphibians and reptiles were not conducted, but an adult Eastern (Black) Ratsnake (*Pantherophis alleghaniensis*) was observed during the Phase I survey. It is interesting to note that a large snake species still persists in a heavily urbanized area.

If you have any questions, please do not hesitate to contact me at 717-933-8380.

Sincerely,

HERPETOLOGICAL ASSOCIATES, INC.

Michael E. Torocco
Pennsylvania Regional Manager

Herpetological Associates, Inc. - Environmental Consultants

- Plant and Wildlife Specialists -

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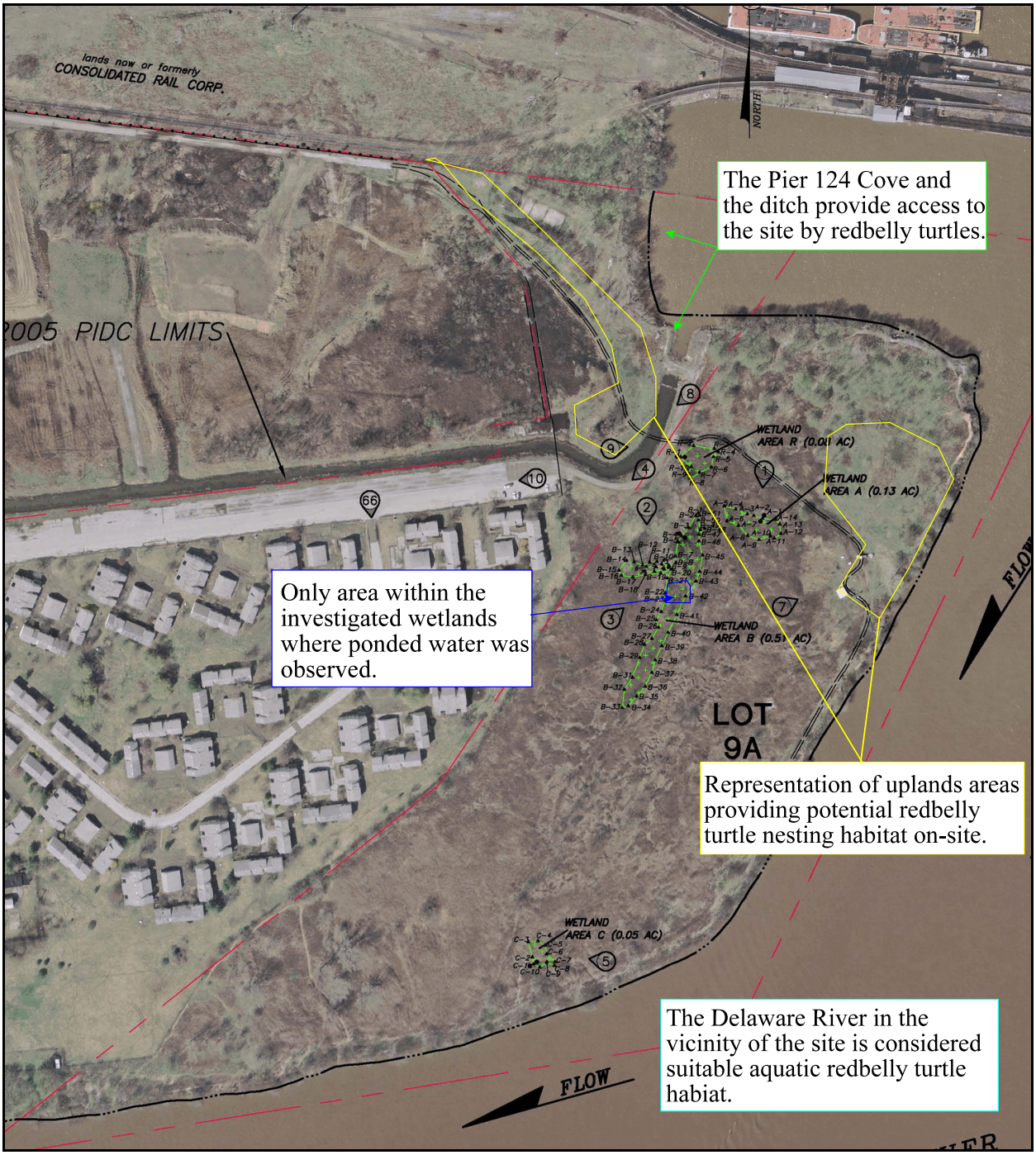

Figure 1. Aerial of the Southport site showing the areas of potential habitat.

APPENDIX D.3

HERPETOLOGICAL ASSOCIATES, INC. PHASE I HABITAT EVALUATION, MUSTIN HOUSING SITE

Herpetological Associates, Inc. - Environmental Consultants
- Plant and Wildlife Specialists -

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E-mail: mtorocco@herpetologicalassociates.com • tbickhart@herpetologicalassociates.com

February 5, 2010

Mr. Sonny Rutkowski PE
Weston Solutions
1400 Weston Way
West Chester, PA 19380

Re: Phase I habitat evaluations for the Bog Turtle, Redbelly Turtle, Southern (Coastal Plain) Leopard Frog, and New Jersey Chorus Frog at the Mustin Housing Site, City of Philadelphia, Pennsylvania HA File No. PA09.26.

Dear Mr. Rutkowski:

Herpetological Associates, Inc. (HA) conducted a Phase I Habitat Evaluation for threatened and endangered amphibian and reptile species on October 6, 2009 and February 5, 2010 at the Mustin Housing site. The species targeted in the investigation were the Redbelly Turtle (*Pseudemys rubriventris*), Southern (Coastal Plain) Leopard Frog (*Lithobates sphenocephala*), New Jersey Chorus Frog (*Pseudacris kalmi*), and Bog Turtle (*Glyptemys muhlenbergii*). Michael Torocco and Tessa Bickhart of HA conducted the habitat investigation on both dates. Barry Dubinski and Zack Keegan of Weston Solutions provided a site tour and accompanied HA during the October 6 Phase I survey. The Mustin Housing site is an abandoned Navy housing area which is slated for demolition. The site is located on Lot 9, adjacent to the Delaware River, and is positioned on the western border of the Southport site (**Figure 1**).

On February 5, 2010 the upland areas surrounding the existing dwellings were further examined for potential Redbelly Turtle nesting habitat, and the chain-link fence that surrounds the site was examined to determine accessibility by turtles. The treeless areas and areas previously maintained are currently vegetated by dense-growing grasses and other old field species. The banks of the Delaware River adjacent to the site are steep and littered with broken concrete. Currently, a chain-link fence surrounds the site on all sides, providing a barrier between the aquatic habitat (Delaware River and canal/ditch) and the site. The long period of site abandonment has, however, left numerous gaps in the fence which are large enough to allow turtles to pass beneath, especially along the river. Fewer gaps were observed along the canal/ditch which could allow larger turtles to pass beneath the chain-link fence. The conditions of the river bank and the presence of the fence may limit access to the site by Redbelly Turtles, but the site is considered potential (albeit marginal) nesting habitat.

No delineated wetlands are currently identified on-site, and suitable habitat for the Bog Turtle, Southern Leopard Frog, and New Jersey Chorus Frog was not observed. Suitable aquatic habitat for Redbelly Turtle is absent within the housing area footprint, although the adjacent Delaware River and canal/ditch do provide suitable aquatic habitat.

Based on the conditions observed during the Phase I survey, HA does not recommend Phase II Nest Surveys on the Mustin Housing site. Mitigation measures that include the use of silt fence barriers to exclude Redbelly Turtles from the site should adequately protect the species during demolition. Alternately, time-of-year restrictions can be used to limit work to winter season months. An environmental monitor who is

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trained to identify and locate turtles in the work area may also be used if work is conducted outside of restricted periods, or if silt fence barriers are not feasible in some areas.

If you have any questions, please do not hesitate to contact me at 717-933-8380.

Sincerely,

HERPETOLOGICAL ASSOCIATES, INC.

Michael E. Torocco
Pennsylvania Regional Manager

Herpetological Associates, Inc. - Environmental Consultants
- Plant and Wildlife Specialists -

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Figure 1. Aerial photo showing habitat features at the Mustin Housing site.

APPENDIX D.4

HERPETOLOGICAL ASSOCIATES, INC. PHASE II REDBELLY TURTLE NESTING HABITAT ASSESSMENT

HA File # PA10.07

DRAFT

Northern Redbelly Turtle (*Pseudemys rubriventris*) Nest Surveys at the Southport Navy Yard East Site, Philadelphia, Pennsylvania

DRAFT Submitted July 13, 2010

to

Weston Solutions
1400 Weston Way
West Chester, PA 19380

by

Michael E. Torocco, Tessa M. Bickhart, and Robert T. Zappalorti

Herpetological Associates, Inc.
Plant and Wildlife Consultants
581 Airport Road
Bethel, Pennsylvania 19507

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DRAFT

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DRAFT

INTRODUCTION

Herpetological Associates, Inc. (HA) was contracted by Weston Solutions, Inc. to conduct Phase I surveys for redbelly turtle (*Pseudemys r. rubriventris*), southern (Coastal Plain) leopard frog (*Lithobates sphenocephala*), New Jersey chorus frog (*Pseudacris kalmi*), and bog turtle (*Glyptemys muhlenbergii*) at the Southport Navy Yard East site in Philadelphia, Pennsylvania, which includes the abandoned Mustin Housing Barracks and a wooded area along the Delaware River (PNDI # 20090901208135). Phase I evaluations were conducted on October 6, 2009 and February 4, 2010 (Appendix).

DRAFT

The results of the Phase I investigation indicated that suitable habitat is not present for southern leopard frog, New Jersey chorus frog, or bog turtle, and furthermore bog turtles are not currently considered present in Philadelphia County. Suitable aquatic habitat was observed for redbelly turtles in the existing canal that connects to the cove at Pier 124 as well as within the Delaware River. Potential upland nesting habitat was observed within the old fields on the eastern end of the Southport study site. Since redbelly turtles are known within the Delaware River, presence of this species was assumed within the Delaware River and canal, and no trapping surveys were conducted. It was unclear whether the site serves as nesting habitat, therefore Phase II Redbelly Turtle Nest Surveys were recommended by HA. This report presents the results of 2010 nest surveys.

PROJECT DESCRIPTION

The Commonwealth of Pennsylvania ("Commonwealth") is proposing the development of a new marine terminal (Southport) in the City of Philadelphia, PA. The proposed Southport site extends along the Delaware River, from the east end of the former Philadelphia Naval Shipyard to the existing sheetpile bulkhead just south of Pier 124. The Southport development will be approximately 116 acres, with capacity at full build-out for an annual container throughput of 1.34 million twenty-foot equivalent units (TEUs). Southport is projected to create thousands of new, family-sustaining jobs and inject substantial new business and tax revenue into the regional economy.

The conceptual design plan for the Southport development envisions a two-berth marine terminal on approximately 116 acres of vacant land, most of which previously was used by the U. S. Navy. The proposed project includes construction of berthing areas, a container yard, new access roadway and existing roadway improvements, installation of utilities, various buildings to support the operations of the terminal, berth and access channel dredging in the Delaware River from the new bulkhead line out to the limits of the federally maintained navigational channel, and the placement of dredged material in a permitted confined disposal facility (CDF).

DRAFT

The mitigation process for the Southport Development Project has included significant efforts to avoid, minimize, and, when necessary, to propose compensation for unavoidable impacts from construction and operation activities associated with the proposed project. The design layout for the project site was selected following a comprehensive assessment to avoid and minimize environmental impacts from the proposed action. This would include obtaining and complying with the necessary Federal, state and local permits and approvals. This also includes restoring or replacing resources which would be lost from this proposed action.

MATERIALS AND METHODS

LOCATION OF THE STUDY SITE

The study area is located at the eastern end of the Philadelphia Navy Yard, east of the confluence of the Schuylkill River and Delaware River, and south of I-95 and the Norfolk-Southern Rail Line. The site is bordered to the south and east by the Delaware River, and can be found on the Philadelphia USGS 7.5-minute quadrangle map (**Figure 1**).

SURVEYORS

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The following HA staff were present during the surveys: Michael E. Torocco (Qualified Redbelly Turtle Biologist), Tessa M. Bickhart (Staff Herpetologist), D. Quillyn Bickley (Field Assistant) and William Callaghan (Field Assistant).

HABITAT EVALUATION METHODS

The redbelly turtle is a large, aquatic species that inhabits large ponds, lakes, and slow-flowing, deep-water streams. They are usually found in deep water with numerous basking sites and muddy or sandy substrate. Ample aquatic vegetation is important, as redbelly turtles are primarily herbivorous. The suitability of the site for redbelly turtles was determined by evaluating the existing habitat components. Vegetative communities, hydrological conditions, topography, soil characteristics, and the surrounding upland habitat were investigated to evaluate the habitat for the redbelly turtle. HA has three criteria for judging the value of the existing conditions for turtle species. These are:

1. **Structure of Available Habitat:** Habitat potential for redbelly turtles may be determined by evaluating the size and depth of open water habitats, quantity of aquatic vegetation, and substrate type. The presence of basking sites, as well as their location are also noted. Nesting habitat requires evaluating upland areas surrounding aquatic habitat. A sunny location with sandy or loamy soil is required for nesting redbelly turtles (Ernst, Lovich, and Barbour, 1994; and Heyer et al, 1994).

2. **Historic Evidence:** The overall range of the redbelly turtle and historic records on or near a water body site are important to the overall evaluation of a site.

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3. **Connectivity of Habitats:** The proximity of confirmed or highly potential redbelly turtle habitat to potential habitat on a study site, and the type and extent of their hydrologic connectivity are evaluated. Overland routes for migration between aquatic habitats and to nesting sites are also examined.

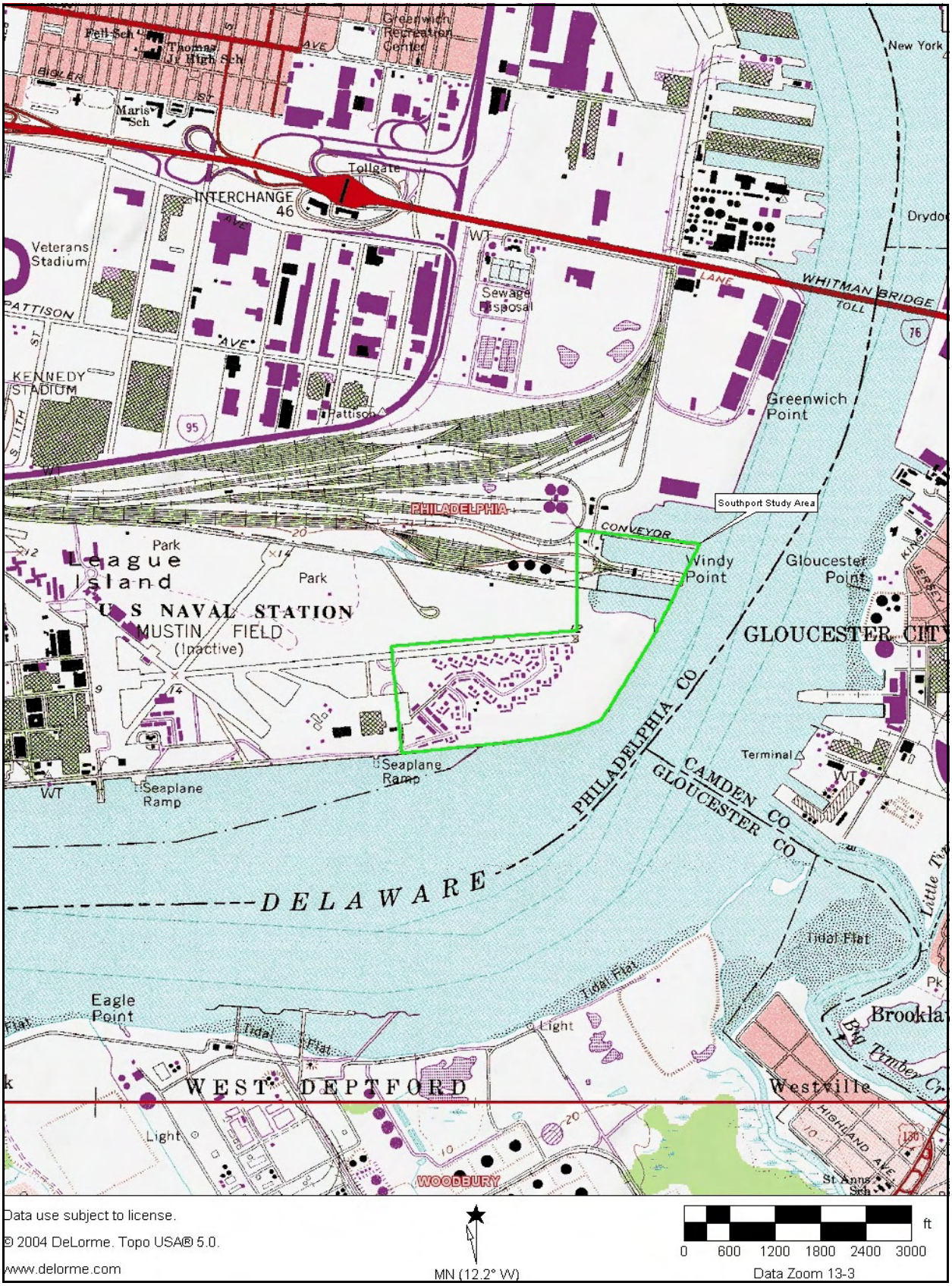

Figure 1. The approximate location of the Southport study area is indicated by the green polygon.

REDBELLY TURTLE NESTING HABITAT SURVEY METHODS

Surveys for nesting habitat and turtle nests are conducted by first identifying all potential aquatic turtle habitat (ponds, lakes, and large, slow-moving streams). Once each aquatic habitat is evaluated for redbelly turtle potential, the areas surrounding the open water habitat are examined for potential nesting habitat. Areas within 1,000 ft of the aquatic habitat with ample sun exposure and well-drained soils are considered potential nesting habitat. Conversely, habitat that surrounds the open water habitat but has heavy canopy cover, has poorly drained (wetland) soils, or contains impervious surfaces (e.g., concrete, asphalt) is not considered potential redbelly turtle nesting habitat.

DRAFT

All potential redbelly turtle nesting habitat is carefully examined by a team of experienced biologists using systematic visual searches. Beginning at the upland edge of a waterbody, searches are conducted by walking parallel transects around the open water habitat. The search radius is expanded up to 1,000 ft from each waterbody to the point that habitat becomes unsuitable for nesting.

All signs of turtle nesting are recorded. This evidence includes attempted nests, destroyed nests, and viable nests. These features are defined as:

1. *Attempted nests* are those which an nest cavity was started, but the nest was abandoned and no eggs were laid. Attempted nests are identified by noting the well defined nest cavity which has been dug by the female, with a lack of egg shell fragments and associated mammal digging (denoting predation).

2. *Destroyed nests* are successfully created nests in which eggs were laid, but a predator found the site, excavated the eggs, and consumed them. These sites are identified by the presence of egg shell fragments on the ground, which surround an excavated nest chamber. The distinction between a destroyed nest/mammal digging and an attempted/abandoned nest cavity are typically distinctive.

3. *Viable nests* are successfully created nest cavities in which eggs have been deposited, and predation has not occurred. Viable nests are not easily found due to the nesting female's ability to camouflage her nest, but they may be found either by finding a turtle in the act of nesting, or by finding the subtle signs of recent nesting.

DRAFT

Egg shell fragments are examined to determine overall size and shape of each egg, which can help to determine if a destroyed nest is potentially that of a redbelly turtle. However, positive identification of egg shell fragments is often not possible without observing the turtle creating a nest. For this reason, the location of all destroyed nests are noted, which identifies particular areas as suitable for turtle nesting. All nest locations are documented by photographs, and by GPS using a Trimble GeoXT GPS receiver. All nest locations recorded via GPS are processed and plotted using GPS Pathfinder Office (ver. 4.1) and ArcMap (ver 9.1).

DESIGNATED SURVEY AREA

The Designated Survey Area (DSA) is the area that is evaluated and examined for nesting habitat surveys. The area is defined by first determining the area of proposed disturbance (project area), and then identifying all suitable nesting habitat in the impact area and up to 1,000 ft from the impact area. The DSA may closely mirror the project/disturbance area, or may be sized/shaped differently that the project/disturbance area. Significant areas within the DSA that are clearly unsuitable, such as existing structures, buildings, pavement, etc. may be excluded from the final acreage. The DSA is defined by a Recognized Qualified Redbelly Turtle Surveyor using features such as canopy closure, soil texture, and proximity to aquatic habitat. Note that the DSA is an approximate representation of the area deemed suitable for nesting, and of the area surveyed for this study, but should not be construed as an detailed, on-the-ground delineation. DSA was calculated using the polygon tool in Google Earth Pro.

DRAFT

Figure 2. Designated Survey Areas for the nesting survey at the Southport site. DSA = 3.4 acres.

RESULTS

OVERVIEW

Aquatic habitats were evaluated to determine the suitability of the various waterbodies for redbelly turtles and the likelihood of occurrence. Two permanent bodies of water are within or adjacent to the project area, including the Delaware River, and the Pier 124 canal and cove. Four wetlands were delineated on the site within Lot 9A (Wetlands A-C and R), but only Wetland B contains standing water for any length of time. Suitable aquatic habitat was observed, and further evaluations were conducted to determine the location and extent of potential upland nesting habitat.

DRAFT

The primary emphasis of this study was to conduct Phase II Nest Surveys to document the location of suitable turtle nesting areas in upland habitat. Detailed Phase II surveys for individual redbelly turtles in aquatic habitat were not performed, and all open water habitat is assumed to be occupied by the species.

AQUATIC HABITAT DESCRIPTION

Pier 124 Canal and Cove (**Figures 3-5**): The Pier 124 cove has a fluctuating water depth based on the tide. At low tide, the cove becomes completely drained with an exposed mud substrate, and at high tide it becomes inundated with several feet of water. Spatterdock (*Nuphar lutea*) is present at the western edge of the cove, but no other aquatic vegetation was visible.

The canal has rip-rapped banks at its confluence with the cove, but has mud banks throughout the majority of its on-site length. The banks are steeply sloped, and are vegetated primarily with *Phragmites australis*, although areas of trees and shrubs are present. Tidal fluctuations are significant within the canal, but appear to have the greatest impact at its eastern end. Persistent water of at least a few feet was noted at low tide within the canal. Milfoil (*Myriophyllum* sp.) was observed to be growing within the canal. Access to the western portion of the canal (off-site) was not available, therefore habitat conditions were not documented.

Delaware River (**Figure 6**): The Delaware River near the site is extremely busy with boat traffic, but deep water conditions are present. The width of the river near the site ranges from approximately 2,400 feet to 4,000 feet, and a large cove is present on the New Jersey side. Little aquatic vegetation is present along the banks at the site, owing to the tidal fluctuations and the river flow. The banks are constructed of concrete debris and are dominated by trees and shrubs. Basking structure is limited to the river banks.

DRAFT

Wetland B (**Figure 7**): This largest wetland on site has an area of persistent standing water (up to three feet deep), but is chocked with a dense stand of *Phragmites*. Only a small area (approximately 5 feet by 10 feet) has open water.

Figure 3. The Pier 124 Cove at the confluence with the canal. Water can be seen rushing from the canal due to low tide.

Figure 4. The Pier 124 Cove during a higher tidal period. Spatterdock can be seen on the west (left) endo of the cove.

Figure 5. The canal that connects to the cove.

Figure 6. The Delaware River at the eastern bank of the Southport site, looking north.

Figure 7. Small open-water area in Wetland B.

AQUATIC HABITAT EVALUATION

The Pier 124 Canal and Cove and the Delaware River provide suitable, slow-moving, deep water for redbelly turtles. Despite tidal fluctuations within the canal, deep water pools appear to provide suitable habitat for year-round habitation, but movement patterns and overwintering would be difficult to determine without radiotelemetry. Basking structure is limited, but the banks and debris provide suitable opportunity for sunning. Aquatic vegetation, a food resource for redbelly turtles, is also present. The cove and the canal also provide potential access to upland areas for redbelly turtles seeking nesting sites. Furthermore, during the Phase II nest surveys, at least three individual redbelly turtles were observed within the canal, but to the west (off-site) of the project area. Redbelly turtles should be considered present within these waterbodies.

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Wetland B lacks suitable size and structure, particularly due to the dense growth of *Phragmites*. While the presence of migrant turtles is possible, redbelly turtles are not expected to reside permanently within Wetland B.

NESTING HABITAT DESCRIPTION

Two primary areas were found to contain potential conditions for turtle nesting. These areas include a field and gravel access road to the south of the Pier 124 Cove, and an old, grassy access road and adjacent patches of field to the west of the cove and canal (**Figures 2, 8-10**). Additional treeless areas are located on site, but these areas are dominated by excessively dense herbaceous vegetation or *Phragmites*, and/or are at a relatively low elevation, and therefore nesting is not expected. Dominant vegetation within the nesting areas includes grasses, motherwort (*Leonurus cardiaca*), mullein (*Verbascum thapsus*), blackberry (*Rhubus* sp.), golden rod (*Solidago* sp.), and *Phragmites*.

NESTING HABITAT EVALUATION

Nesting habitat on the Southport site is considered marginal. The site itself was formerly marsh that has received several feet of fill in its history, including bricks, variable sized pieces of broken concrete, asphalt, and gravel (**Figure 11**). The substrate in many of the open areas is rocky, and digging by a turtle would be difficult. Erosion of the fill material on the bank of the Delaware River has left a clear profile of this material, and has created a sheer 3-6 foot embankment of concrete debris. This embankment creates a formidable barrier to turtles trying to access upland areas, although access to upland areas is available in the western side of the cove and along the canal. Additionally, dense growth of grasses, herbaceous vegetation, and *Phragmites* has left some of the open-canopy habitat unsuitable for nesting.

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Figure 8. Old road north and west of the canal which provided potential nesting habitat.

Figure 9. Field to the south of the cove, which was a survey area for redbelly turtle nests.

Figure 10. Area with loose soil and open canopy within an old road along the eastern shore of the study area.

Figure 11. Rubble forms the banks of the Southport site, making access to turtles difficult.

Figure 12. Delaware River shoreline showing rubble and sheer embankment.

Table 1. Nest Habitat Survey Summary.

Date	Time In-Out	Surveyors	Total Person Hours	Search Time (prs-hrs) Per Acre	Number of Nests Observed
6/04/10	1000-1400	MT WC QB	12.0	3.5	0
6/09/10	1000-1400	MT WC QB	12.0	3.5	0
6/22/10	0800-1200	MT TB QB	12.0	3.5	0
6/30/10	0900-1300	MT TB QB	12.0	3.5	0

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REPTILES AND AMPHIBIANS OBSERVED

Table 2 provides a species list and estimated number of individual reptiles observed. Redbelly turtles were observed off-site, to the west of the project area

Table 2. Reptiles and Amphibians Observed on the Study Site.

Common Name	Scientific Name	Number Observed
Reptiles		
Northern Redbelly Turtle	*Pseudemys rubriventris*	3
E. Painted Turtle	*Chrysemys p. picta*	20
Red-eared Slider	*Trachemys scripta elegans*	1
Eastern Garter Snake	*Thamnophis sirtalis*	1 shed
Eastern (Black) Ratsnake	*Pantherophis alleghaniensis*	1 + 8 sheds

RECOMMENDATIONS

Redbelly turtles were confirmed in aquatic habitat to the west of the site (off-site). Mitigation work, particularly for impacts to wetlands, is proposed at an off-site location. This mitigation will not benefit redbelly turtles on the Southport site, and therefore some limited mitigation measures are recommended for redbelly turtles on-site. These include:

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1. The Pier 124 canal provides suitable aquatic habitat for redbelly turtles, and may support an overwintering population. Radiotelemetry of several redbelly turtles may help to determine seasonal habitat use prior to and during construction activities.
2. A portion of the canal is proposed to be filled and relocated. This work should only be conducted during warm season months when turtles can move or be moved from construction areas. Trapping prior to relocation of the canal will facilitate removal of all turtles. A monitoring biologist should be present during all instream work.
3. Nesting habitat is limited and of poor quality in the vicinity of the canal. An artificial nesting area should be constructed in close proximity to the canal using sandy, gravel-free soil.

SUMMARY AND CONCLUSIONS

Herpetological Associates, Inc. (HA) was contracted by Weston Solutions, Inc. to conduct Phase I surveys for redbelly turtle (*Pseudemys r. rubriventris*), southern (Coastal Plain) leopard frog (*Lithobates sphenocephala*), New Jersey chorus frog (*Pseudacris kalmi*), and bog turtle (*Glyptemys muhlenbergii*) at the Southport Navy Yard East site in Philadelphia, Pennsylvania, which includes the abandoned Mustin Housing Barracks and a wooded area along the Delaware River (PNDI # 20090901208135). Suitable habitat was observed for redbelly turtle, but not for the other species of concern.

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Suitable aquatic habitat was observed for redbelly turtles in the existing canal that connects to the Pier 124 cove, and within the Delaware River. Presence of the redbelly turtle was assumed within these waterbodies based on recent and historic records, and three individual redbelly turtles were observed by HA within the canal (off-site, to the west) during 2010 surveys. Potential upland nesting habitat was observed on the Southport site within the old fields on the eastern end of the site. Phase II redbelly turtle nest surveys were conducted to determine if on site upland areas are currently serving as nesting habitat.

Phase II nest surveys were conducted on June 4, 9, 22, and 30, 2010, which corresponded to the time frame of redbelly turtle nesting at other sites in 2010. A total of 48 person-hours of search effort was expended searching for turtle nests and other herpetofauna in an approximately 3.4 acre designated survey area. No turtle nests were found in the DSA during the study, which indicates that limiting factors such as soil texture and bank conditions may preclude turtles from using the site. Impacts to redbelly turtle nesting habitat is not expected as a result of the project. However, because redbelly turtle were documented in the canal, several mitigation measures have been recommended to minimize impacts.

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THE ECOLOGY OF THE REDBELLY TURTLE

Identifying Characteristics

The redbelly turtle (*Pseudemys rubriventris*; Leconte, 1830; **Figures 13 and 14**) is a large basking turtle averaging 10-12 inches (254-305 mm) in carapace length when mature (Conant and Collins, 1991). Coloration and pattern are highly variable, but in general, the carapace is mahogany to black, with light chestnut to reddish vertical bars on the laminae. The name *rubriventris* is from the Latin words *rubidus* or reddish, and *venter* for belly, referring to the reddish plastron (Graham, 1991). The common name follows Collins and Tagart (2002).

Figure 13. Hatchling redbelly turtle.

Considerable sexual dimorphism exists in body size and scute proportions (Graham, 1991). Female redbelly turtles are larger and have a longer plastron, higher shell and wider bridges, and plastral scutes are relatively longer at the midline, except the femoral scute, which is slightly longer in males. Redbelly turtles, especially males, tend to become melanistic with age. Background color of the male plastron is pale pink overlaid with dark vermicular mottling; in females, it is coral red with grey figures narrowly bordering the plates (Graham, 1971b). The front of the upper jaw has a terminal notch flanked on each side by a distinct maxillary cusp. The presence of maxillary cusps distinguishes the redbelly group, which also includes the Florida redbelly turtle *(P. nelsoni*) and the Alabama redbelly turtle *(P. alabamensis*).

Status

Pennsylvania Status - Threatened
Federal Status - None

Range

The redbelly turtle has a relatively continuous coastal plain distribution across seven mid-Atlantic states from eastern North Carolina to central New Jersey, and a disjunct population in southeastern Massachusetts (Ernst and Barbour,1989). Waters (1962) suggests that the Massachusetts population may be a relic from a once continuous, prehistoric distribution across the eastern coastal United States. *P. rubriventris* could have expanded its range when the continental shelf was emergent during the post-Wisconsin glacial period, which became isolated as the shelf submerged with the retreat of the glaciers. South of New England, the northernmost redbelly population known occurs in Middlesex County, New Jersey. Redbelly turtles are also known historically from New York (Babcock, 1938; Carr, 1952), and an introduced population apparently became established in Charleston, Staten Island, New York, R. Zappalorti, in Litt. 1992).

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Habitat and Life History

Although most of their time is spent in fresh water ponds, Pennsylvania redbelly turtles may also be found on land. In late spring and early summer, females select nesting sites in sandy soil, usually within 100 yards (90 m) of the pond. Females occasionally travel greater distances from the ponds in search of suitable nesting sites (J.D. Lazell, Conservation Agency, Conanicut Island, Rhode Island, in Litt. 1980). In each nest, an average of 12 eggs (range 5-17) are deposited (Zappalorti, personal observations; Haskell, 1993). Incubation takes 73-80 days at 25°C (Graham, 1971b). Hatchlings average about 1.25 inches (32 mm) in length (range 25.8-40.8 mm). Under certain conditions, hatchlings do not emerge from nests to enter ponds and instead overwinter in the nest chamber. Sexual maturity in redbelly turtles is probably reached at 15 years by females and sooner by males.

Figure 14. Adult redbelly turtle.

Redbelly turtles are usually active from late March to November. During the winter, they rest on the bottom of ponds under the ice, in a state of relative inactivity known as brumation. Current data gathered suggests that aquatic vegetation is the primary diet for all ages classes (Graham, 1969; 1981).

Factors Contributing to the Threatened Status in Pennsylvania

The Pennsylvania Fish and Boat Commission, with the advice of a team of herpetologists, generally considered the following factors that may adversely affect the redbelly turtle and its habitat: adverse modification of water quality, such as siltation from land clearing adjacent to ponds; pollution and eutrophication of ponds; pollution of groundwater or reduction in the levels of ponds from groundwater pumping; any draining or filling of wetlands adjacent to occupied ponds; and shoreline modification such as filling, dredging for beaches, dikes, real estate development or similar types of activity (Graham, 1984; U.S. Fish and Wildlife Service, 1994). Other factors include:

1. Predation of eggs by raccoons and striped skunks, whose population tend to increase with residential development and habitat fragmentation;
2. Predation on hatchlings and young turtles from introduced and natural predators, such as largemouth bass, herons, bullfrogs, etc.;
3. Loss of nesting and basking sites to development, recreation, and forest canopy closure;
4. Manipulation of aquatic vegetation, including herbicide use, which may impact quality and quantity of food resources;
5. Collection and harassment by humans;
6. Incidental mortality from highway traffic and shooting;
7. Isolation of populations resulting in inbreeding and genetic drift, which can reduce genetic variability and potentially decrease survivorship.

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APPENDIX:

Phase I Letter

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- Plant and Wildlife Specialists -

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February 5, 2010

Mr. Sonny Rutkowski PE
Weston Solutions
1400 Weston Way
West Chester, PA 19380

Re: Phase I habitat evaluations for the Bog Turtle, Redbelly Turtle, Southern (Coastal Plain) Leopard Frog, and New Jersey Chorus Frog at the Southport Navy Yard East, City of Philadelphia, Pennsylvania HA File No. PA09.26.

Dear Mr. Rutkowski:

Herpetological Associates, Inc. (HA) conducted a Phase I Habitat Evaluation for threatened and endangered amphibian and reptile species on October 6, 2009 at the Southport Navy Yard East site. The species targeted in the investigation were the Redbelly Turtle (*Pseudemys rubriventris*), Southern (Coastal Plain) Leopard Frog (*Lithobates sphenocephala*), New Jersey Chorus Frog (*Pseudacris kalmi*), and Bog Turtle (*Glyptemys muhlenbergii*). Michael Torocco and Tessa Bickhart of HA conducted the habitat investigation. Barry Dubinski and Zack Keegan of Weston Solutions provided a site tour and accompanied HA during the Phase I survey, and Joe Arsenault (botanical consultant) was also present. The Southport Navy Yard East site is composed Lot 9A, the eastern edge of Lot 8A, the Pier 124 cove, a ditch, and the Delaware River, all of which were included in the investigation.

Wetland Areas A-C and R are located on Lot 9A and are relatively small wet depressions dominated by common reed (*Phragmites communis*). The largest wetland (Wetland Area B) had an area of persistent standing water (up to three feet deep), but the other wetlands were dry at the time of the survey. Although none of these wetlands provide the typical combination of hydrology and vegetation that is considered suitable habitat for either the Coastal Plain Leopard Frog or the New Jersey Chorus Frog, increased rainfall during the spring months may provide sufficient water for breeding habitat. Redbelly Turtles are not expected to inhabit these wetlands, although they are known from the Delaware River within the immediate vicinity of the study site and may occupy the wetlands periodically during the active season. None of the investigated wetlands provide suitable Bog Turtle habitat.

The Pier 124 cove has a fluctuating water depth based on the tide, but was inundated at the time of the Phase I survey. Spatterdock (*Nuphar lutea*) is present at the western edge of the cove, but no other aquatic vegetation was visible. The investigated portion of the ditch has rip-rapped, sloped banks and is fenced and lined with a thicket of trees, shrubs, and *Phragmites*. The cove and the ditch provide aquatic habitat and potential access to upland areas for Redbelly Turtles seeking nesting sites.

The eastern edge of a wetland located west of the Pier 124 cove and primarily on the adjacent Lot 8A was also included in the investigation. The majority of the investigated portion of the wetland was dry and dominated by common reed, although shrub-scrub wetland is present along the eastern fringe. Suitable conditions were not observed for any of the target species within the investigated portions of this wetland. The west bank of the Delaware River on Lot 9A is steeply sloped with a four to eight foot vertical, eroded

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bank, which is lined with trees and shrubs. The bank of the River is littered with concrete and construction debris, but a gently-sloped, pebble intertidal zone was present during the survey at low tide. In many places the steep bank forms a formidable barrier to Redbelly Turtles, which may limit their access to the site for nesting. The uplands on the site otherwise provide suitable nesting habitat in locations where tree and shrub cover is limited and sparse herbaceous vegetation and sandy soil dominate.

In summary, the Delaware River in the vicinity of the site provides suitable Redbelly Turtle aquatic habitat and is within the known range of the species. The cove and the ditch also provides suitable aquatic habitat, although turtles would be forced from these areas at low tide and during the overwintering months. Suitable turtle nesting habitat is available on the study site in the upland, dry fields where *Phragmites* is absent. However, due to the debris that lines the west bank of the River, access to the site by nesting turtles is likely limited to the cove and ditch. Nevertheless, surveys for nesting Redbelly Turtles may be requested by the Pennsylvania Fish and Boat Commission (PFBC). The creation of artificial nesting beaches may also be suggested as mitigation to offset the loss of any nesting habitat. Avoidance measures including seasonal restrictions on construction activities will likely be requested.

None of the investigated wetlands provide suitable Bog Turtle habitat. Surveys for Bog Turtles are not typically requested within the City of Philadelphia. Therefore HA anticipates that a review of this project is not necessary by the U.S. Fish and Wildlife Service concerning impacts to Bog Turtles.

The site is considered extremely marginal by HA for the targeted frog species, and none of the wetlands currently provide the typical combination of hydrology and vegetation that is considered suitable habitat for either species. The overall degraded conditions of the site, including the history of site disturbance and the current monoculture of common reed, limit the likelihood these species currently occur in the investigated wetlands.

Detailed searches for amphibians and reptiles were not conducted, but an adult Eastern (Black) Ratsnake (*Pantherophis alleghaniensis*) was observed during the Phase I survey. It is interesting to note that a large snake species still persists in a heavily urbanized area.

If you have any questions, please do not hesitate to contact me at 717-933-8380.

Sincerely,

HERPETOLOGICAL ASSOCIATES, INC.

Michael E. Torocco
Pennsylvania Regional Manager

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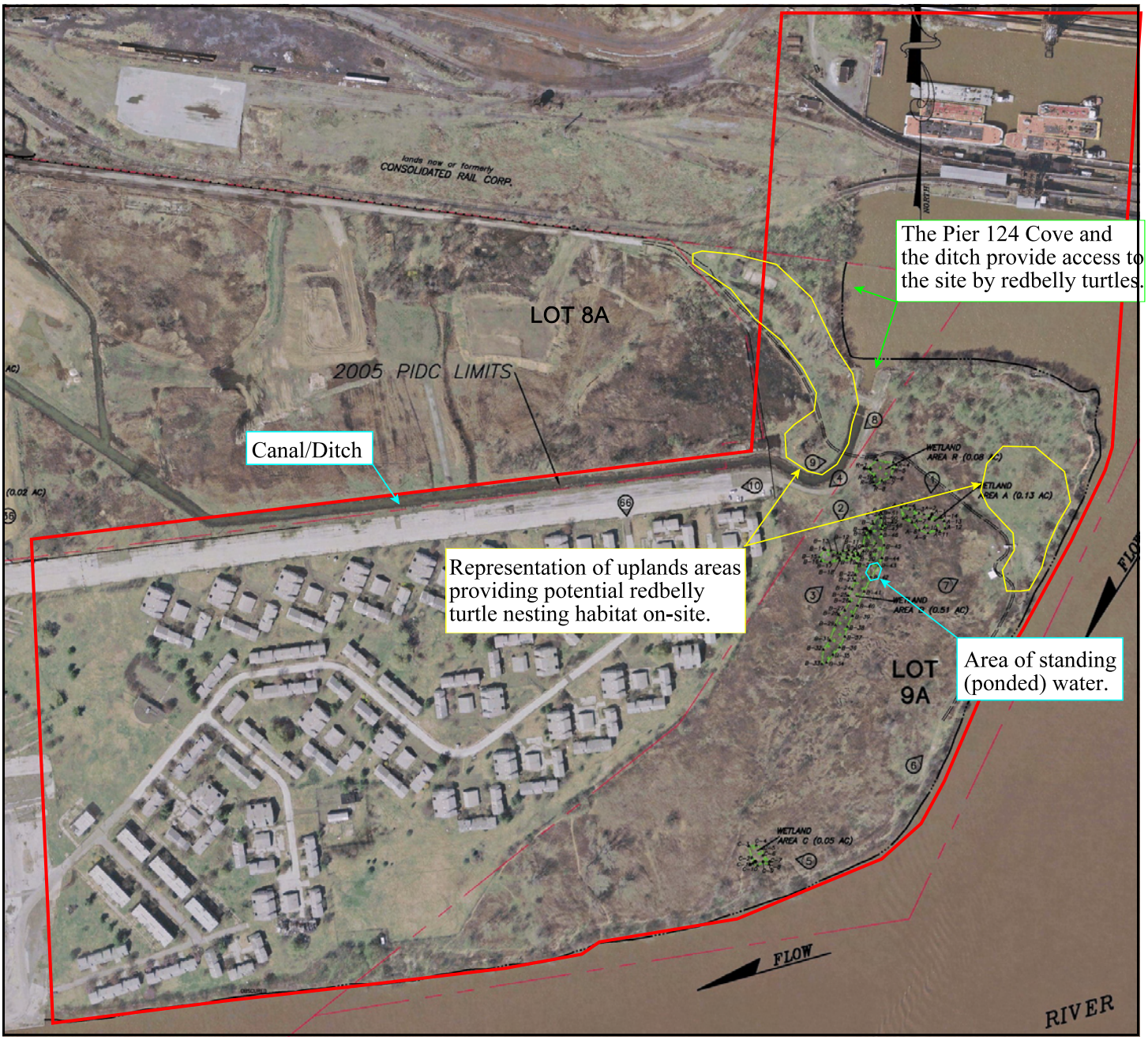

Figure 1. Aerial of the Southport site showing potential habitat. The bold red line represents the overall study area.

APPENDIX E

SUBMERGED AQUATIC VEGETATION SURVEY

6/30/2010

Submerged Aquatic Vegetation Survey

A Study Completed for the Southport Project, Philadelphia, Pennsylvania

Prepared By
Joseph R. Arsenault

Submerged Aquatic Vegetation Survey

A Study Completed for the Southport Project, Philadelphia, Pennsylvania

The Southport Project is a waterfront redevelopment endeavor that proposes to dramatically modify the shoreline of the Delaware River, south of Windy Point within the eastern edge of the Philadelphia Naval Yard. In the redevelopment process, alterations to the littoral and sub-littoral zone will occur. To accomplish this task, environmental permits will be required and part of this permit process will address the natural resources associated with the sub-tidal habitats.

Independent studies completed for benthic animals, fishes and terrestrial organisms have already been prepared. The search for submerged aquatic vegetation (SAV) will complement the existing resource studies and complete the ecosystem analysis required for the environmental permit review. SAV is composed of suite of vascular and non-vascular plants capable of surviving in the aqueous environment. A plethora of literature has been written on the topic, focusing on the biological, chemical and sediment segments to this ecosystem. It is well known many SAV have specific preferences for substrates, light and other important aquatic features. The Southport location (Figure 1) is unique, occupying a portion of the freshwater tidal Delaware River. This part of the river is named Horseshoe Reach and is the western edge of the Port of Philadelphia's Shipping Channel. The position near the base of the Walt Whitman Bridge places the site above the northern normal seasonal saline isohaline. Similar freshwater tidal habitats in Eastern North America support similar freshwater tidal environments and have typical representative genera: *Anacharis, Ceratophyllum, Hydrilla, Najas, Potomogeton, Scirpus, Eleocharis, Vallisneria, Zannichellia, Chara, & Nitella*. If habitat exists these would be targeted by the study.

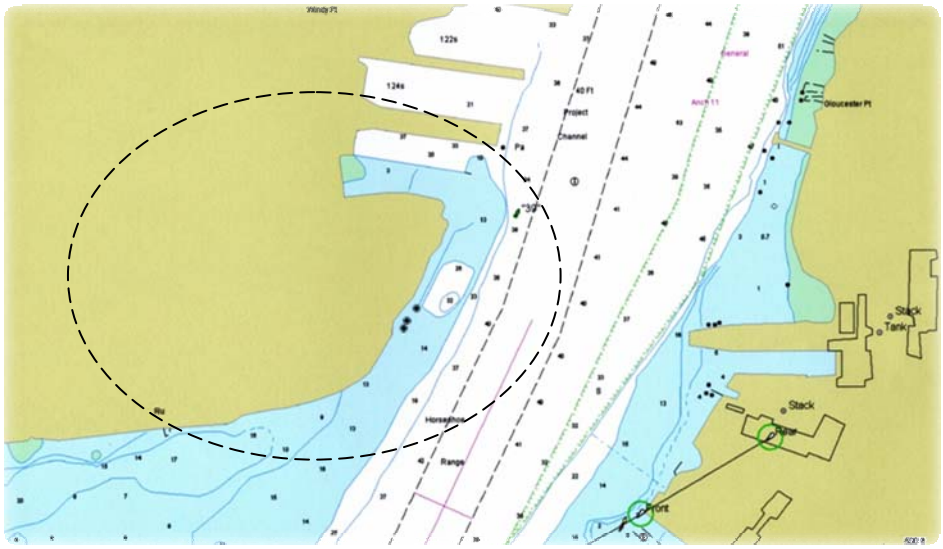

Figure 1: Southport Project Area (oval) shown on Garmin Blue Water Navigation Chart

Freshwater tidal and sub-littoral habitats are special for a variety of reasons, many centered on the limited available habitat. The coincidence of human port activities and the tidal portion of the river have influenced the SAV distribution, limiting the resource to small beds associated with the few river shallows. This limited resource has been deemed important by most environmental regulatory agencies. USACOE and its reviewing partners (USFWS, NMFS, and NPS) and similar State regulatory authorities have permit requirements that demand data to accurately assess the proposed project's impact on natural resources. This survey, as documented in this summary report, serves to determine the presence or absence of SAV and their extent within the Southport Project area.

Study Objective

The SAV survey objective is to determine if submerged aquatic plants occupy any part of the suitable habitat found in the sub-littoral portion of the Southport Project area.

Study Goal

The primary study goal is to provide the physical labor and field time necessary to sample the aqueous project area for SAV. This study uses standard de novo search protocols to make the presence or absence determination. A second goal of the study would document the extent of SAV if such species are encountered during the sampling effort. This would be accomplished using the evidence collected by the site sample protocol and the best interpretation of the principal scientist.

Methods

Southport's survey followed standard SAV collection protocols. SAV sampling the Southport Project area used simple equipment to collect from the sub-littoral area surrounding the project site:

- 14'gas engine propelled flat bottom boat equipped with an electronic depth sounder, Garmin GPS III *plus*, VHF Com radio, 16' Push pole and standard safety equipment.
- Weighted double sided rake used to collect specimens from river bottom sediments
- Secchi Disk used to document the river light penetration
- Collection bags, identification tags

Depth recordings and secchi readings assisted the definition of the search area. Each sample point was sampled from an anchored boat. The collection rake was tossed and retrieved three times. The tosses were 90°s to the two sides and front of the boat, collecting from separate areas at each anchored point. Data on the presence or absence on each throw and species if present was recorded at each station. The boat was motored or poled around the northern quite portion of the study site, while the Delaware River edge study segment required power to slow and drop anchor for samples collected in that environment.

An estimate of the quantity of population size was made from the results of the various collection tosses as well as the corresponding depths. The SAV bed size is estimated based on the presence of collected specimens. Waypoints collected on its perimeter provide an aerial measurement and specific location to the presence or absence determination.

The tidal regime requires special SAV collection consideration. The tidal water fluctuations in this part of the river can exceed 5-6'. Sampling at high tide can be difficult and may not provide an accurate assessment. Enhanced search conditions are found 1.5 hours on either side of the low tide, so sample timing relied on the tidal predictions provided by NOAA at http://tidesandcurrents.noaa.gov/.

The sampling goal was to observe the Southport tidal environment during the peak growing period during a low tide predicted during the mid-morning to early afternoon. This timing is necessary sample when the submerged aquatic vegetation would be most visible while providing safe sampling conditions. The information gathered during this sampling event is presented in the Results section of this summary report.

Results

The SAV survey occurred during a morning low tide (9:45AM PLT) on June 27, 2010. The principal scientist and assistant launched the flat bottom boat at 6:30 AM EST and motored to the Southport site. Sampling began around 7:00AM in the ship slip located at the northeastern edge of the project area. Eight sample points in the ship slip and 6 sample points on the Delaware River shoreline resulted in 42 sub-sample collections. These samples resulted in the identification of SAV in the ship slip as well as along the river.

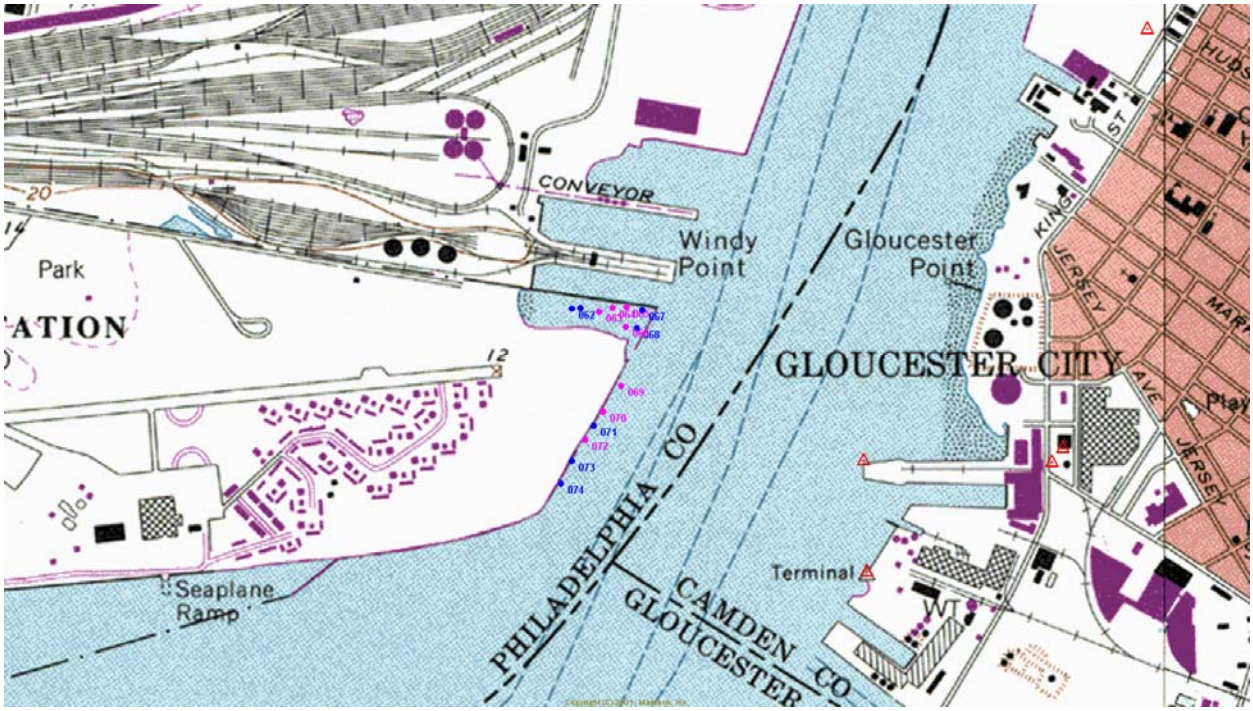

Figure 2: USGS Philadelphia, PA topographic quadrangle illustrating sample points: SAV present (pink) absent (blue)

The sampling effort resulted in the identification of SAV at 50percent of the anchored stations. It found SAV on 35.7 percent sample tosses where two SAV species were identified. Wild celery (*Vallisneria americana*) and musk grass (*Chara vulgaris*) have representative populations within the Southport Project aqueous habitat. Wild celery and musk grass have been found in the ship slip. Sample points 61 through 68 found wild celery at 50 percent of the sample stations. It was found in the center of the slip where the depth of the water at low tide is sufficient to cover the plants yet shallow enough to provide ambient light to provide photosynthesis. Based on the depth readings made during the survey, the population is confined to the water with depths between 3 and 6 feet MLW. Secchi readings indicate light penetration is restricted to the upper three feet (31-38") of the water column. The shallower areas receive saturation whereas the deeper areas the light reached the upper unfolded leaves of the deepest plants. Specimens collected during the sampling effort exhibited two distinct growth forms attributed to the depth in which the specimens were collected. Shallow water collections in less than 3 feet (JRA #2238; 2251) had stunted and deep green robust leaves weathered by wave action and saturated by sunlight. The deeper specimens (JRA #2247; 2261) had lighter green thin leaves with long twisted blades typical of specimens found on the limit of their depth distribution. The second species found in the collection effort was musk grass. This is a non-vascular alga that is found with and in slightly more extreme conditions than wild celery. Musk grass was found intermixed with wild celery in the ship slip and as small discrete, isolated patches along the river's edge. Table 1 provides the results of the sampling for SAV.

Two addition species were collected in the project area as floating specimens. *Potamogeton pusillus* and *Ceratophyllum demersum* were found inter-twined at station #061 within the ship slip. The providence of these specimens is unknown, but is expected to have been transported from a regional population by the tides and wind.

Table 1: Sample Results from June 27, 2010 SAV Study

Sample	GIS Lat/Long	Location	Rake Pull 1	Rake Pull 2	Rake Pull3	Secchi	Depth
61	39.89406109 75.14124879 4571790.34953989 2030901.75488216	Slip	0*	0	0	To bottom	30”
62	39.89403963 75.14149555 4571783.555464 2030880.99273995	Slip	0	0	0	To bottom	32”
63	39.89398062 75.14071235 4571790.90197014 2030949.82919982	Slip	*Chara*	*Chara*	*Vallisneria*	36-38”	36”
64	39.89406645 75.14034220 4571807.09281681 2030979.7332058	Slip	*Vallisneria, Chara*	*Vallisneria*	*Vallisneria, Chara*	38”	38”
65	39.89407718 75.13991833 4571815.84111371 2031016.00132361	Slip	*Vallisneria*	*Vallisneria, Chara*	*Vallisneria, Chara*	36”	38”
66	39.89364266 75.13995060 4571766.66873771 2031023.26695606	Slip	*Vallisneria*	*Vallisneria, Chara*	*Vallisneria*	39”	48”
67	39.89400744 75.13946244 4571816.15988712 2031056.88839648	Slip	0	0	0	33”	60-72”
68	39.89361048 75.13962337 4571768.89703588 2031052.20183797	Slip Mouth	0	0	0	35”	8-9’
69	39.89230692 75.14008471 4571614.88811027 2031042.59358767	Slip Mouth	*Chara*	0	0	34	13’
70	39.89173293 75.14061042 4571541.33002158 2031010.57173342	Delaware	*Chara*	0	0	31	4’
71	39.89142716 75.14087864 4571502.35570713 2030994.53224431	Delaware	0	0	0	36”	4-5’
72	39.89111602 75.14112004 4571463.25844458 2030980.92726046	Delaware	*Chara*	0	0	35”	7’
73	39.89064395 75.14149019 4571403.869844 2030959.94967374	Delaware	0	0	0	35”	10’
74	39.89014506 75.14180669 4571342.43703585 2030944.21365216	Delaware	0	0	0	36”	12-15’

Population Size

Sample waypoints 75 through 87 surround the SAV bed in the ship slip. It corresponds to the light and depth limits associated with the collected specimens. Not shown in Figure 3 are the sample points along the edge of the river. Points #69, 70 and 72 are isolated small patches that were attached or between the concrete rubble of which the shoreline is composed. The eastern limit for both the ship slip and the shore line is the 1 fathom line (6'). Deeper than this the light is significantly reduced. The water depths drop into the shipping channel quickly beyond the eastern 1-fathom limit, reaching 12-15' within a few feet. The shore line collections are located within a few feet of the Delaware River shoreline where a single pull success identified *Chara* for each station.

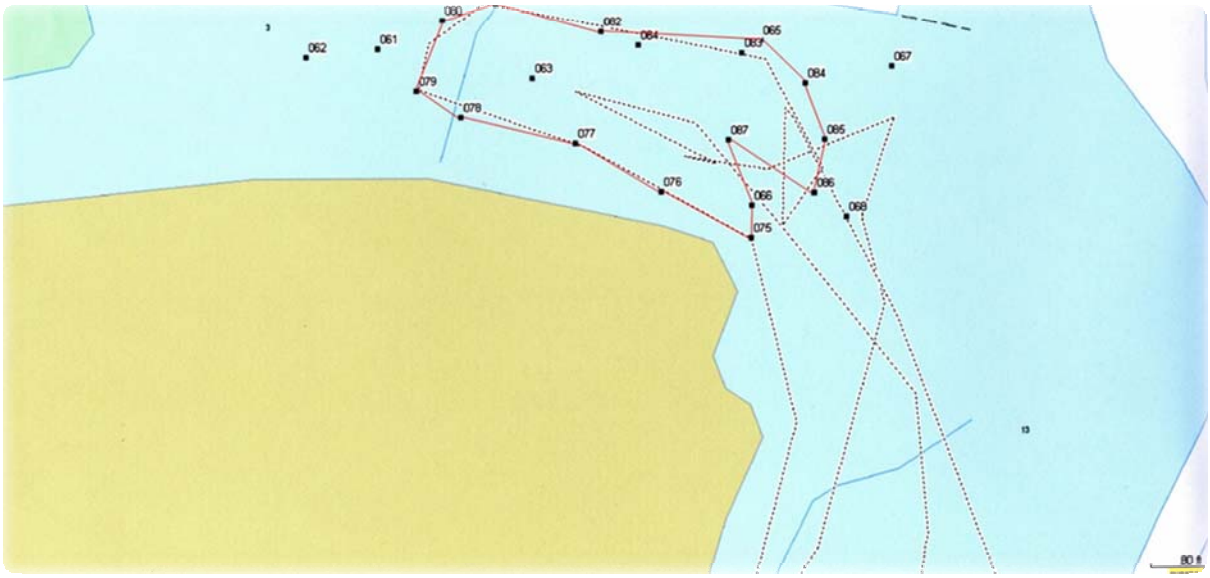

Figure 3: SAV bed (red line) surrounds *Vallisneria* and *Chara* habitat. The bed size is approximately 1.1 acres (49,920 SF).

The wild celery population is distributed evenly within the identified habitat. The quantity of vegetation retrieved during each successful sample pull was characterized by the consistent gradient between few and many from exposed to covered habitats. It was less dense and stunted in the western, shallower waters of the slip and it was denser and robustly vegetated with well developed blades and flowering stalks on the deeper edges of the bed.

Musk grass, on the other hand, appeared to be evenly distributed in the slip where suitable habitat existed, from its first identification to the edge of its presence. Its form and quantity was consistent: it was best represented on the outer edges of the wild celery bed, probably due to available rooting space and available light. The river edge population is sparse and exists as discrete isolated patches in shallow water confined to a few feet from the river's low water edge.

Conclusions

SAV have been discovered in the Southport Project area's tidal waters. Two species **wild celery and musk grass** have been discovered rooted in the project area. Wild celery and musk grass occupy approximately 1 acre of suitable habitat, with the bulk of the SAV being located within the ship slip.

Figure 4: Approximate location of SAV bed (red) and scattered plants (green) on South port Project Site, (NJDEP 1995 IRC)

The SAV is restricted to waters less than 6' MLW and greater than 2', limited by exposure and light penetration. Habitat meeting these limitations exists in the ship slip and along an extreme narrow area on the Delaware River shoreline. Vascular species, wild celery, is restricted to the fine silt mud substrates in the ship slip. The shoreline habitat is compromised by limited suitable substrate as well as depth. Most of the river shoreline is composed of concrete and stony rubble with no more than an occasional few square feet of potential SAV habitat interspersed among the large construction debris and stony rubble fill materials.

Additionally, the water along the shoreline drops off to depths greater than 6' within 25' of the low tide shoreline, further reducing suitable SAV conditions. This has been demonstrated by the few samples of musk grass collected along this portion of the project area.

APPENDIX F

WETLAND SURVEYS

APPENDIX F.1

SOUTHPORT WETLAND AND OTHER WATERS INVESTIGATION REPORT

Wetland and Other Waters Investigation Report

Southport Project

East End of Former Philadelphia Navy Yard

City of Philadelphia, Pennsylvania

May 2010

Prepared for:

Commonwealth of Pennsylvania
Department of General Services
Philadelphia, PA

and

Philadelphia Regional Port Authority
Philadelphia, PA

Prepared by:

Weston Solutions, Inc.
1400 Weston Way
West Chester, PA 19380

DRAFT

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1 INTRODUCTION

Weston Solutions, Inc. investigated a site (referred to as the "Southport Project") located in the City of Philadelphia, to identify and delineate waters of the United States (wetlands and other waters; Figure 1 in Appendix A). The approximately 160-acre site is bordered primarily by the Packer Terminal and Delaware River to the north, the Delaware River to the east and south, and the former Philadelphia Navy Yard and Norfolk Southern property to the west (Figure 2 in Appendix A). This delineation was conducted to determine areas that would be regulated under Federal (Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act) and State (Chapter 105 – Dam Safety and Water Management) wetland and water programs.

The identification and delineation of wetlands was conducted using the method currently used by the U.S. Army Corps of Engineers (USACE) Philadelphia District (CENAP) to delineate wetlands in the Atlantic Coastal Plain Region (ERDC, 2008), recent USACE and EPA guidance related to Jurisdictional Determinations (JD), and best professional judgment. Field investigations were conducted during September, October, and November 2009.

This report includes information necessary for the USACE to make a JD of the extent of wetlands and other waters of the United States on the Southport Project site. The results of this wetland investigation should be considered preliminary until the USACE makes a determination (issues a JD) of the proposed extent of waters of the United States, and until the Pennsylvania Department of Environmental Protection (PADEP) determines the extent of waters of the Commonwealth regulated under its Chapter 105 program.

2 RESULTS

2.1 Site Conditions

All premises on the subject property formerly consisted of marshlands or were part of the Delaware River (Weston Solutions, Inc. 2010). The land was created through filling of the site footprint in the 1900s, altering the topography and drainage of the entire Southport Project site. The west portion of the site contains the buildings and infrastructure formerly used for housing at the Navy Yard, and which are abandoned. The area east of the Navy Yard housing has been filled with dredged material, construction rubble and blasting grit to depths of up to 15 feet, elevating most of the site above its former elevation (Weston 2009). The area west of the interpier area (Piers 122 and 124) has been filled and contains a former pistol range.

The site is mostly vegetated, with several distinct vegetation communities having a species composition common in disturbed areas:

- Areas of both wetland and upland dominated by common reed (*Phragmites australis*);
- upland fields;
- scattered areas of forest mostly associated with shoreline areas;
- landscaped and now overgrown area of former Navy housing;
- mostly unvegetated intertidal and shallow water habitat.

2.1.1 Surface Water and Site Drainage

Based on existing topography on the site and site investigations, surface runoff from undeveloped portions of the site drain via sheet flow into the Delaware River or via groundwater infiltration in depressions on the site where runoff can collect.

Stormwater in the former Navy Housing area collects via sheet flow in a series of stormwater inlets which are a component of the engineered collection and conveyance system. The system discharges stormwater to the Delaware River via three outfalls at the southern site boundary. Other sheet flow may discharge directly to the Delaware River from positive drainage.

A stormwater channel traverses the property (conveying stormwater from the Norfolk Southern property) to the north of the former Mustin Field runway and discharges into the Delaware River at the north boundary of the Navy Yard property (Figure 2 in Appendix A and wetland plan in back folder of report).

2.1.2 Soils

The *Soil Survey of Bucks and Philadelphia Counties, Pennsylvania* (Tompkins, 1975) maps the soil type on the site as Urban Land (Ub; Figure 3 in Appendix A). Located in built-up areas of Bucks and Philadelphia Counties, most of these mapped areas have been smoothed and the original soil material disturbed, filled over, or otherwise disturbed. The observed site characteristics and previous investigations demonstrate the history of soil disturbance in the Southport project footprint (Weston Solutions, Inc., 2009, 2010).

2.1.3 National Wetland Inventory

The U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) quad map (Philadelphia, PA-NJ quadrangle) identifies no wetlands or other waters associated with the land portions of the Southport Development site (Figure 4 in Appendix A). The section of the Delaware River adjacent to the site is classified as Riverine, Tidal, Open

Water (R1OW). Any discrepancy between the NWI and our field investigation can be explained by the USFWS reliance on aerial photography at the mapping scale of 1:80,000 to design the NWI maps and lack of ground truth. In addition, wetland areas of less than 5 acres are generally not mapped under the NWI program.

2.2 Wetlands and Other Waters Delineation

2.2.1 Delineation Methodology and Rationale

The identification and delineation of wetlands was conducted following the method currently used by the U.S. Army Corps of Engineers (USACE) Philadelphia District to delineate wetlands in the Atlantic Coastal Plain Region (ERDC, 2008), recent Corps and EPA guidance related to Jurisdictional Determinations (JD), and best professional judgment. Field investigations were conducted during September, October, and November 2009.

Due to the site history of development, filling (including dredged material placement, landfill, and construction rubble) and grading soils were not considered a reliable wetland indicator using color. However, observable changes in redoximorphic features (e.g., oxidized root channels) and mineral composition (sand, silt and clay) along wetland-to-upland gradients in some instances supported the wetland delineation.

The wetland investigation and delineation initially focused on observations of vegetation (changes in vegetation communities), hydrologic conditions and previous delineations. The wetland/upland boundary in some areas was readily located using evidence of standing water and/or saturation to the soil surface. There were also readily observed changes in vegetation. Wetland vegetation consisted of primarily dense stands of common reed (*Phragmites australis*) with soft rush (*Juncus effusus*), silky dogwood (*Cornus amomum*) and black willow (*Salix nigra*) common in some wetland areas where the size and density of common reed is less robust. With increasing elevation, upland communities were readily apparent with common species including mugwort (*Artemesia ludoviciana*), broomsedge (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), bentgrass (*Agrostis* spp.), staghorn sumac (*Rhus typhina*), black locust (*Robinia pseudoacacia*), mulberry (*Morus* spp.), princess tree (*Paulownia tomentosa*) and eastern cottonwood (*Populus deltoides*).

Significant areas of the site are populated by dense, nearly impenetrable, stands of common reed. Within these areas a series of cut lines (transects) were made to provide access for wetland assessments. These areas were evaluated for changes in vegetation (e.g. adventitious roots, species composition) and soil characteristics (soil texture and redoximorphic features) and hydrologic conditions [direct (e.g., standing water) and indirect (e.g., water stained leaves)]. This effort resulted in the identification of 2 wetland areas designated as Wetland C and Wetland D (refer to wetland plans in the Back Folder of report).

Sample stations representative of wetland and non-wetland areas were selected to collect data on the vegetative community, soils and hydrologic conditions. At sample stations species aerial coverage was visually estimated in quadrants properly scaled to the community structure. Plant species were identified using appropriate botanical publications for the region. Soils and hydrologic conditions were characterized following methods identified in the USACE Manual (ERDC, 2008) and supporting guidelines. Intermittent streams, ditches, and swales were identified where appropriate following USACE guidelines (USACE, 2007) and WESTON's best professional judgment. Sample station data sheets are found in Appendix B. Photographs of the survey area were taken and are included in Appendix C. A map showing the surveyed wetland/water boundaries and the location of sample stations and photographs is found in the back folder of this report.

The Corps of Engineers (Mr. Ed Bonner) conducted a site visit on 30 April 2010 to assess the proposed delineation of wetlands and other waters. Based on this site visit, changes were made to the made to the delineation of some isolated wetlands and one additional isolated wetland was identified and delineated. These changes were surveyed and are included in the wetland/waters delineation plan found in the back folder of this report.

2.2.2 Wetland/Water Delineation Results

Non-Tidal Freshwater Wetlands - The site is characterized by a history of land use activities resulting in the creation of isolated depressions where water ponds and vegetation common in disturbed areas (e.g., common reed) are present. These depressions are assumed to be the result of the placement of fill and site grading resulting in a perched water table. Five isolated depressions having wetland character were identified, delineated (flagged), and surveyed during site investigations. The presence of hydrophytic vegetation and evidence of wetland hydrologic conditions (standing water, water stained leaves, adventitious roots) indicate that the areas function as wetland. All are considered to be the result of historic site disturbance (fill and grading) related to historic land use. None of the wetland areas are associated with surface water features, including stormwater management systems. Vegetation consists of primarily dense stands of common reed with soft rush, silky dogwood and black willow present in some areas (particularly Wetland E) where the size and density of common reed is generally less robust.

Stormwater Channel – A stormwater channel traverses the property (conveying stormwater from the Norfolk Southern property located west of the site) to the north of the former Mustin Field runway and discharges into the Delaware River at the north boundary of the Navy Yard property (Figure 2 in Appendix A and wetland plan in back folder of report). The portion of the channel traversing the site is tidal, with flows restricted by a weir located at the eastern end. Two PVC pipes allow flow though the weir during low tide. The weir is overtopped during high tide.

Emergent tidal freshwater wetland – An area of emergent intertidal wetland was identified between the northern boundary of the Navy Yard property and a sheet pile area south of Pier 124 (Appendix A). The dominant vegetation in this low marsh area was spatterdock (*Nuphar luteum var. advena*). The intertidal area in this portion of the site extends into mudflats.

Observed Soils – the observed soils in both wetland and upland areas illustrate the history of filling and grading at the Site. The site has been used for disposal of dredged material, construction debris and blasting grit (Weston Solutions, Inc., 2009, 2010). Due to the site history of development, filling (including dredged material placement, landfill, and construction rubble) and grading, soils were not considered a reliable wetland indicator using color. However, observable changes in redoximorphic features (e.g., oxidized root channels) and mineral composition (sand, silt and clay) along wetland-to-upland gradients in some instances supported the wetland delineation.

2.2.3 Other Intertidal Habitat

North of the Navy Yard the shoreline is a combination of 1) bulkheads, and 2) narrow, steep areas characterized by minimal vegetation and construction rubble. There is a larger intertidal zone (primarily characterized by mudflats) between the north end of the Navy Yard and an area of sheet piles south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow, consisting of construction rubble and stone. The Mean High Water elevation (Section 10 Rivers and Harbors Act jurisdiction) is 3.04' NAVD 1988. The Spring High Water elevation (Section 404 Clean Water Act jurisdiction) is 4.48' NAVD 1988. The tide elevations were derived from NOAA data for the gauging station closest to the site (Philadelphia USCG Station, Station ID: 8545240), located approximately 3 miles upstream. Shallow water zones (extending to 6.6 feet below the mean lower low water elevation of -3.15 NAVD 1988) are present along the Delaware River at the north, east and south edges of the Southport Project site (refer to wetland plan in back folder of report).

2.2.4 Upland Habitats

Wooded – Limited woodland areas consist of primarily thin stands of young trees with varying undercover species. These wooded areas are primarily limited to the river's edge. The more common tree species include box elder (*Acer negundo*), mulberry (*Morus* spp.), black cherry (*Prunus serotina*), tree of heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*) and black locust (*Robinia pseudoacacia*). Common shrub species include blackberry (*Rubus allegheniensis*), false indigo (*Amorpha fruticosa*) and silky dogwood (*Cornus amomum*).

Upland fields – These areas are chacracterived by a diversity of species mixes consisting of both native and invasive species. Some upland areas are dominated by common reed

(*Phragmites australis*) in varying density. Common in these areas are dense stands of Asiatic tearthumb (*Polygonum cuspidatum*). There are fields lacking common reed dominated by areas of warm season grasses with mixtures of native and invasive species. This includes broomsedge (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), common wormwood (*Artemisia vulgaris*), black knapweed (*Centaurea nigra*), camphor weed (*Heterotheca subaxillaris*) and bush clover (*Lespedeza* spp.). Woody species include saplings of trees in wooded areas on the site and blackberry.

3 CONCLUSION

Weston Solutions, Inc. conducted a wetland and other water investigation of the proposed Southport Project site. The investigation resulted in the identification and delineation of a number of wetland and water areas, including both nontidal and tidal areas.

The subject property consists of land created through historic filling of the site footprint. The west portion of the site contains the buildings and infrastructure formerly used for housing at the Navy Yard, and now abandoned. The area east of the Navy Yard housing has been filled with dredged material, construction rubble and blasting grit to depths of up to 15 feet, elevating most of the site above its former elevation. The area west of the interpier area (Piers 122 and 124) has been filled and contains a former pistol range.

Historic land use activities have resulted in the creation of isolated depressions where water ponds and vegetation common in disturbed areas (e.g., common reed) are present. Five isolated depressions having wetland character were identified and delineated (flagged) during site investigations.

A stormwater channel traverses the property (conveying stormwater from the Norfolk Southern property located west of the site) to the north of the former Mustin Field runway and discharges into the Delaware River at the north boundary of the Navy Yard property. The section within the Southport Project site is intertidal.

A small area of emergent intertidal wetland was identified between the northern boundary of the Navy Yard property and a sheet pile area south of Pier 124. The dominant vegetation in this low marsh area was spatterdock. The intertidal area in this portion of the site transitions into mudflats and shallow water areas proceeding east. The intertidal zone along the east and south boundary of the Navy Yard is narrow, consisting of construction rubble and stone. The Mean High Water elevation (Section 10 Rivers and Harbors Act jurisdiction) is 3.04’ NAVD 1988. The Spring High Water elevation (Section 404 Clean water Act jurisdiction) is 4.48’ NAVD 1988. The tide elevations were derived from NOAA data for the gauging station closest to the site (Philadelphia USCG Station, Station ID: 8545240), located approximately 3 miles upstream. Shallow water zones (extending to 6.6 feet below the mean lower low water elevation of -3.15 NAVD

1988) are present along the Delaware River at the north, east and south edges of the Southport Project site.

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APPENDIX A

FIGURES

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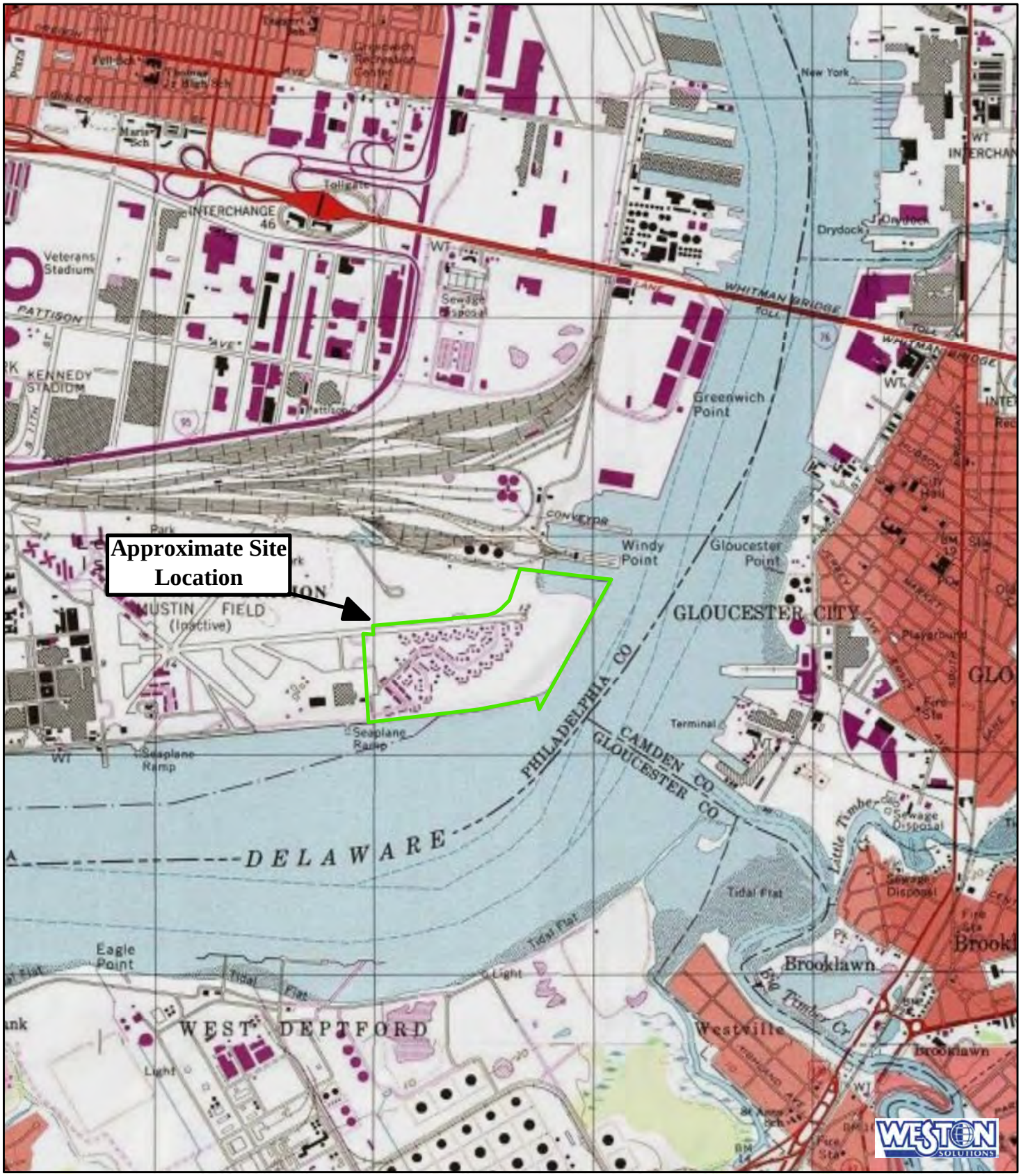

Legend

Southport

SOURCE: USGS 7.5 Minute Series
(Topographic) Quadrangle:
Philadelphia PA, 1986, Camden NJ, 1985

N
W E
S

0 1,000 2,000
Feet

Figure 1
USGS Quad
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\USGS_quad_siteloc.mxd, 16-Mar-10 14:11, ricksc

Legend

Southport

N
W E
S

0 700
Feet

Figure 2
Aerial Imagery
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\Aerial.mxd, 16-Mar-10 14:18, ricksc

Legend

Southport

Soil Survey

Ub - Urban Land

W - Water

N
W E
S

0 350 700 Feet

Figure 3
Soil Survey
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

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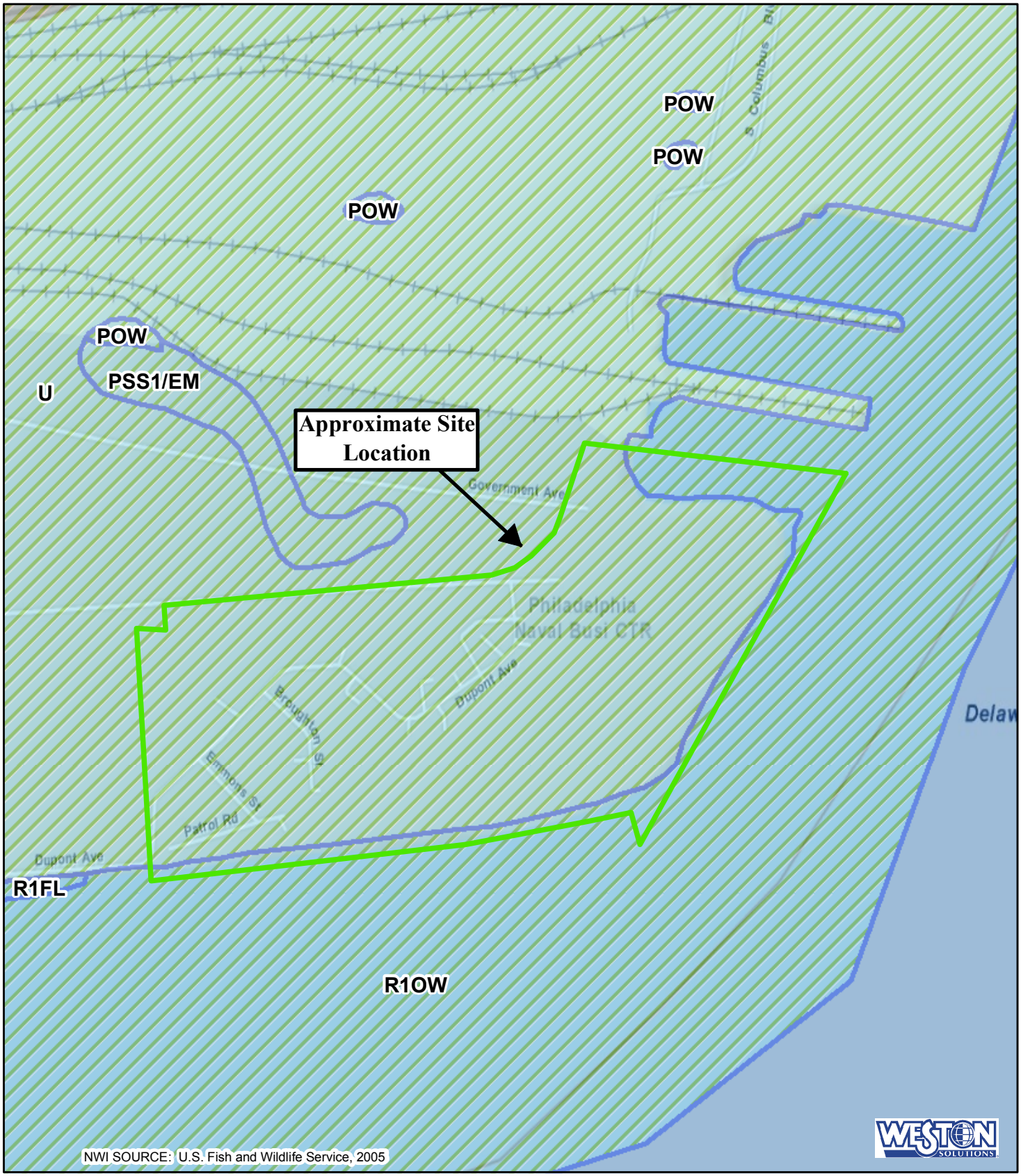

Legend

- Southport
- National Wetlands Inventory
  - PEM - Palustrine, Emergent
  - POW - Palustrine, Open Water/Unknown Bottom
  - PSS1/EM - Palustrine,Scrub-Shrub, Broad-Leaved Deciduous, Emergent
  - R1OW- Riverine, Tidal, Open Water/Unknown Bottom
  - U - Upland

N W E S

0 350 700 Feet

Figure 4
National Wetlands Inventory
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

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APPENDIX B

SAMPLE STATION DATA FORMS

DRAFT

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 10/12/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #1 - E Wetland Flag E14/E15

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____	
Hydric Soil Present? Yes ✓ No _____		
Wetland Hydrology Present? Yes ✓ No _____		

Remarks: All wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ✓ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: #1

Tree Stratum (Plot sizes: 20' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	60	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	
Sapling Stratum ( )			
1.			
2.			
3. N/A			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (10' radius)			
1. Cornus amomum	25	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	25	= Total Cover	
Herb Stratum (10' radius)			
1. Phragmites australis	80	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	= Total Cover	
Woody Vine Stratum ( )			
1.			
2. N/A			
3.			
4.			
5.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	105	x 2 =	210
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	165 (A)		270 (B)

Prevalence Index = B/A = 1.64

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/1		7.5YR 4/6				loam	
8-16	layered fine sandy loam w reducing features							
16-24	10YR 4/1		10YR 4/6				sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Soil boring demonstrates history of fill activities at site.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 10/12/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #2-E Wetland Flag E14/E15

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26" N Long: 75°08'42" W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: No wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No evidence of wetland hydrologic conditions.

VEGETATION – Use scientific names of plants. Sampling Point: #7

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3. N/A			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (20' radius)			
1. Morus spp.	15	Y	–
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Shrub Stratum (10' radius)			
1. Rhus typhina	15	Y	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (10' radius)			
1.	40	Y	UPL
2. Festuca rubra	30	Y	FACU
3. Andropogon virginicus	5		FACU
4. Agrostis alba	5		FACW
5. Daucus carota	1		UPL
6. Aster sp.	T		
7.			
8.			
9.			
10.			
11.			
12.			
	81	= Total Cover	
Woody Vine Stratum (_____)			
1.			
2. N/A			
3.			
4.			
5.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	30	x 4 =	120
UPL species	55	x 5 =	275
Column Totals:	85 (A)		395 (B)

Prevalence Index = B/A = 4.65

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2						loam	
6-16	10YR 5/3		10YR 3/2				sandy loam	
16+	refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 11/19/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #3 - B Wetland

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: All three wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): 12
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Field observations indicate wetland hydrologic conditions.

VEGETATION – Use scientific names of plants. Sampling Point: #3

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (10' radius)			
1. Phragmites australis	60		FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	= Total Cover	
Woody Vine Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	60	x 2 =	120
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	60 (A)		120 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
	SOIL TOO WET TO PROFILE							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Soil too wet to profile. Texture (sandy) suggests dredged material placed on site.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 11/19/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #4-B Wetland

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: wetland criteria not met based on lack of observable wetland hydrologic conditions and hydric soil indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No evidence of wetland hydrologic conditions.

VEGETATION – Use scientific names of plants. Sampling Point: #4

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (10 radius)			
1. Phragmites australis	90		FACW
2. Phytolacca americana	1		
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	91	= Total Cover	
Woody Vine Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	90	x 2 =	180
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	90 (A)		180 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (If observed, list morphological adaptations below).

Porkpen in landscape and lack of indicators of wetland hydrologic indicators and hydric soils indicate area is not a wetland.

SOIL

Sampling Point: #4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
2-0							Organic	
0-12	2.5Y 4/4						sandy loam	
12-24	2.5Y 4/3		2.5Y 5/3				sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 11/19/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #5-A Wetland Flag A3/A4

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): I Local relief (concave, convex, none): concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks: Three wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No ✓	Depth (inches): _____
Water Table Present?	Yes ✓	No ___	Depth (inches): 6
Saturation Present? (includes capillary fringe)	Yes ✓	No ___	Depth (inches): 2

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: #5

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3. N/A			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (10' radius)			
1. Acer rubrum	1	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	1	= Total Cover	
Shrub Stratum (10' radius)			
1. Cornus amomum	25	Yes	FACW
2. Rubus allegheniensis	40	Yes	FACU-
3. Sambucus canadensis	1		FACW-
4.			
5.			
6.			
7.			
	66	= Total Cover	
Herb Stratum (10' radius)			
1. Juncus effusus	50	Yes	FACW+
2. Polygonum pensylvanicum	10	Yes	FAC
3. Solidago gigantea	5		FACW
4. Solidago rugosa	5		FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70	= Total Cover	
Woody Vine Stratum (_____)			
1.			
2. N/A			
3.			
4.			
5.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	–	x 1 =
FACW species	81	x 2 = 162
FAC species	16	x 3 = 48
FACU species	40	x 4 = 160
UPL species		x 5 =
Column Totals:	137 (A)	370 (B)

Prevalence Index = B/A = 2.70

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
2-0	10YR 3/1							organic - H_2S smell
0-24	2.5Y 4/1		2.5Y 4/2				Coarse Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks: redoximorphic features throughout profile.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 11/19/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #6-A Wetlan. Flat A3-A4

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UrB) NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: None of wetland criteria met

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes ✓	No _____	Depth (inches): 16
Saturation Present? (Includes capillary fringe)	Yes ✓	No _____	Depth (inches): 14

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: #6

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (20' radius)			
1. Prunus serotina	1	yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	1	= Total Cover	
Shrub Stratum (10' radius)			
1. Rubus allegheniensis	40	yes	FACU
2. Cornus amomum	5	yes	FACW
3.			
4.			
5.			
6.			
7.			
	45	= Total Cover	
Herb Stratum (10' radius)			
1. Agrostis stolonifera	40	yes	FACW
2. Solidago canadensis	25	yes	FACU
3. Dichanthelium acuminatum	7		FAC
4. Andropogon virginicus	5		FACU
5. Artemisia pilosa	5		UPL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	82	= Total Cover	
Woody Vine Stratum (10' radius)			
1. Parthenocissus quinquefolia	20	yes	FACU
2.			
3.			
4.			
5.			
	20	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	–	x 1 =	–
FACW species	45	x 2 =	90
FAC species	7	x 3 =	21
FACU species	91	x 4 =	364
UPL species	5	x 5 =	25
Column Totals:	148 (A)		500 (B)

Prevalence Index = B/A = 3.38

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
2-0							organic	
0-7	2.5Y 5/4						sand	
7-16	10YR 5/4		2.5Y 4/2				fine sand	layered - dredge material
16-24	fill - includes concrete, rubble, coarse stone, sand							
24+	refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 11/19/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #7 - C Wetland Flag C-7

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42" W Datum: _____

Soil Map Unit Name: Urban Land (UrB) NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: Three wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes ✓	No _____	Depth (inches): 10
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: #7

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Sapling Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Shrub Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (10' radius)			
1. Juncus effusus	40	yes	FACW+
2. Phragmites australis	25	yes	FACW
3. Carex scoparia	1		FACW
4. Lythrum salicaria	1		FACW+
5. Polygonum punctatum	1		
6. Eupatorium perfoliatum	1		
7.			
8.			
9.			
10.			
11.			
12.			
	69	= Total Cover	

Woody Vine Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	65	x 2 =	130
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	65 (A)		130 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2						silty sand	
2-7	2.5Y 4/1		5YR 4/6				fine sand	
7-21	4/N		7.5YR 4/6				fine sand	
21+	Too Wet to Probe						sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 11/19/09

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: #8 - C Wetland Clay C-2

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: #8

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Sapling Stratum (20' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Paulownia tomentosa	5	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	5	= Total Cover	

Shrub Stratum (10' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Rubus laciniatus	5	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	5	= Total Cover	

Herb Stratum (10' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum perfoliatum	40	Yes	FAC
2. Phrymites australis	15	Yes	FACW
3. Phytolacca americana	1		FACU+
4. Erechtites hieracifolia	1		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	57	= Total Cover	

Woody Vine Stratum (10' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Parthenocissus quinquefolia	1	Yes	FACU
2.			
3.			
4.			
5.			
	1	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	15	x 2 =	30
FAC species	40	x 3 =	120
FACU species	1	x 4 =	4
UPL species	10	x 5 =	50
Column Totals:	66 (A)		204 (B)

Prevalence Index = B/A = 3.09

Hydrophytic Vegetation Indicators:

__ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
1-0	10YR 3/2						Organic	
0-10	2.5Y 4/3		2.5Y 5/3				Sandy Loam	
10-24	2.5Y 4/1						Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

#9

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 5/4/10

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: Flag D4A-# Wetland

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: All three wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): 12
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Recent significant precipitation.

VEGETATION – Use scientific names of plants.

Sampling Point: #9

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Sapling Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Shrub Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Herb Stratum (_____)			
1.			
2. Phragmites australis	75	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75 = Total Cover		
Woody Vine Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	75	x 2 =	150
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	75 (A)		150 (B)

Prevalence Index = B/A = 2

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	2.5Y 3/1						silt loam	
MOTTLE TOO WET TO PROFILE								

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Soil is dredged material. Prominent oxidized root channels throughout profile

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

#10

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 5/4/10

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: Flag DYA #1 Upland

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: None of the wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Recent significant precipitation

VEGETATION – Use scientific names of plants.

Sampling Point: #10

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Sapling Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Shrub Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Herb Stratum (10')			
1.			
2. Phragmites australis	90	yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90 = Total Cover		
Woody Vine Stratum (10')			
1.			
2. Parthenocissus quinquefolia	1	yes	FACU
3.			
4.			
5.			
	1 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	90	x 2 =	180
FAC species		x 3 =	
FACU species	1	x 4 =	4
UPL species		x 5 =	
Column Totals:	91 (A)		184 (B)

Prevalence Index = B/A = 2.02

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No _____

Remarks: (If observed, list morphological adaptations below).

Position in landscape and lack of indicators of wetland hydrologic conditions and hydric soils indicate area is not a wetland.

SOIL

Sampling Point: #10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/2						sandy loam	- dredged material
16-25	10YR 4/1	> layered					sandy loam/silt loam	
	10YR 4/2						"	"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

12-16 - occasional oxidized root channels
16-25 - layered profile 10YR 4/1 silt loam
10YR 4/2 sandy loam
soil is dredged material

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

#11

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 5/4/10

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: Flag F9-# wetland

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: All three wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): 8
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Recent significant precipitation.

VEGETATION – Use scientific names of plants.

Sampling Point: #11

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Sapling Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Shrub Stratum (10')			
1.			
2. Rubus allegheniensis	5	yes	FACU
3.			
4.			
5.			
6.			
7.			
	5 = Total Cover		
Herb Stratum (10')			
1.			
2. Phragmites australis	50	yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	50 = Total Cover		
Woody Vine Stratum (_____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	50	x 2 = 100
FAC species		x 3 =
FACU species	5	x 4 = 20
UPL species		x 5 =
Column Totals:	55 (A)	120 (B)

Prevalence Index = B/A = 2.18

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
	TOO WET TO PROFILE							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks: Soil is dredged material.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Southport Development City/County: Philadelphia Sampling Date: 5/4/10 #12

Applicant/Owner: Philadelphia Regional Port Authority State: PA Sampling Point: Flag Fg-#1 Upland

Investigator(s): B. Dubinski Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR or MLRA): MLRA Lat: 39°53'26"N Long: 75°08'42"W Datum: _____

Soil Map Unit Name: Urban Land (UB) NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: No wetland criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes ✓	No _____	Depth (inches): 21
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 8

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Recent significant precipitation

VEGETATION – Use scientific names of plants.

Sampling Point: #12

Tree Stratum (Plot sizes: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3. N/A			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling Stratum (_____)			
1.			
2.			
3. N/A			
4.			
5.			
6.			
7.			
	= Total Cover		
Shrub Stratum (10')			
1. Rubus allegheniensis	40	Yes	FACU-
2. Cornus amomum	1	No	FACW
3.			
4.			
5.			
6.			
7.			
	41 = Total Cover		
Herb Stratum (10')			
1. Phragmites australis	10	Yes	FACW
2. Polygonum perfoliatum	5	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15 = Total Cover		
Woody Vine Stratum (10')			
1.			
2. Parthenocissus quinquefolia	5	Yes	FACU
3.			
4.			
5.			
	5 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	11	x 2 =	22
FAC species	5	x 3 =	15
FACU species	45	x 4 =	180
UPL species		x 5 =	
Column Totals:	61 (A)		217 (B)

Prevalence Index = B/A = 3.56

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: #12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2						loam	
6-11	10YR 4/1						fine sandy loam	layered dredge material
	7.5YR 4/6						fine sandy loam	
11-17	10YR 4/2						fine sandy loam	
17-25	10YR 4/4						fine sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12) (LRR T, U)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

Soil is dredged material.

APPENDIX C

PHOTOGRAPHS
Existing Site Conditions

DRAFT

PHOTO 1. View north of upland to wetland transition in Wetland E.

PHOTO 2. View south of stormwater channel at low tide.

PHOTO 3. View northwest of intertidal wetland area at low tide.

PHOTO 4. View northeast of intertidal mudflat at low tide.

PHOTO 5. View northeast of upland field at north end of Navy Yard.

PHOTO 6. View north of upland to wetland transition in Wetland A (flag A2).

PHOTO 7. View west of Wetland B. Note steep banks.

PHOTO 8. View southwest of Wetland C (flag C3).

PHOTO 9. View southwest of upland to wetland transition at Wetland D.

PHOTO 10. View west of wetland to upland transition at Wetland D (flag D4A).

PHOTO 11. View south of shoreline on east side of property.

PHOTO 12. View north of shoreline on east side of property.

PHOTO 13. View west of shoreline and steep banks on east side of property.

PHOTO 14. View south of typical vegetation in area of former Navy housing.

PHOTO 15. View north of upland field in area of former Navy housing.

PHOTO 16. View south of upland field in southern portion of site.

PHOTO 17. View east of southern edge of site.

PHOTO 18. View east of shoreline along southern edge of site.

PHOTO 19. View southwest of wetland to upland transition at Wetland F (flag F9).

APPENDIX F.2

WETLAND/WATERS DELINEATION FIGURE

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83),
VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

REFERENCE: AERIAL DATA REDUCTION ASSOCIATES, INC.
DATE OF PHOTOGRAPHY: JUNE 22, 1994
DATE OF COMPILATION: NOVEMBER 1994

CONVERSION OF THE NAVD 1988 GROUND ELEVATIONS TO NGVD 1929 IS +0.98'
CONVERSION OF THE NAVD 1988 TIDAL DATA TO NGVD 1929 IS +1.32'

THE EXTENT OF TIDAL JURISDICTION IS BASED UPON TIDAL DATA AS FOLLOWS:
SECTION 10 –– MEAN HIGH WATER –– 3.04' NAVD 1988
SECTION 404 – SPRING HIGH WATER – 4.48' NAVD 1988

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE, STATION 8545240, PHILADELPHIA (USCG STATION), DELAWARE RIVER, PA, BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 IS AS FOLLOWS:

HIGHEST RECORDED TIDE 7.34' (NOV 1950)
MEAN HIGHER HIGH TIDE 3.46'
MEAN HIGH TIDE 3.04'
MEAN TIDE LEVEL 0.04'
MEAN LOW TIDE –2.96'
MEAN LOWER TIDE –3.15'
LOWEST RECORDED TIDE –9.96' (DEC 1962)
100 YEAR FLOOD ELEVATION 9.00' (NAVD 88)

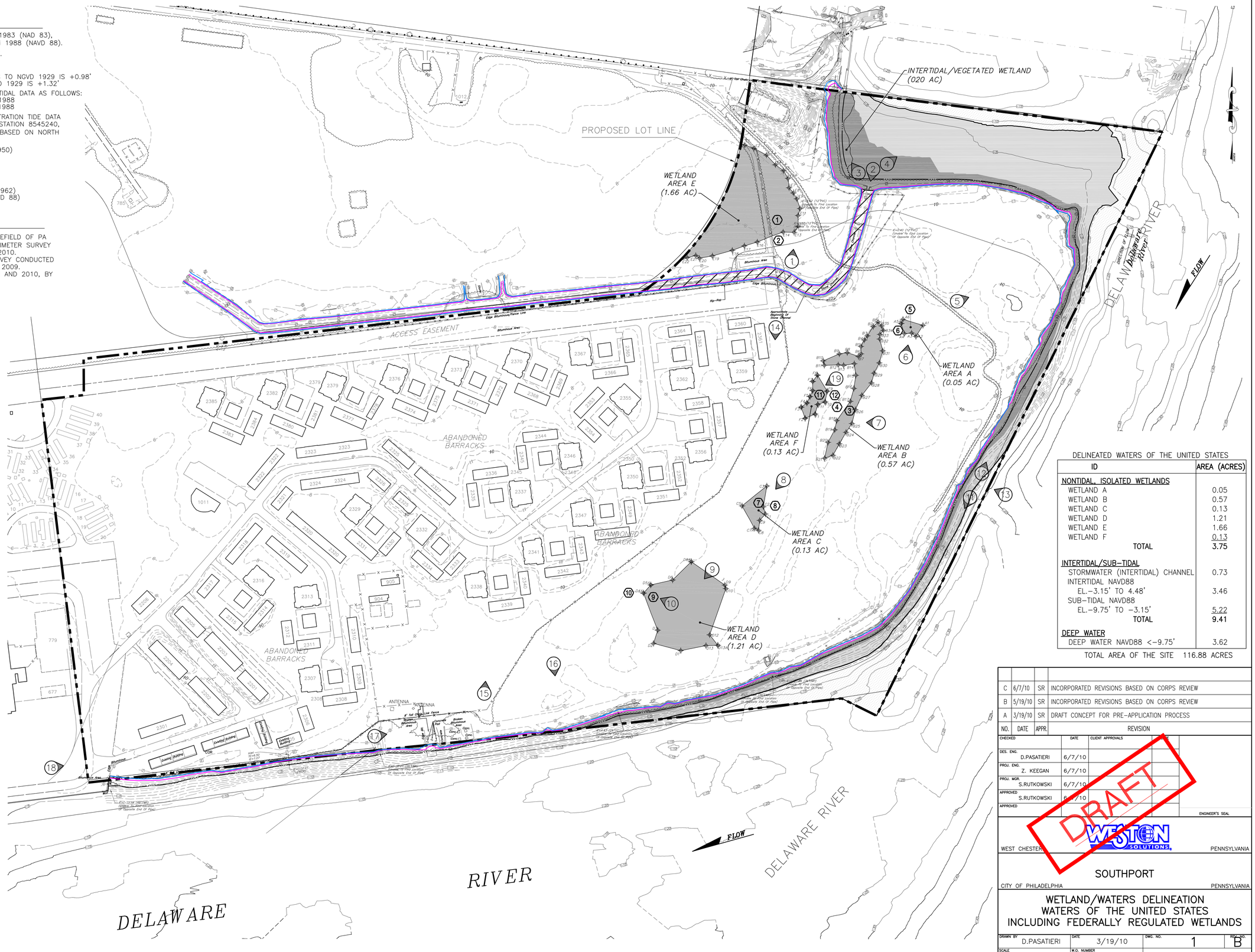
GENERAL NOTES

- TOPOGRAPHY INFORMATION FROM CUSHMAN & WAKEFIELD OF PA (1992) PNBC TOPOGRAPHY MAP, MODIFIED BY PERIMETER SURVEY PERFORMED BY RETTEW ASSOCIATES, INC. MARCH 2010.
- BATHYMETRY INFORMATION FROM FATHOMETRIC SURVEY CONDUCTED BY HYDROGRAPHIC SURVEYS DATED SEPTEMBER 3, 2009.
- WETLAND DELINEATIONS WERE CONDUCTED IN 2009 AND 2010, BY WESTON SOLUTIONS, INC.

LEGEND

- FENCE
- GUIDERAIL
- UTILITY POLE
- DENSE VEGETATION/ SHADOWS (DENSE WOODS)
- BUILDING WITH NUMBER (5432)
- WOODS LINE
- SHRUB/BRUSH AREA
- EXISTING CONTOURS WITH LABELS (10, 2)
- DRAINAGE
- SITE BOUNDARY
- PHOTOGRAPH LOCATION AND DIRECTION (11)
- SAMPLE STATION (4)
- SURVEYED WETLAND BOUNDARY LINES
- SURVEYED WETLAND BOUNDARY POINTS (A2)
- STORMWATER CHANNEL
- ISOLATED FRESHWATER WETLANDS
- INTERTIDAL WATERS
- SUB-TIDAL WATERS
- DEEP WATER
- SPRING HIGH WATER LINE
- MEAN HIGH WATER LINE

120 0 120 240
SCALE: 1"=120'-0"



DELINEATED WATERS OF THE UNITED STATES

ID	AREA (ACRES)
NONTIDAL, ISOLATED WETLANDS	
WETLAND A	0.05
WETLAND B	0.57
WETLAND C	0.13
WETLAND D	1.21
WETLAND E	1.66
WETLAND F	0.13
TOTAL	3.75
INTERTIDAL/SUB-TIDAL	
STORMWATER (INTERTIDAL) CHANNEL	0.73
INTERTIDAL NAVD88 EL.–3.15' TO 4.48'	3.46
SUB-TIDAL NAVD88 EL.–9.75' TO –3.15'	5.22
TOTAL	9.41
DEEP WATER	
DEEP WATER NAVD88 <–9.75'	3.62

TOTAL AREA OF THE SITE 116.88 ACRES

NO.	DATE	APPR.	REVISION
C	6/7/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
B	5/19/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
A	3/19/10	SR	DRAFT CONCEPT FOR PRE-APPLICATION PROCESS

CHECKED	DATE	CLIENT APPROVALS
DES. ENG. D.PASATIERI	6/7/10	
PROJ. ENG. Z. KEEGAN	6/7/10	
PROJ. MGR. S.RUTKOWSKI	6/7/10	
APPROVED S.RUTKOWSKI	6/7/10	
APPROVED		

ENGINEER'S SEAL

DRAFT

WEST CHESTER WESTON SOLUTIONS PENNSYLVANIA

SOUTHPORT

CITY OF PHILADELPHIA PENNSYLVANIA

WETLAND/WATERS DELINEATION WATERS OF THE UNITED STATES INCLUDING FEDERALLY REGULATED WETLANDS

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	3/19/10	1	B
SCALE 1"=120'-0"	W.O. NUMBER 14637.001.001.0003.07	SHEET 1 OF 1	

Filename: G:\ACADPROJ\12769006003 PRPA Southport\PIDC\WetlandsMarch2010.dwg

APPENDIX F.3

SOUTHPORT JURISDICTIONAL DETERMINATION

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO ATTENTION OF

JUN 14 2010

Regulatory Branch
Applications Section I

SUBJECT: CENAP-OP-R 2009-933-1 (JD)
Project Name: Southport

Mr. Barry J. Dubinski, Ph.D.
Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380

Dear Mr. Dubinski:

This letter is written with regard to your request on behalf of the Philadelphia Regional Port Authority for verification of a jurisdictional delineation of a project site known as Southport. The property encompasses approximately 117 acres of land located at the extreme eastern end of the the former Philadelphia Naval Shipyard, which was conveyed to the City of Philadelphia with the closure of the base. The project is bounded to the east and south by the Delaware River.

The plans identified on the following pages depict the extent of Federal jurisdiction on the subject property. The basis of our determination of jurisdiction is also provided (Enclosure 1).

Pursuant to Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, a Department of the Army permit is required for work or structures in navigable waters of the United States and the discharge of dredged or fill material into waters of the United States including adjacent and isolated wetlands. Any proposal to perform the above activities within the area of Federal jurisdiction requires the prior approval of this office.

This delineation/determination has been conducted to identify the limits of the Corps Clean Water Act jurisdiction for the particular site identified in this request. This delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985, as amended. If you or your tenant are U.S. Department of Agriculture (USDA) program participants, or anticipate participating in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service prior to starting work.

This letter is valid for a period of five (5) years. This jurisdictional determination is issued in accordance with current Federal regulations and is based upon the existing site conditions and

information provided by you in your application. This office reserves the right to reevaluate and modify the jurisdictional determination at any time should the existing site conditions or Federal regulations change, or should the information provided by you prove to be false, incomplete or inaccurate.

This letter contains an approved jurisdictional determination for your subject site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR 331. Enclosed you will find a combined Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form (Enclosure 2). If you request to appeal this determination, you must submit a completed RFA form to the North Atlantic Division Office at the following address:

Mr. Michael G. Vissichelli
Administrative Appeals Review Officer
North Atlantic Division, Corps of Engineers Fort Hamilton Military
Community Bldg. 301, General Lee Avenue Brooklyn, NY 11252-6700
Telephone: (718) 765-7163
Email: Michael.G.Vissichelli@usace.army.mil

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by AUG 16 2010.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this letter.

If you have any questions regarding this matter, please contact Mr. Edward Bonner at (215) 656-5932 or write to the above address.

Sincerely,

Frank J. Cianfrani
Chief, Regulatory Branch

****

SUBJECT PROPERTY: The project site is known as Southport. It encompasses approximately 117 acres of land located at the extreme eastern end of the the former Philadelphia Naval Shipyard, which was conveyed to the City of Philadelphia with the closure of the base. The project is bounded to the east and south by the Delaware River.

****

SURVEY DESCRIPTION: The approved delineation of federally regulated wetlands and waters of the United States is shown on the plan entitled Southport, City of Philadelphia, Pennsylvania, Wetlands/Waters Delineation Waters of the United States, Including Federally Regulated Wetlands, drawing #1, dated 3/19/10 and last revised on 6/7/10. The approved plan was prepared by Weston Solutions, Inc.

****

COMMENTS: Site inspections by a representative of this office were conducted on October 21, 2009 and April 30, 2010.

****

Enclosures

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): JUN 14 2010

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: CENAP-OP-R-2009-0933-1

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: Pennsylvania County: Philadelphia City: Philadelphia
Center coordinates of site (lat/long in degree decimal format): Lat. 39.891277 N Long. 75.141907 W
Universal Transverse Mercator: Northing Easting
Name of nearest waterbody: Delaware River
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Delaware River
Name of watershed or Hydrologic Unit Code (HUC): Lower Delaware

☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): 21 Oct 09 and 30 Apr 10

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **are** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☒ Waters subject to the ebb and flow of the tide.
☒ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: The Delaware River is a tidal waterway that contains a federally authorized commercial navigation channel identified as Philadelphia to the Sea.

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **are** *waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]

☒ TNWs, including territorial seas
☒ Wetlands adjacent to TNWs
☒ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
☐ Non-RPWs that flow directly or indirectly into TNWs
☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
☐ Impoundments of jurisdictional waters
☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:
Non-wetland waters: linear feet: width (ft) and/or 13 acres.
Wetlands: 3.75 acres.

c. Limits (boundaries) of jurisdiction based on: 1987 Delineation Manual
Elevation of established OHWM (if known):

2. Non-regulated waters/wetlands (check if applicable):[3]

☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: .

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW
Identify TNW: Delaware River
Summarize rationale supporting determination: The Delaware River is a tidal waterway with an average tidal amplitude of approximately 2 meters. In addition, the Delaware River is a federally authorized and maintained navigation channel that was recently authorized to a channel depth of 45 feet from the previously authorized channel depth of 40 feet. The channel is identified as Philadelphia To the Sea.

2. Wetland adjacent to TNW
Summarize rationale supporting conclusion that wetland is "adjacent":There is a small tidal wetland located along a tidal slip at the project site. In addition there are five wetland pockets located in the vicinity of the Delaware River (within 500 feet) that developed in an old dredged material disposal area previously used to dispose of dredged materials from the river. The area occupied by these five wetland pockets was part of the Delaware River prior to the dredged material disposal activities. The five wetland pocket are also close enough in proximity to provide an ecological connection to the river.

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under Rapanos have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: _____
Drainage area: _____
Average annual rainfall: inches
Average annual snowfall: inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☐ Tributary flows through _____ tributaries before entering TNW.

Project waters are _____ river miles from TNW.
Project waters are _____ river miles from RPW.
Project waters are _____ aerial (straight) miles from TNW.
Project waters are _____ aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain:

Identify flow route to TNW[5]:
Tributary stream order, if known:

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is:
- ☐ Natural
- ☐ Artificial (man-made). Explain:
- ☐ Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: _____

Primary tributary substrate composition (check all that apply):

☐	Silts	☐	Sands	☐	Concrete	
☐	Cobbles	☐	Gravel	☐	Muck	
☐	Bedrock	☐	Vegetation.	Type		% cover:
☐	Other. Explain:					

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain:
Presence of run/riffle/pool complexes. Explain:
Tributary geometry:_____
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: _____
Estimate average number of flow events in review area/year: _____
Describe flow regime:
Other information on duration and volume:

Surface flow is: _____ Characteristics:

Subsurface flow: _____ Explain findings:
- ☐ Dye (or other) test performed:

Tributary has (check all that apply):
- ☐ Bed and banks
  - ☐ OHWM[6] (check all indicators that apply):
    - ☐ clear, natural line impressed on the bank
    - ☐ changes in the character of soil
    - ☐ shelving
    - ☐ vegetation matted down, bent, or absent
    - ☐ leaf litter disturbed or washed away
    - ☐ sediment deposition
    - ☐ water staining
    - ☐ other (list):
    - ☐ the presence of litter and debris
    - ☐ destruction of terrestrial vegetation
    - ☐ the presence of wrack line
    - ☐ sediment sorting
    - ☐ scour
    - ☐ multiple observed or predicted flow events
    - ☐ abrupt change in plant community
  - ☐ Discontinuous OHWM.[7] Explain:

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):
- ☐ High Tide Line indicated by:
  - ☐ oil or scum line along shore objects
  - ☐ fine shell or debris deposits (foreshore)
  - ☐ physical markings/characteristics
  - ☐ tidal gauges
  - ☐ other (list):
- ☐ Mean High Water Mark indicated by:
  - ☐ survey to available datum;
  - ☐ physical markings;
  - ☐ vegetation lines/changes in vegetation types.

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain:
Identify specific pollutants, if known:

[6] A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7] Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

☐ Riparian corridor. Characteristics (type, average width):
☐ Wetland fringe. Characteristics:
☐ Habitat for:
  ☐ Federally Listed species. Explain findings:
  ☐ Fish/spawn areas. Explain findings:
  ☐ Other environmentally-sensitive species. Explain findings:
  ☐ Aquatic/wildlife diversity. Explain findings:

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:
Properties:
Wetland size: acres
Wetland type. Explain:
Wetland quality. Explain:
Project wetlands cross or serve as state boundaries. Explain:

(b) General Flow Relationship with Non-TNW:
Flow is:_____ Explain:

Surface flow is: _____
Characteristics:

Subsurface flow: _____ Explain findings:
☐ Dye (or other) test performed:

(c) Wetland Adjacency Determination with Non-TNW:
☐ Directly abutting
☐ Not directly abutting
  ☐ Discrete wetland hydrologic connection. Explain:
  ☐ Ecological connection. Explain:
  ☐ Separated by berm/barrier. Explain:

(d) Proximity (Relationship) to TNW
Project wetlands are _____ river miles from TNW.
Project waters are _____ aerial (straight) miles from TNW.
Flow is from: _____
Estimate approximate location of wetland as within the _____ floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain:
Identify specific pollutants, if known:

(iii) Biological Characteristics. Wetland supports (check all that apply):

☐ Riparian buffer. Characteristics (type, average width):
☐ Vegetation type/percent cover. Explain:
☐ Habitat for:
  ☐ Federally Listed species. Explain findings:
  ☐ Fish/spawn areas. Explain findings:
  ☐ Other environmentally-sensitive species. Explain findings:
  ☐ Aquatic/wildlife diversity. Explain findings:

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: _____
Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☒ TNWs: linear feet width (ft), Or, 13 acres.
   - ☒ Wetlands adjacent to TNWs: 3.75 acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☒ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:The project site includes an unamed drainage ditch flows into the Delaware River form an adjacent intermodal rail facility. This drainage ditch flows year round and is tidal for most of its course. There is a daily tidal exchange with the ditch and the Delaware River.
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally:

   Provide estimates for jurisdictional waters in the review area (check all that apply):
   - ☒ Tributary waters:1000 linear feet width (ft).
   - ☐ Other non-wetland waters: acres.
     Identify type(s) of waters:

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
   - ☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional waters within the review area (check all that apply):
   - ☐ Tributary waters: linear feet width (ft).

☐ Other non-wetland waters: acres.
Identify type(s) of waters:

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**

☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.

☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above Provide rationale indicating that wetland is directly abutting an RPW:

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**

☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**

☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.**[9]

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.

☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]

☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain:
☐ Other factors. Explain:

Identify water body and summarize rationale supporting determination:

[8] See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

Provide estimates for jurisdictional waters in the review area (check all that apply):

☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters:
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.

- ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain:
- ☐ Other: (explain, if not covered above):

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource:
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource:
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☐ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps:
- ☐ Corps navigable waters' study:
- ☐ U.S. Geological Survey Hydrologic Atlas:
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☐ U.S. Geological Survey map(s). Cite scale & quad name:
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation:
- ☐ National wetlands inventory map(s). Cite name:
- ☐ State/Local wetland inventory map(s):
- ☐ FEMA/FIRM maps:
- ☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  ☐ or Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter:
- ☐ Applicable/supporting case law:
- ☐ Applicable/supporting scientific literature:
- ☐ Other information (please specify):

B. ADDITIONAL COMMENTS TO SUPPORT JD: As noted above, the Delaware River is a tidal waterway with a tidal amplitude of approximately 2 meters. The Delaware River also is a major commercial waterway with an authorized federal navigation channel. The unnamed tributary to the Delaware River is also a tidal waterway. And the mapped wetlands on the project site are considered adjacent to these navigable waterways.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Philadelphia Regional Port Authority	File Number: CENAP-OP-R-2009-0933-1	Date: JUN 14 2010
Attached is:		See Section below
☐	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
☐	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
☐	PERMIT DENIAL	C
☒	APPROVED JURISDICTIONAL DETERMINATION	D
☐	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the Philadelphia District Engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations (JD) associated with the permit.

- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the Philadelphia District Engineer. Your objections must be received by the Philadelphia District Engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the Philadelphia District Engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the Philadelphia District Engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the Philadelphia District Engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the North Atlantic Division Engineer, ATTN: CENAD-PD-PSD-O, Fort Hamilton Military Community, Building 301, General Lee Avenue, Brooklyn, NY 11252-6700. This form must be received by the North Atlantic Division Engineer within 60 days of the date of this notice with a copy furnished to the Philadelphia District Engineer.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the North Atlantic Division Engineer, ATTN: CENAD-PD-PSD-O, Fort Hamilton Military Community, Building 301, General Lee Avenue, Brooklyn, NY 11252-6700. This form must be received by the North Atlantic Division Engineer within 60 days of the date of this notice with a copy furnished to the Philadelphia District Engineer.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.

- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the North Atlantic Division Engineer, ATTN: CENAD-PD-PSD-O, Fort Hamilton Military Community, Building 301, General Lee Avenue, Brooklyn, NY 11252-6700. This form must be received by the North Atlantic Division Engineer within 60 days of the date of this notice with a copy furnished to the Philadelphia District Engineer.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact: Edward Bonner U.S. Army Corps of Engineers, Philadelphia District ATTN: CENAP-OP-R Wanamaker Building, 100 Penn Square East Philadelphia, PA 19107-3390 Telephone: 215-656-5932	If you only have questions regarding the appeal process you may also contact: Mr. Michael G. Vissichelli Administrative Appeals Review Officer North Atlantic Division, Corps of Engineers Fort Hamilton Military Community Bldg. 301, General Lee Avenue Brooklyn, NY 11252-6700 Telephone: (718) 765-7163 Email: Michael.G.Vissichelli@usace.army.mil

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

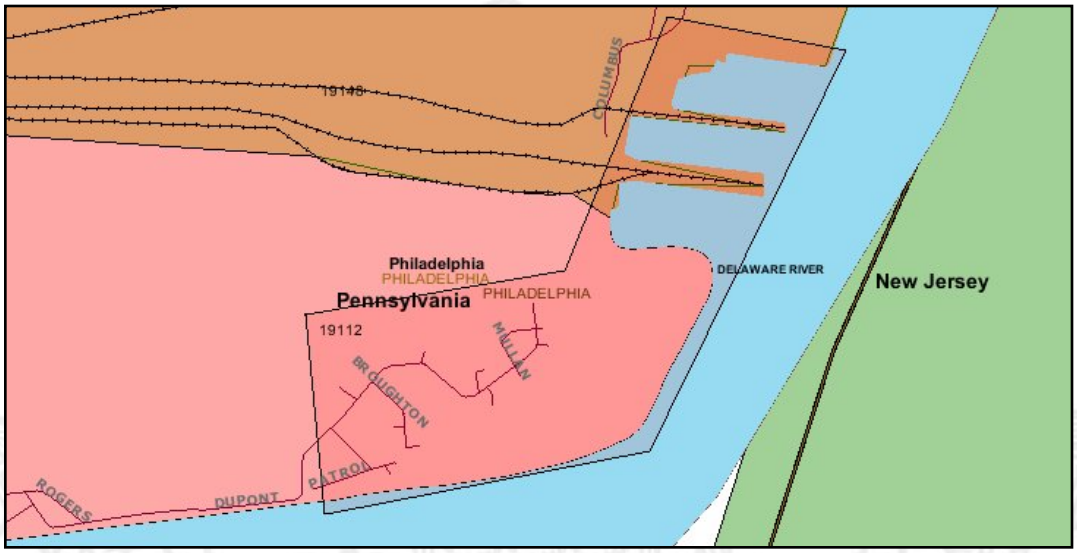
APPENDIX G

PENNSYLVANIA NATURAL DIVERSITY INVENTORY (PNDI)

PNDI ID # 20090901208135
PNDI AND ATTACHMENTS SENT TO AGENCIES FOR REVIEW

1. PROJECT INFORMATION

Project Name: **PRPA Southport**
Date of review: **9/1/2009 8:55:33 AM**
Project Category: **In-stream / Riverine Activities and Projects,Dock**
Project Area: **169.4** acres
County: **Philadelphia** Township/Municipality: **Philadelphia**
Quadrangle Name: **PHILADELPHIA**
ZIP Code: **19148,19112**
Decimal Degrees: **39.88812 N, --75.15126 W**
Degrees Minutes Seconds: **39° 53' 17.2" N, -75° 9' 4.6" W**



2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Department of Conservation and Natural Resources	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

RESPONSE TO QUESTION(S) ASKED

Q1: "Will any and all on-land (non-aquatic) disturbance occur in or on an existing building, parking lot, driveway, road, road shoulder, street, runway, paved area, railroad bed, maintained (periodically mown) lawn, crop agriculture field or maintained orchard?"
Your answer is: **2. No**

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for one year** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt.

PA Game Commission

PGC Species:
Scientific Name: Sensitive Species**
Common Name:
Current Status: Threatened
Proposed Status: Threatened

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PA Department of Conservation and Natural Resources

DCNR Species:
Scientific Name: Cuscuta pentagona
Common Name: Field Dodder
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Juncus dichotomus
Common Name: Forked Rush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Lycopus rubellus
Common Name: Bugleweed
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Panicum scoparium
Common Name: Velvety Panic-grass
Current Status: Endangered
Proposed Status: Endangered

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PA Fish and Boat Commission

PFBC Species:
Scientific Name: Sensitive Species**
Common Name:
Current Status: Threatened
Proposed Status: Special Concern Species*

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

U.S. Fish and Wildlife Service

RESPONSE: No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be preformed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams
____The DEP permit(s) required for this project

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. For cases where a "Potential Impact" to threatened and endangered species has been identified before the application has been submitted to DEP, the application should not be submitted until the impact has been resolved. For cases where "Potential Impact" to special concern species and resources has been identified before the application has been submitted, the application should be submitted to DEP along with the PNDI receipt, a completed PNDI form and a USGS 7.5 minute quadrangle map with the project boundaries delineated on the map. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. DEP and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at http://www.naturalheritage.state.pa.us.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources

Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service

Endangered Species Section
315 South Allen Street, Suite 322, State College, PA. 16801-4851
NO Faxes Please.

PA Fish and Boat Commission

Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission

Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

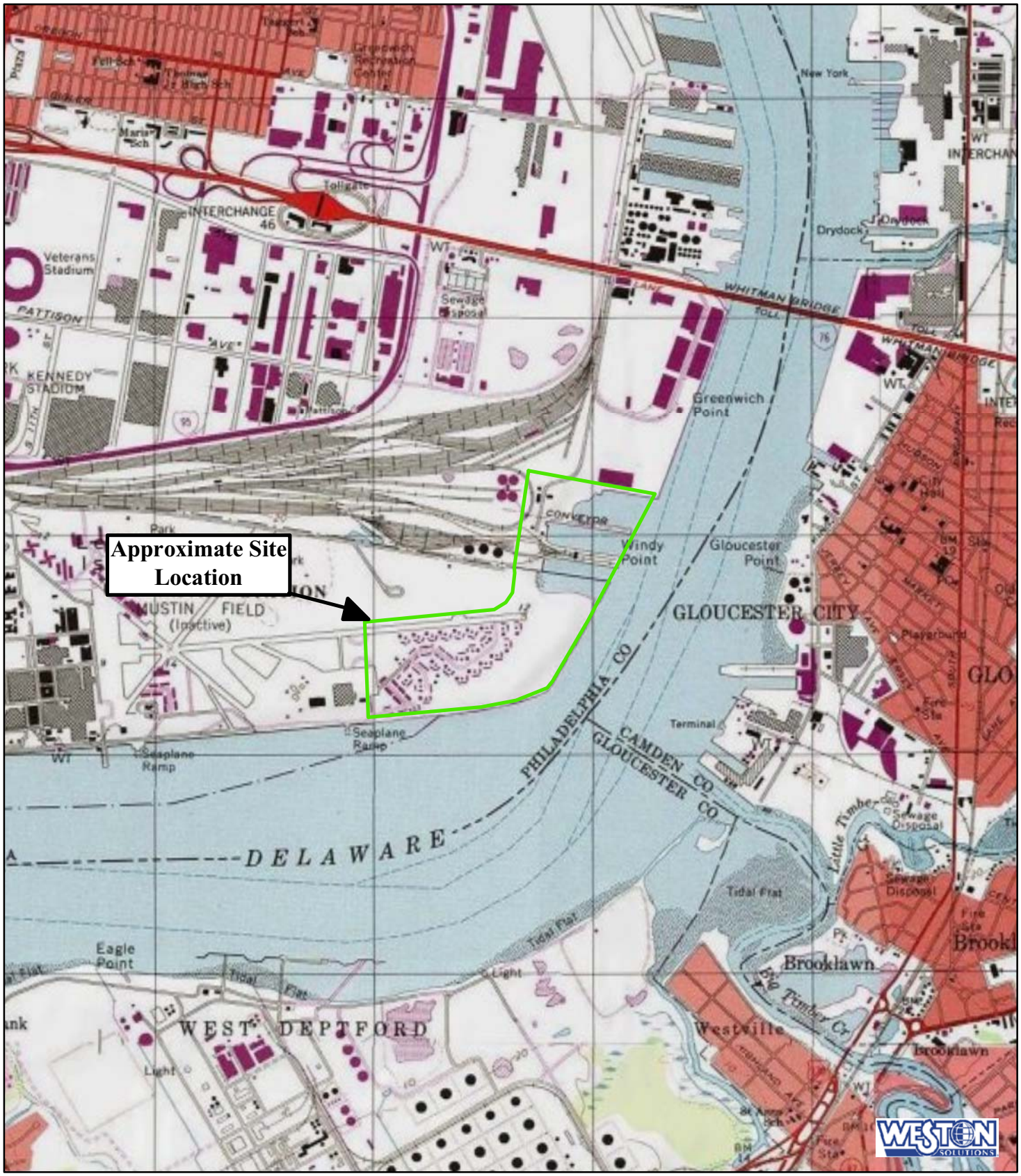
7. PROJECT CONTACT INFORMATION

Name:_____
Company/Business Name:_____
Address:_____
City, State, Zip:_____
Phone:(_____)_____Fax:(_____)_____
Email:_____

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

_____ _____
applicant/project proponent signature date



Legend

Southport

SOURCE: USGS 7.5 Minute Series
(Topographic) Quadrangle:
Philadelphia PA, 1986, Camden NJ, 1985

N
W E
S

0 1,000 2,000
Feet

Figure 1
USGS Quad
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\USGS_quad_siteloc.mxd, 13-Nov-09 10:37, curtisf

SURVEY NOTES
(CUSHMAN & WAKEFIELD–1992)

REFERENCE: AERIAL DATA REDUCTION ASSOCIATES, INC.
DATE OF PHOTOGRAPHY: JUNE 22, 1994
DATE OF COMPILATION: NOVEMBER 1994

CONVERSION OF THE NAVD 1988 GROUND ELEVATIONS TO NGVD 1929 IS +0.98'
CONVERSION OF THE NAVD 1988 TIDAL DATA TO NGVD 1929 IS +1.32'

THE EXTENT OF TIDAL JURISDICTION IS BASED UPON TIDAL DATA AS FOLLOWS:
SECTION 10 –– MEAN HIGH WATER –– 2.38' NAVD 1988
SECTION 404 – SPRING HIGH WATER – 2.58' NAVD 1988

NATIONAL OCEANOGRAPHIC AND ATOMSPHERIC ADMINISTRATION
TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE,
PHILADELPHIA PIER 11 NORTH, BASED ON NORTH AMERICAN
VERTICAL DATUM OF 1988 IS AS FOLLOWS:
HIGHEST RECORDED TIDE 7.18' (NOV 1950)
MEAN HIGHER HIGH TIDE 3.14'
MEAN HIGH TIDE 2.73'
MEAN TIDE LEVEL –0.034'
MEAN LOW TIDE –3.42'
MEAN LOWER TIDE –3.61'
LOWEST RECORDED TIDE –10.12' (DEC 1962)

HORIZONTAL DATUM IS THE NORTH AMERICAM DATUM 1983 (NAD 83),
VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988

CONTOUR INTERVAL 2 FOOT

OUTLINED AREAS LABELED "OBSCURED", "DENSE WOODS" OR "SHADOWS" HAVE NO GUARANTEED OR IMPLIED HORIZONTAL AND VERTICAL ACCURACIES

ALL ELEVATIONS ON THE PNBC FINAL PLAT ARE IN NAVD 1988. THE 100 YEAR FLOOD ELEVATION IS 9.0 NAVD 1988 DATUM. THE 100 YEAR FLOOD ELEVATION CONVERTS INTO 4.2 CITY DATUM. THIS INFORMATION SUPPLIED BY WILLIAM ERICKSON (DEVELOPMENT PLANNER – PHILA. CITY PLANNING COMMISION & VERIFIED BY JOSEPH KELLEHER (PROFESSIONAL LAND SURVEYOR), DATED 9–11–03.

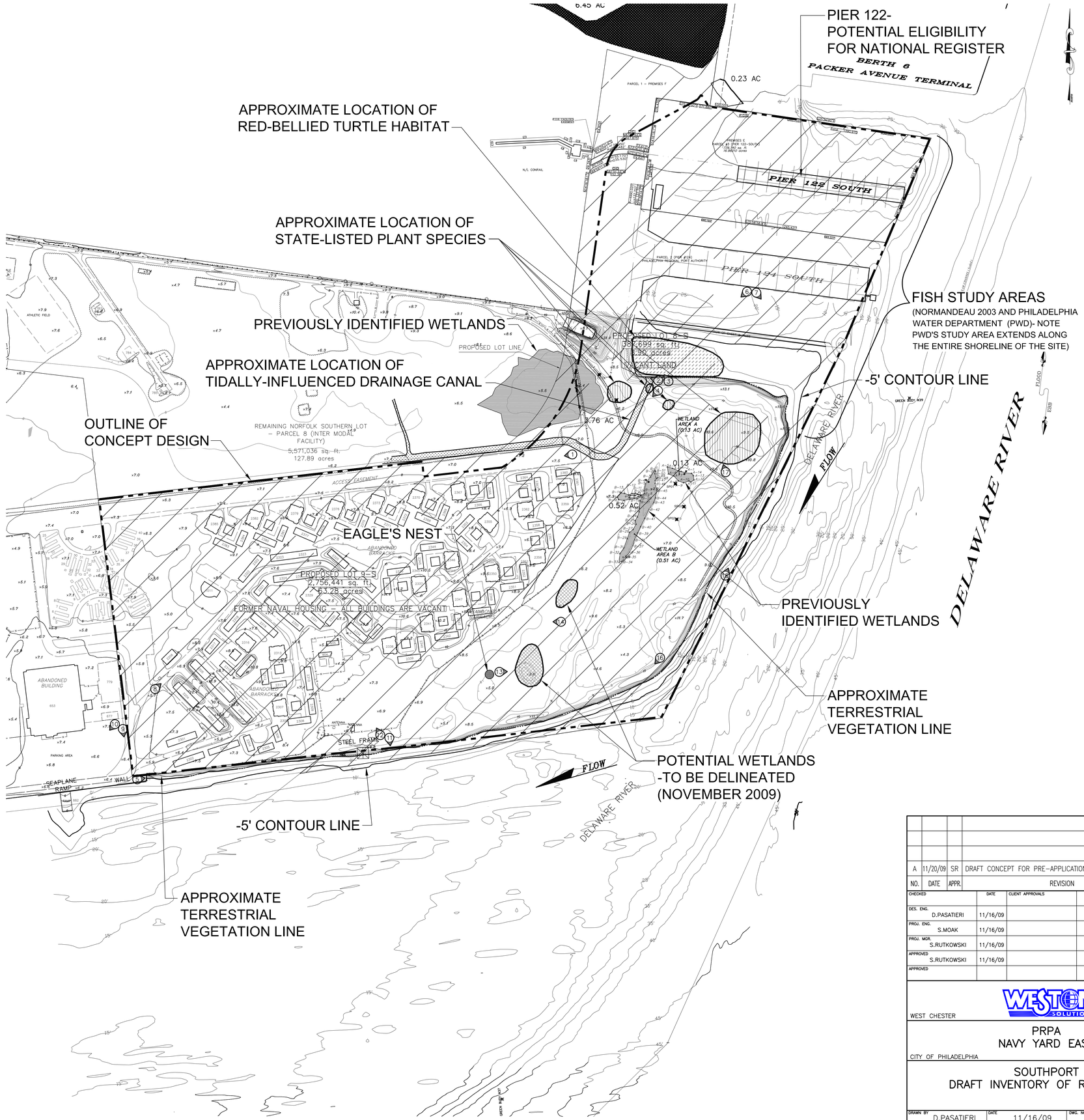
NOTES

- BASE PLAN FROM CUSHMAN & WAKEFIELD OF PA (1992) PNBC TOPOGRAPHY MAP.
- WETLAND DELINEATIONS WERE CONDUCTED IN 2005 AND 2007, BY SCHOOR DEPALMA, INC. AND A–TECH ENGINEERING.
- SITE BOUNDARY ESTIMATED FROM RFP AERIAL (2004).
- APPROXIMATE LOCATIONS OF POTENTIAL HABITATS AND RESOURCES WERE IDENTIFIED BY WESTON SOLUTIONS, INC. AND ARE BEING FURTHER DELINEATED AND/OR ASSESSED AS PART OF THE SOUTHPORT DESIGN AND PERMIT PROCESS.

LEGEND

FENCE
GUIDERAIL
SPOT ELEVATION ×7.8
TOWER
UTILITY POLE
WETLAND FLAG LOCATION
ROUTINE SAMPLE POINT G1
PHOTO LOCATION POINT 11
DENSE VEGETATION/ SHADOWS DENSE WOODS
BUILDING WITH NUMBER 5432
WOODS LINE
SHRUB/BRUSH AREA
INDEX CONTOUR WITH LABEL 10
INTERMEDIATE CONTOUR WITH LABEL 8 6
DRAINAGE
SITE BOUNDARY
TRAIL

200 0 200 400
SCALE: 1"=200'–0"



NO.	DATE	APPR.	REVISION
A	11/20/09	SR	DRAFT CONCEPT FOR PRE–APPLICATION PROCESS

CHECKED		DATE	CLIENT APPROVALS	DATE
DES. ENG.	D.PASATIERI	11/16/09		
PROJ. ENG.	S.MOAK	11/16/09		
PROJ. MGR.	S.RUTKOWSKI	11/16/09		
APPROVED	S.RUTKOWSKI	11/16/09		
APPROVED				

ENGINEER'S SEAL

WESTON SOLUTIONS
WEST CHESTER PENNSYLVANIA

PRPA
NAVY YARD EAST
CITY OF PHILADELPHIA PENNSYLVANIA

SOUTHPORT
DRAFT INVENTORY OF RESOURCES

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	11/16/09	1	A
SCALE 1"=200'–0"	W.O. NUMBER 14637.001.001.0003.07	SHEET 1 OF 1	

Filename: G:\ACAD\PROJ\12769006003 PRPA Southport\PDCX\inventory.dwg

PHOTO 1. View west along runway (Mustin Housing Complex can be seen to the left)

PHOTO 2. View west at inter-tidal area south of Pier 124.

PHOTO 3. View northwest at inter-tidal area south of Pier 124.

PHOTO 4. View southwest at drainage channel.

PHOTO 5. View east along southern edge of site.

PHOTO 6. View southwest from Pier 124.

PHOTO 7. View southeast from Pier 124.

PHOTO 8. View northeast into the Mustin Housing Complex.

PHOTO 9. View southwest to Delaware River (Mustin Housing Complex is on right).

PHOTO 10. View southwest to Delaware River (historic seaplane hangar on the right).

PHOTO 11. View south to Delaware River.

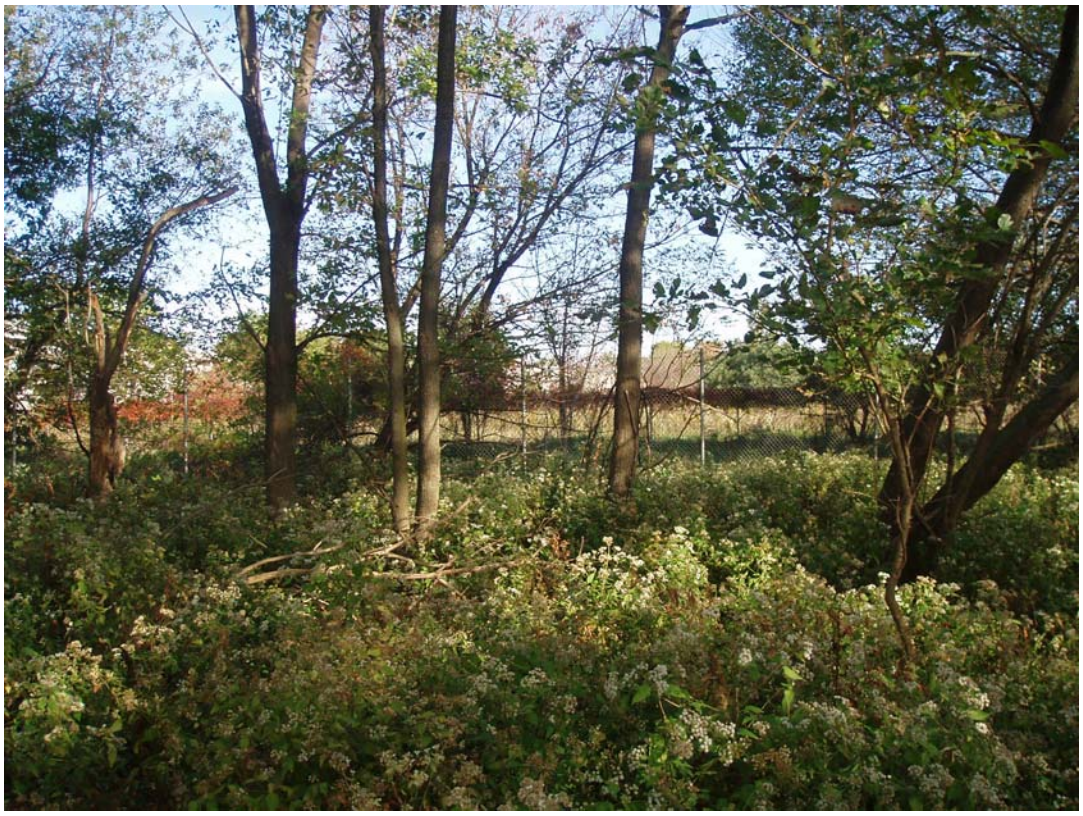


PHOTO 12. View north towards the Mustin Housing Complex.

PHOTO 13. View east from a location south of the Mustin Housing Complex.

PHOTO 14. View east from a location east of the Mustin Housing Complex.

PHOTO 15. View northeast along eastern shore of the site.

PHOTO 16. View southwest along the southern shore of the site.

PHOTO 17. View northwest at a location on the northern boundary of the site.

PENNSYLVANIA GAME COMMISSION CORRESPONDENCE

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

24 November 2009

Pennsylvania Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning
and Habitat Protection
2001 Elmerton Avenue
Harrisburgh, PA 17110-9797

Re: Pennsylvania Natural Diversity Inventory (PNDI) Environmental Resources Review
Proposed Development of Southport, Philadelphia, PA

Dear Sir or Madame:

The Southport project involves the development of a brand-new, approximately 175 acre marine container terminal in Philadelphia, PA. The Commonwealth of Pennsylvania has contracted WESTON Solutions, Inc. (WESTON) to address the environmental permitting for the project including the Federal National Environmental Policy Act (NEPA) permitting requirements (Section 404, Endangered Species Act, and USACE Jurisdictional Determination) and State permitting requirements (401 WQC, Coastal Zone Management Act, Section 106).

A PNDI search (Project Search ID 20090901208135) was conducted by WESTON for the site of the Southport development. The PNDI search resulted in potential impacts to sensitive species with your agency. WESTON requests that your agency review this PNDI for the presence of species of special concern or critical habitats on or near the site. Enclosed is a copy of the PNDI search conducted by WESTON.

Project Narrative

The Southport site extends along the Delaware River, from the east end of the Philadelphia Naval Yard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal (see attached USGS Philadelphia quadrangle). For over a decade, the site has been vacant and out-of use. Previous activity on the site includes industrial uses and various uses associated with the Naval Base (i.e. housing and runway). The development of Southport will involve assessment and mitigation of the various elements of large scale marine terminal design and construction, including but not limited to, new wharf construction, open-water fill (approximately 25 acres), and loading issues associated with heavy equipment.

At full build-out, Southport will have capacity for 1,000,000+ containers per annum, creating thousands of new, family-sustaining jobs and injecting substantial new business and tax revenue into the regional economy. It is expected that the development of Southport will be competitively bid among major shipping lines, terminal operators and infrastructure investors, with substantial, ongoing positive economic impact and return to the region. Further, for the second time this

decade, the Port of Philadelphia has been designated a Strategic Military Port by the US Surface Deployment and Distribution Command (SDDC). Additionally, the development of Southport is consistent with the region's economic initiatives to take advantage of increased cargoes resulting from widening of the Panama Canal.

The Commonwealth will be responsible for adhering to both the state and the federal aspects of the environmental permitting. Because of the likely impacts to waterways, the Commonwealth has engaged in preliminary conceptual discussions with the United States Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) Wildlife Service, and United States Fish and Wildlife Service (USFWS) from the Federal government as well as the New Jersey Department of Environmental Protection (NJDEP), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission (PAFBC), Pennsylvania Department of Conservation and Natural Resources (PA DCNR), and Pennsylvania Coastal Zone Management (PACZM) from the State government. In addition to the aforementioned federal and state agencies, the Commonwealth has also had discussions with the Delaware River Basin Commission (DRBC) regarding this project. Note that WESTON plans to conduct biological assessments (terrestrial threatened and endangered species, fish and benthic, herpetological) and wetland delineations assessments in support of this project.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information to complete your review, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
- USGS Quadrangle
- PNDI Review Receipt
- Site Location Figure
- Photolog

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
2001 ELMERTON AVENUE, HARRISBURG, PA 17110

"TO MANAGE ALL WILD BIRDS, MAMMALS AND THEIR HABITATS FOR CURRENT AND FUTURE GENERATIONS."

PNDI Number(s): 20090901208135

January 7, 2010

Ms. Shana Moak
Weston Solutions, Inc.
PO Box 2653
West Chester, PA 19380

PNDI Number**(s):** 20090901208135
Re: PRPA Southport Development (169.4-Acres)
City and County of Philadelphia, PA

Dear Ms. Moak:

Thank you for submitting the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 20090901208135 for review. The Pennsylvania Game Commission (PGC) screened this project for potential impacts to species and resources of concern under PGC responsibility, which includes birds and mammals only.

Potential Impact Anticipated

PNDI records indicate species or resources of concern maybe located in the vicinity of the project. The PGC has received and thoroughly reviewed the information that you provided to this office dated November 24, 2009, as well as PNDI data, and has determined that potential impacts to threatened, endangered or species of special concern may be associated with your project. Therefore, further coordination with this office is necessary to avoid potential impacts to the species listed below.

Scientific Name	Common Name	PA Status	Federal Status
Haliaeetus leucocephalus	Bald Eagle	THREATENED	UNLISTED

Next Steps

- ***A survey needs to be conducted several times between January 1st and March 1st 2010 to determine if there is an active bald eagle nest on the proposed project area. Please submit the survey results to the PGC Environmental Review Staff upon completion.***

In 2006, there was an active bald eagle nest on the proposed project area. One eaglet was fledged that year from the nest located at the following latitude and longitude: 39.889933 & 75.146278. In 2007, this previously active nest was abandoned (i.e. became inactive). In 2008 and again in 2009, the eagle nest was inactive. A survey needs to be conducted early during the 2010 breeding and nesting season to determine if the eagles have become active again on the proposed project area. The survey results will be used to determine whether the development of Southport will impact breeding and nesting bald eagles.

In addition to being protected under State law, the bald eagle is also protected under Federal law. The Bald and Golden Eagle Protection Act protects eagles from various forms of take, including disturbance. Please refer to the U.S. Fish and Wildlife Service's National Bald Eagle Management Guidelines (http://www.fws.gov/migratorybirds/baldeagle.htm) for specific measures that should be taken to ensure bald eagles are not disturbed. If you have questions about when and how to obtain a federal permit because you believe your proposed project will disturb bald eagles, and you are not able to implement measures to avoid disturbance, please contact the Fish and Wildlife Service's Migratory Bird Permit Program at 413-253-8643 or permitsr5mb@fws.gov.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. An absence of recorded information does not necessarily imply actual conditions on site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

This finding applies to impacts to birds and mammals only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure that the U.S. Fish and Wildlife Service, the PA Department of Conservation and Natural Resources, and/or the PA Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

James R. Leigey
Division of Environmental Planning & Habitat Protection
Bureau of Wildlife Habitat Management
Phone: 717-787-4250, Extension 3128
Fax: 717-787-6957
e-Mail: jleigey@state.pa.us

A PNHP Partner

Pennsylvania Natural Heritage Program

cc: File
Gross
Morgan
Tibbett, U.S. Fish & Wildlife Service

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
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23 April 2010

James R. Leigey
Pennsylvania Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning
and Habitat Protection
2001 Elmerton Avenue
Harrisburgh, PA 17110-9797

Re: Pennsylvania Natural Diversity Inventory (PNDI) Environmental Resources Review
Southport Development Project, Philadelphia, PA
PNDI Project Search ID: 20090901208135

Dear Mr. Leigey:

On 24 November 2009, Weston Solutions, Inc. (WESTON) submitted the results of a Pennsylvania Natural Diversity Index (PNDI) search for the proposed Southport development project to the office of the Pennsylvania Game Commission for review (see attached letter). On 7 January 2010, WESTON received a response letter from the PA Game Commission regarding the bald eagle nest known in the vicinity of the project site (see attached letter). This letter requested that several surveys be performed from 1 January 2010 to 1 March 2010 to determine if the bald eagle nest is active.

It is WESTON's understanding that the Commonwealth of Pennsylvania, the U.S. Fish and Wildlife Service, and the PA Game Commission have been working together for some time in connection with this bald eagle nest. WESTON understands that the Commonwealth of Pennsylvania engaged in regular site observation of the bald eagle nest and no current activity has been observed.

It is also worthy to note that the project footprint was downsized following WESTON's 24 November 2009 submission to your office. A copy of the new conceptual plan for the Southport site has been attached to this letter for your reference.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information to complete your review, please do not

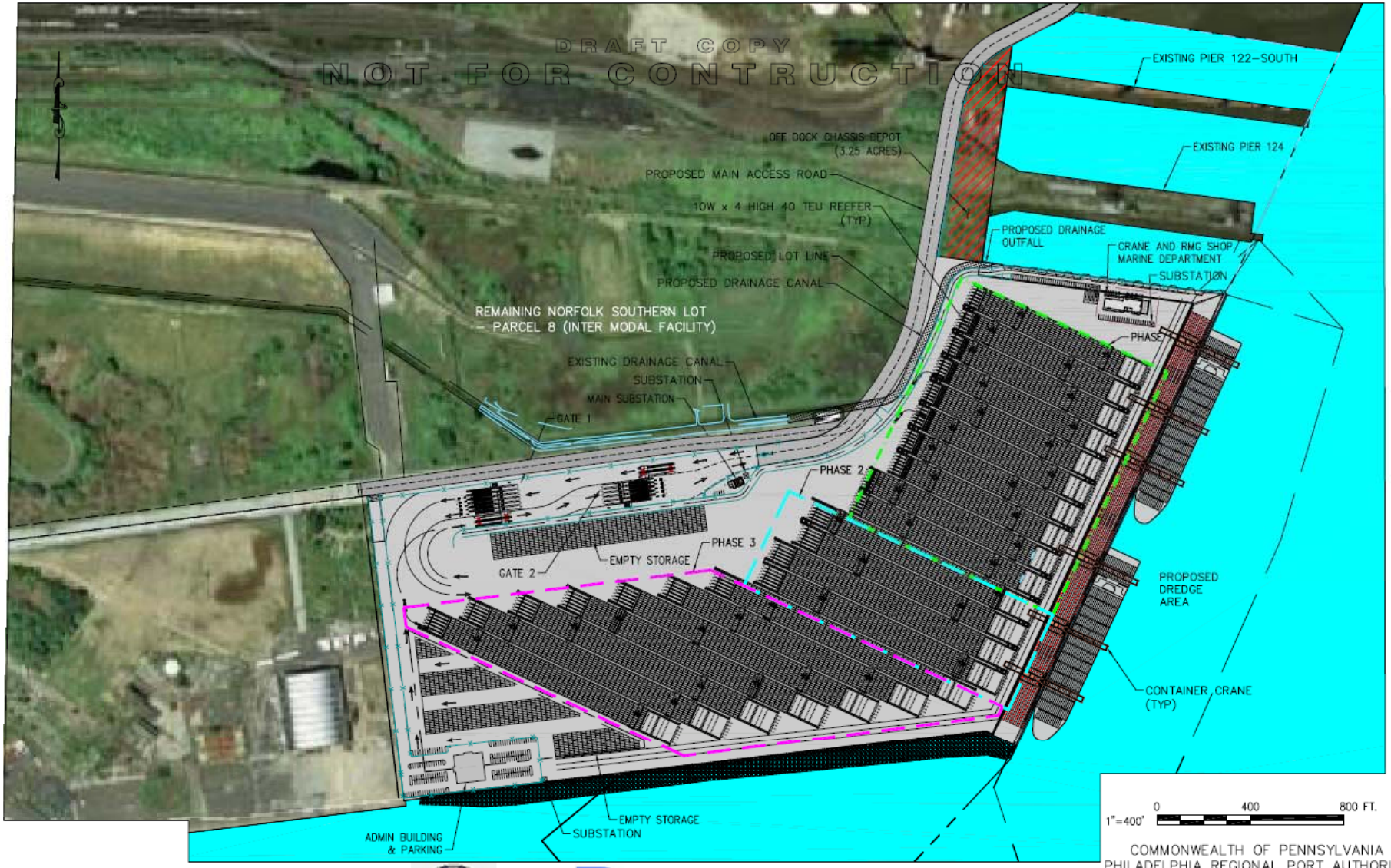
hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak
Project Scientist

Attachments
24 November 2009 Correspondence
PA Game Commission Response Letter
Conceptual Design



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COMMONWEALTH OF PENNSYLVANIA
PHILADELPHIA REGIONAL PORT AUTHORITY
PHILADELPHIA, PA
SOUTHPORT PROJECT

CONTAINER YARD
FINAL ARRANGEMENT LAYOUT

FIG 1

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COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
2001 ELMERTON AVENUE, HARRISBURG, PA 17110

"TO MANAGE ALL WILD BIRDS, MAMMALS AND THEIR HABITATS FOR CURRENT AND FUTURE GENERATIONS."

May 10, 2010 PNDI Number: 20090901208135

Shana Moak
Weston Solutions Inc.
P.O. Box 2653
West Chester, PA 19380

PNDI Number: 20090901208135
Re: Southport Development Project
City of Philadelphia, Philadelphia County, PA

Dear Ms. Moak,

Thank you for submitting the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 20090901208135 for review. The Pennsylvania Game Commission (PGC) screened this project for potential impacts to species and resources of concern under PGC responsibility, which includes birds and mammals only.

Potential Impact Anticipated

PNDI records indicate species or resources of concern are located in the vicinity of the project. The PGC has received and thoroughly reviewed the information that you provided to this office dated April 23, 2010, as well as PNDI data, and has determined that potential impacts to threatened, endangered or species of special concern may be associated with your project. Therefore, further coordination with this office is necessary to avoid potential impacts to the species listed below.

Scientific Name	Common Name	PA Status
Haliaeetus leucocephalus	Bald Eagle	THREATENED

Next Step

- The PGC understands that habitat mitigation is planned to compensate for the removal of bald eagle nest habitat from the development of the Southport project. Please provide the details of the Southport Bald Eagle Habitat Mitigation Plan to the PGC for review.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. An absence of recorded information does not necessarily

imply actual conditions on site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for an additional year.

This finding applies to impacts to birds and mammals only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure that the U.S. Fish and Wildlife Service, the PA Department of Conservation and Natural Resources, and/or the PA Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Tracey Librandi Mumma

Tracey Librandi Mumma
Division of Environmental Planning & Habitat Protection
Bureau of Wildlife Habitat Management
Phone: 717-787-4250, Extension 3614
Fax: 717-787-6957
E-mail:tlibrandi@state.pa.us

A PNHP Partner

PNHP
Pennsylvania Natural Heritage Program

TLM/tlm

cc: Jennifer Kagel, U.S. Fish & Wildlife Service
DuBrock
Brauning
Gross

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

29 June 2010

Tracey Librandi Mumma
Pennsylvania Game Commission
Division of Environmental Planning & Habitat Protection
Bureau of Wildlife Habitat Management
2001 Elmerton Avenue
Harrisburg, PA 17110

Re: Mustin Field Demolition, Philadelphia Navy Yard
PNDI Number: 20100126226096

Southport Development Project
PNDI Number: 20090901208135

Dear Ms. Mumma,

We are in receipt of your letters dated May 7 and May 10, 2010, in connection with the above-referenced projects. The letters indicate that further coordination with the Pennsylvania Game Commission is necessary to avoid potential impacts to bald eagles and lists the appropriate conservation measures to observe with respect to each project. Finally, your letters indicate that the bald eagle is protected under federal law and refers to the U.S. Fish and Wildlife Service's National Bald Eagle Management Guidelines.

Our client, the Commonwealth of Pennsylvania, is aware of the existence of an inactive bald eagle nest on the project site and has been working closely with the Pennsylvania Game Commission and the U.S. Fish and Wildlife Service. Extensive observation of the nest site was conducted by a wildlife biologist on behalf of the Commonwealth of Pennsylvania and an application is currently pending with the U.S. Fish and Wildlife Service for removal of the inactive nest and implementation of a plan that will result in a "net benefit" to the regional bald eagle population. A copy of the application was provided simultaneously to Carol Roe, Executive Director of the Pennsylvania Game Commission and, at Mr. Roe's request, to Jerry Czech, WCO Philadelphia and Doug Gross, PGC Endangered Species Biologist. Prior to submission of the application, the Commonwealth held a coordination meeting at the nest site that was attended by representatives of the Pennsylvania Game Commission and the U.S. Fish and Wildlife Service. You were invited to that meeting, but were unable to attend due to a scheduling conflict.

Pennsylvania Game Commission 29 June 2010
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection

Until a determination is made by the U.S. Fish and Wildlife Service with respect to the pending application, the Commonwealth will comply with the conservation measures detailed in your letters. Upon issuance of a determination, the Commonwealth will work closely with the Pennsylvania Game Commission and the U.S. Fish and Wildlife Service to implement the approved plan of action.

If you have any questions or require more information, please contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

cc. K. McNamara (Commonwealth)
L. Magee (PRPA)
E. Hicks (WESTON)
S. Rutkowski (WESTON)

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

5 October 2012

Tracey Mumma
Pennsylvania Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning
and Habitat Protection
2001 Elmerton Avenue
Harrisburg, PA 17110-9797

Re: Proposed Development of Southport, Philadelphia, PA

Dear Ms. Mumma

In July 2010, on behalf of the Commonwealth of Pennsylvania Department of General Services (PADGS) and the Philadelphia Regional Port Authority (PRPA), Weston Solutions, Inc. (WESTON®) submitted a Joint Permit Application to the Pennsylvania Department of Environmental Protection (PADEP) that included a Draft Environmental Assessment (EA) which details the affected environment and potential impacts resulting from the proposed Southport Marine Terminal Project (Southport). In support of the permitting process for this project, a Pennsylvania Natural Diversity Index (PNDI) search was performed for the Southport project site. A summary of the previous correspondence related to the PNDI search is presented below.

Southport Project Site

The original PNDI Search Receipt for this project was submitted to the Pennsylvania Game Commission (PGC) on 24 November 2009 (see Attachment 1). On 7 January 2010, WESTON received a letter from the PGC requesting a survey of the bald eagle nest to be conducted several times from January 1 to March 1 (see Attachment 2). On 23 April 2010, WESTON submitted information on the reduced project footprint to the PGC (see Attachment 3). On 10 May 2010, WESTON received a letter from the PGC requesting a copy of the mitigation plan for the bald eagle (see Attachment 4). And finally, on 29 June 2010, WESTON submitted a letter to the PGC that discussed the permit application that had been submitted to remove the nest from the project site (see Attachment 5).

Current Status of Project

As you are aware, the Commonwealth contracted Normandeau Environmental Consultants (Normandeau) to conduct site surveys to determine if the bald eagle was continuing to utilize the nest that was located in the vicinity of the project site. Normandeau submitted the results of these site surveys to you on a weekly basis. In addition, the Commonwealth has recently submitted a supplement to the "Take" permit to your office and to the U.S. Fish and Wildlife Service.

Pennsylvania Game Commission 5 October 2012
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection

Please review the enclosed materials regarding the proposed project and let WESTON know if any additional information will be needed to issue a response (clearance) letter for this project. Please note that the Commonwealth would follow the approach that was developed during the last nesting season with respect to monitoring and work limitations. If you have any questions concerning this request or need additional information, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@westonsolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

cc: L. Magee (PRPA)
G. Iannarelli (PRPA)
S. Rutkowski (WESTON)

COMMONWEALTH OF PENNSYLVANIA
Pennsylvania Game Commission

2001 ELMERTON AVENUE
HARRISBURG, PA 17110-9797

"To manage all wild birds, mammals and their habitats for current and future generations."

ADMINISTRATIVE BUREAUS:

ADMINISTRATION.....717-787-5670
HUMAN RESOURCES.....717-787-7836
FISCAL MANAGEMENT.....717-787-7314
CONTRACTS AND PROCUREMENT.....717-787-6594
LICENSING.....717-787-2084
OFFICE SERVICES.....717-787-2116
WILDLIFE MANAGEMENT.....717-787-5529
INFORMATION & EDUCATION.....717-787-6286
WILDLIFE PROTECTION.....717-783-6526
WILDLIFE HABITAT MANAGEMENT.....717-787-6818
REAL ESTATE DIVISION.....717-787-6568
AUTOMATED TECHNOLOGY SERVICES.....717-787-4076

www.pgc.state.pa.us

Division of Environmental Planning and Habitat Protection
717-783-5957

November 14, 2012 PNDI Number: 20120924373537

Shana Moak
Weston Solutions
1400 Weston Way
West Chester, Pennsylvania 19380

Re: PRPA-Southport – Proposed Southport Marine Terminal
City of Philadelphia, Philadelphia County, Pennsylvania

Dear Ms. Moak,

Thank you for submitting the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 20120924373537 for review. The Pennsylvania Game Commission (PGC) screened this project for potential impacts to species and resources of concern under PGC responsibility, which includes birds and mammals only.

No Impact Anticipated

The PGC identified a bald eagle nest within 1,000 feet of the project area during a 2010 review of the project. The PGC requested that a bald eagle survey be completed several times during the nesting season to determine if the nest was active. However, on April 23, 2010, the PGC received revised plans showing that the project footprint had been reduced. After discussions between the PGC and the project proponent, it was determined that bald eagle nest habitat would still be lost as a result of this project. Therefore, on May 10, 2010, the PGC requested a copy of the Southport Bald Eagle Habitat Management Plan for review. In response, the PGC was notified on June 29, 2010 that the project proponent had submitted an application to the United States Fish and Wildlife Service (USFWS) to remove the bald eagle nest from the project site. Since that time, the USFWS and PGC have been reviewing the application and several site visits have been completed by determine suitable a mitigation strategy. As the permitting process continued, supplemental information relating to the 2010 permit application was provided to the USFWS on September 27, 2012 and to the PGC on October 23, 2012. During the review of this addendum, the USFWS requested clarification of whether the nest still was present as previous monitoring efforts reported that it was in disrepair.

On November 6, 2012, Normandeau Associates (the project consultant) provided the *Statement of fact concerning the presence of an eagle nest at the east end of the Philadelphia Navy Yard* report to the USFWS and PGC. This report summarized that the bald eagle nest was last active

during the 2008 nesting season and as of November 2, 2012, it had fallen completely out of the tree. Based on the fact that the nest had been inactive since 2009, that the breeding pair had not attempted to rebuild or repair this nest between 2009 and 2012, and that the nest is no longer present, on November 7, 2012, the USFWS determined that the project, including removal of the former nest tree, can move forward without a permit from USFWS under the Bald and Golden Eagle Protection Act. On November 8, 2010, the PGC responded that they concurred with the USFWS determination and that the project may move forward without further restrictions for bald eagles. However, the PGC requests that if eagles are seen using the area or attempting to rebuild the nest, the PGC should be notified and this determination may be revisited.

This response represents the most up-to-date summary of the PNDI data files and is valid for two (2) years from the date of this letter. An absence of recorded information does not necessarily imply actual conditions on site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for two additional years.

This finding applies to impacts to birds and mammals only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure that the U.S. Fish and Wildlife Service, the PA Department of Conservation and Natural Resources, and/or the PA Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Olivia A. Mowery
Environmental Planner
Division of Environmental Planning & Habitat Protection
Bureau of Wildlife Habitat Management
Phone: 717-787-4250, Extension 3128
Fax: 717-787-6957
E-mail:OMowery@pa.gov

A PNHP Partner

PNHP
Pennsylvania Natural Heritage Program

OAM/oam

cc: Jennifer Siani, U.S. Fish & Wildlife Service
Librandi Mumma
DuBrock
Brauning
Gross
Barber
File

PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES (DCNR) CORRESPONDENCE

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

24 November 2009

Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Pennsylvania Natural Diversity Inventory (PNDI) Environmental Resources Review
Proposed Development of Southport, Philadelphia, PA

Dear Sir or Madame:

The Southport project involves the development of a brand-new, approximately 175 acre marine container terminal in Philadelphia, PA. The Commonwealth of Pennsylvania has contracted WESTON Solutions, Inc. (WESTON) to address the environmental permitting for the project including the Federal National Environmental Policy Act (NEPA) permitting requirements (Section 404, Endangered Species Act, and USACE Jurisdictional Determination) and State permitting requirements (401 WQC, Coastal Zone Management Act, Section 106).

A PNDI search (Project Search ID 20090901208135) was conducted by WESTON for the Southport development site. The PNDI search resulted in four potential impacts with your agency. The species listed included *Cuscuta pentagona*, *Juncus dichotomus*, *Lycopus rubellus*, and *Panicum scoparium*. WESTON requests that your agency review this PNDI for the presence of additional species of special concern or critical habitats on or near the site. Enclosed is a copy of the PNDI search conducted by WESTON.

Project Narrative

The Southport site extends along the Delaware River, from the east end of the Philadelphia Naval Yard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal (see attached USGS Philadelphia quadrangle). For over a decade, the site has been vacant and out-of use. Previous activity on the site includes industrial uses and various uses associated with the Naval Base (i.e. housing and runway). The development of Southport will involve assessment and mitigation of the various elements of large scale marine terminal design and construction, including but not limited to, new wharf construction, open-water fill (approximately 25 acres), and loading issues associated with heavy equipment.

At full build-out, Southport will have capacity for 1,000,000+ containers per annum, creating thousands of new, family-sustaining jobs and injecting substantial new business and tax revenue into the regional economy. It is expected that the development of Southport will be competitively

bid among major shipping lines, terminal operators and infrastructure investors, with substantial, ongoing positive economic impact and return to the region. Further, for the second time this decade, the Port of Philadelphia has been designated a Strategic Military Port by the US Surface Deployment and Distribution Command (SDDC). Additionally, the development of Southport is consistent with the region's economic initiatives to take advantage of increased cargoes resulting from widening of the Panama Canal.

The Commonwealth will be responsible for adhering to both the state and the federal aspects of the environmental permitting. Because of the likely impacts to waterways, the Commonwealth has engaged in preliminary conceptual discussions with the United States Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) Wildlife Service, and United States Fish and Wildlife Service (USFWS) from the Federal government as well as the New Jersey Department of Environmental Protection (NJDEP), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission (PAFBC), Pennsylvania Department of Conservation and Natural Resources (PA DCNR), and Pennsylvania Coastal Zone Management (PACZM) from the State government. In addition to the aforementioned federal and state agencies, the Commonwealth has also had discussions with the Delaware River Basin Commission (DRBC) regarding this project. Note that WESTON plans to conduct biological assessments (terrestrial threatened and endangered species, fish and benthic, herpetological) and wetland delineations assessments in support of this project.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information to complete your review, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
- USGS Quadrangle
- PNDI Review Receipt
- Site Location Figure
- Photolog

SM 12-10 153

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

BUREAU OF FORESTRY

December 10, 2009

PNDI Number: 20090901208135

Shana Moak
Weston Solutions
FAX: 610-701-3401 (hard copy WILL NOT follow)

Re: Proposed Development of Southport
City of Philadelphia.; Philadelphia County

Dear Shana,

Thank you for submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 20090901208135 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

POTENTIAL IMPACT ANTICIPATED:

PNDI records indicate species or resources of concern are located **within the project area**. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

DCNR requests a survey for the following species:

***Cuscuta pentagona* (Field dodder) Currently unlisted, Proposed PA Threatened:** Found in open woods old fields, thickets and wet banks, parasitic on many hosts; flowering from June to September, fruiting from July to October. **Please have your botanist contact Dr. Ann Rhoads at the Morris Arboretum to coordinate in identifying any *Cuscuta* found on site to the species level.** This species was last found in 2007 growing on *Artemsia vulgaris* on a lower slope along the Delaware River, in a strip of successional old field just inland from the narrow riparian woodland along the bank.

***Lycopus rubellus* (Bugleweed) PA Endangered:** Found in bogs, river banks, pond margins and wet ditches; flowering from June to early September. This species was last found in 2007 along the Delaware River shore growing predominantly in crevices at the bases of trees (mostly *Liriodendron tulipifera)* along the high-water line, in disturbed habitat along the river bank which consisted of a great deal of rubble, masonry debris and alluvium.

***Panicum scoparium* (Velvety panic-grass) PA Endangered:** Found in moist meadows and swales; vernal terminal panicles appear from May to early July. This species was last found in 1991 in the Eastern half of the complex, in flat, open-lighted moist areas.

PNDI records indicate species or resources of concern are located **in the vicinity of the project**. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

DCNR requests a survey for the following species:

***Echinochloa walteri* (Walter's barnyard grass) PA Endangered:** Found in tidal marshes and mudflats; survey from August to September.

***Heteranthera multiflora* (Multi-flowered mud plantain) PA Endangered:** Found on tidal shores and mudflats; flowering from July to early August.

***Juncus dichotomus* (Forked rush) PA Endangered:** Found in moist, sandy, old fields, open woods and gravel pits; flowering and fruiting in Summer.

- A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. Your botanist should *fill out the field survey form while performing their survey*: http://www.naturalheritage.state.pa.us/ InternetFieldSurveyForm.pdf. Your botanist may contact our office prior to the survey for detailed information about the species location(s) within the project area. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.

PNDI Number: 20090901208135

- Any target or non-target state-listed species found during the site visit should be reported. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.

- If the land type(s) does not exist onsite a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types and species found onsite.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. An absence of recorded information does not necessarily imply actual conditions on-site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for an additional year.

This finding applies to impacts to DCNR only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure the U.S. Fish and Wildlife Service, PA Game Commission, and the Pennsylvania Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Mr. Kelly L. Sitch, Environmental Review Specialist FOR Chris Firestone, Wild Plant Program Mgr.
Ph: 717-425-5370 ~ Fax: 717-772-0271 ~ c-ksitch@state.pa.us

BOTANICAL SURVEY REQUIREMENTS for DCNR SPECIES OF SPECIAL CONCERN

This informational sheet has been designed to inform the applicant of all necessary requirements in a botanical survey and survey report. This sheet includes what to send us in your survey report and guidelines on how to conduct a survey for DCNR Species of Special Concern. Please follow these guidelines (or have your botanist follow these guidelines) when surveying and submitting the report. Due to limited time constraints please make sure you have completed the survey properly and that the survey report is complete. If the survey report is incomplete or the survey has not been completed properly, DCNR Bureau of Forestry Ecological Services will request additional information or project area be re-surveyed, resulting in a loss of time for the project.

Guidelines for Conducting Surveys for Species Related to Environmental Reviews

The surveys must include an evaluation of all habitats within the proposed project area, or the portions indicated by BOF needing evaluation. Surveys are to be conducted during the period when the phenology of the target species allows for identification (preferred) – or, if the survey is conducted at some other time, it must be followed up by a survey at the appropriate time of year if the presence of the target species cannot be ruled out on the basis of lack of suitable habitat.

Documentation of the survey should include PNDI survey forms, including a Botanical Field Survey Form for each Plant of Special Concern in Pennsylvania species encountered, whether or not the species is on the target list. These forms must include the following:

- ☐ Brief descriptions of all major habitat types encountered.
- ☐ A reasonably complete list of the plants for any areas that represent potential habitat for the target species.

In addition, voucher specimens should be collected according to the Vascular Plant Technical Committee guidelines for the following:

- ☐ Species that cannot be positively identified by the surveyor in the field.
- ☐ Species closely related to and/or easily confused with the target species.
- ☐ A permit is required for collection.
- ☐ When a species of special concern is found onsite.

Permits

In order to possess plants or parts of plants classified as Pennsylvania Endangered (PE) or Pennsylvania Threatened (PT) a botanist must have in possession a Wild Plant Management Permit. This annual permit is available from DCNR, Bureau of Forestry, Chris Firestone, Wild Plant Program Manager, P.O. Box 8552, Harrisburg, PA 17105, (717) 783-3227.

Survey Report Checklist (Survey reports MUST include the following):

- ☐ Completed Botanical Field Survey Forms, available at http://www.naturalheritage.state.pa.us/InternetFieldSurveyForm.pdf. This method standardizes information and, if species were found, is able to be input in the Pennsylvania Natural Heritage Program database.
- ☐ Narrative describing in detail how the survey was completed. Explain methods and techniques used.
- ☐ Map showing area surveyed. This is necessary for us to be able to see where the project area/disturbance area is and where the botanist surveyed. If the disturbance area was not surveyed, DCNR will ask for a new survey including area to be disturbed.
- ☐ Inventory list of all plants & trees found in project area. The botanist should keep a running tally of all species encountered during survey and include in report.
- ☐ If species of special concern are found onsite:
  - o Document location on a map. Overlay the location of the species with site plans (if applicable) to show limits of disturbance and proximity to species' location.
  - o Include on map numbers of individuals or populations found, GPS locations of populations and delineate limits of populations.
  - o Estimate number of individuals in populations.
  - o Delineate the immediate potential habitat for the species.
  - o A voucher specimen should be collected.
  - o Photos of specimens and habitats found onsite, showing diagnostic characteristics
- ☐ Botanist resume, credentials or experience.

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County	Quad
Survey Date/s	Surveyor
Amount of time spent surveying area	
Name of site owner	
Directions to site	
GPS (decimal degrees preferred) approximate center point of site	
Scientific name/s of target species	
Site habitat description	
Substrate/soil type	
System: Terrestrial Palustrine Estuarine	
Community Description (describe below)	

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous			
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (**http://www.naturalheritage.state.pa.us/PlantsPage.aspx**) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Identification problems? If yes, explain.
References used (flora, experts, herbaria, etc.)
Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.
Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

Ambiguous directions	Disturbances	Exotics	Habitat destroyed
____ Time of year	____ Unsuitable habitat	____ Weather	____ Insufficiently/incompletely surveyed

Elements may have never occurred here – 1st time area searched

Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC

GPS coordinates (decimal degrees preferred)

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	Flat	Open	Crest	____ Inundated (hydric)	Min
E	0-10%	Partial	Upper slope		Max
S	10-35%	Filtered	Mid-slope	____ Saturated (wet-mesic)	
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	____ Moist (mesic)	
NW					
SE				____ Dry (mesic)	
SW					
None				Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf	1-10		1 YD 2	Annuals	Very feeble
In bud	11-50		1-5 YD 2	% Seedlings	Feeble
In flower	51-100		5-10 YD 2	% Immature	Normal
Immature fruit	101-1000		10-100 YD 2	% 1st year	Vigorous
Mature fruit	1001-10K		100 YD 2 – 2 AC	% Mature	Exceptional vigor
Seed dispersing	10K+		2+ ACRES	% Senescent	
	EST #		EST AREA		

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known)
Age, successional stage of system
____ Known or ____ Inferred land use history
Chemical treatment (known or suspected) with herbicides, pesticides, other
Other anthropogenic or unnatural disturbance
Integrity/fragmentation of community
List of invasive species (alien or native)
Threats (on-site)
Threats (off-site)
List other members of this genus that occur on site. Hybridization?
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

26 February 2010

Joy VanDervort Sneed
Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Pennsylvania Natural Diversity Inventory (PNDI) Number 20090901208135
Proposed Development of Southport, Philadelphia, PA

Dear Ms. VanDervort Sneed:

On 24 November 2009, WESTON submitted the results of a Pennsylvania Natural Diversity Index (PNDI) search for the proposed Southport project to the office of the Pennsylvania Department of Conservation and Natural Resources for review. On 10 December 2009, WESTON received, via fax, a response letter from the PA DCNR listing the potential impacts to species within the project area and in the vicinity of the project area (see attached letter). The PA DCNR requested a survey for the following species which are known to occur within the project area [*Cuscuta pentagona* (field dodder), *Lycopus rubellus* (bugleweed), and *Panicum scoparium* (velvety panic-grass)], and species which are located in the vicinity of the project area [*Echinochloa walteri* (Walter's barnyard grass), *Heteranthera multiflora* (multi-flowered mud plantain), and *Juncus dichotomus* (forked rush).

WESTON's subcontractor, Joseph Arsenault, completed surveys of the site on 6 and 14 October 2009, and 19 November 2009. Mr. Arsenault compiled the results of each site visit into one package entitled "Botanical Survey Results" (December 2009). This package is enclosed with for your review. Please note that the six (6) species called out in PA DCNR's 10 December 2010 fax are addressed in this document.

It is worthy to note that the project footprint was downsized following WESTON's 24 November 2009 submission to your office. A copy of the new conceptual plan for the Southport site has been attached to this letter for your reference.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

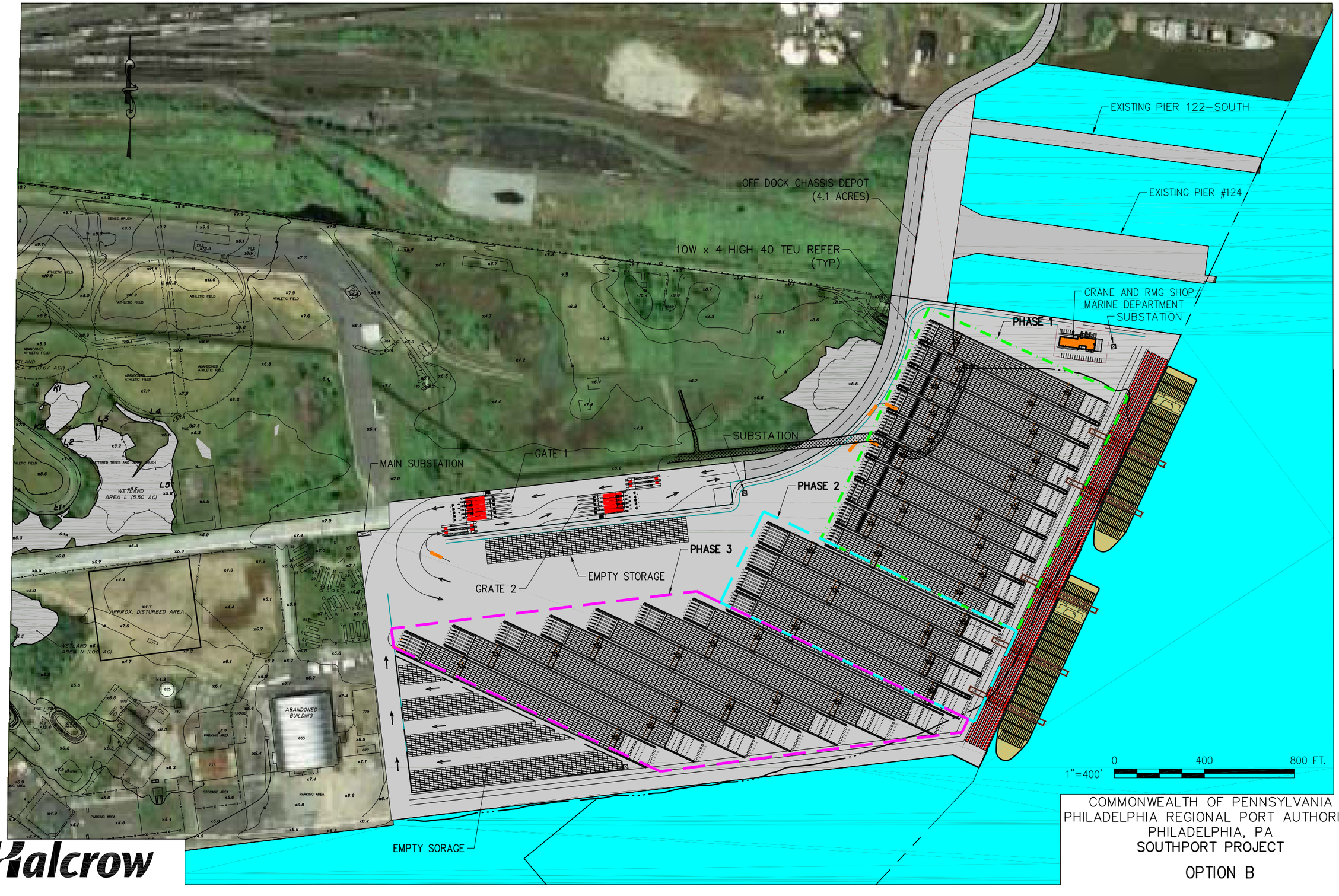
Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
PA DCNR 12/10/09 letter
Botanical Survey Results
Conceptual Design



COMMONWEALTH OF PENNSYLVANIA
PHILADELPHIA REGIONAL PORT AUTHORITY
PHILADELPHIA, PA
SOUTHPORT PROJECT

OPTION B

Halcrow

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pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 30, 2010 **PNDI Numbers:20090901208135**

Shana Moak
Weston Solutions, Inc.
E-mail: Shana.moak@westonsolutions.com (hard copy will NOT follow)
C.C.: Sonny Rutkowski, Sonny.Rutkowski@WestonSolutions.com

Re: Philadelphia Navy Yard, SouthPort project
Philadelphia Township, Philadelphia County,

Dear Mrs. Moak,

Thank you for submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Numbers **20090901208135** for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

Potential Impacts Anticipated

PNDI records indicated species or resources of concern were located in the vicinity of the project which led DCNR to request a survey. Four species of special concern were found on the SouthPort Navy Yard site during the surveys performed by Joseph Arsenault in 2009. The species found on the SouthPort Navy Yard site included *Dichanthelium scoparium*, *Lycopus rubellus*, *Cuscuta pentagona* and *Juncus dichotomus*. DCNR has determined that impact to these species of special concern is anticipated with the development of the SouthPort project.

Next Steps

Mitigation and Monitoring:
It is our understanding that Weston Solutions plans to mitigate for the loss of tidal wetlands by replacing in kind and therefore, we believe that *Lycopus rubellus* (bugleweed), which uses shoreline habitat, can be mitigated in that process. We anticipate receiving more information on the mitigation sites and the proposed mitigation.

Cuscuta pentagona (field dodder), *Panicum scoparium* (velvety panic-grass) and *Juncus dichotomus* (forked rush), will need additional mitigation efforts since they are upland species and will not benefit from the tidal wetland mitigation. Based on the biology of these three species we recommend the collection of seed material from the individuals found on the SouthPort Navy Yard site. Transplanting plant species is rarely an effective preservation method and thus would not be suggested for this project. However, the three upland plant species found at the SouthPort site are early successional or annual and thus the collection of ripe seed and the planting of that seed in suitable habitat may facilitate better protection of the species. Therefore, we recommend that a qualified botanist visit the SouthPort site during the summer and early fall to collect all of the available seeds from *Cuscuta pentagona* (field dodder), *Panicum scoparium* (velvety panic-grass) and *Juncus dichotomus* (forked rush). We recommend

that your botanist visit the site in 2010 and 2011 prior to the start of construction to collect as much seed as possible. Once the seed is collected it should be spread at an early successional site that has been approved by our office. Ideally the location will currently have these species known on site and is therefore proven suitable habitat, or the location can be verified as suitable habitat by our office.

Because habitat for plant species of concern is also going to be taken, we request that Weston Solutions conserve suitable habitat either through the purchase and protection of suitable habitat, or by enhancing other protected sites that have exotic invasive plant species that are reducing the size and occurrence of the existing suitable habitat. This protection and enhancement may be done at the site where the seeds are planted, or at another agreed upon location.

Monitoring of the seed dispersal site and the intertidal wetland site should be conducted once a year for five years to determine if the re-location of the plant species of concern was successful. Monitoring reports may lead to suggestions for management of other populations of these species. Please know that your information and input will be put to good use.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for an additional year.

This finding applies to impacts to DCNR only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure the U.S. Fish and Wildlife Service, PA Game Commission, and the Pennsylvania Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Joy VanDervort-Sneed, Environmental Review Manager FOR Chris Firestone, Wild Plant Program Mgr.
Ph: 717-705-2822 ~ F: 717-772-0271 ~ c-jvanderv@state.pa.us

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

5 October 2012

Deb Fisler
Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Proposed Development of Southport, Philadelphia, PA

Dear Ms. Fisler:

On behalf of the Commonwealth of Pennsylvania Department of General Services (PADGS) and the Philadelphia Regional Port Authority (PRPA), Weston Solutions, Inc. (WESTON®) prepared a Draft Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) which details the affected environment and potential impacts resulting from the proposed Southport Marine Terminal Project (Southport). This EA includes a Conceptual Mitigation Plan to identify a mitigation site and conceptual habitat design for the applicable impacts which could not be avoided or minimized.

In support of the permitting process for this project, Pennsylvania Natural Diversity Index (PNDI) searches were performed for the Southport project site and the proposed mitigation site (Jack's Marina). A summary of the previous correspondence related to the PNDI searches for each site are presented below.

Southport Project Site

The first PNDI Search Receipt for Southport was submitted to the PA Department of Conservation and Natural Resources (DCNR) on 24 November 2009 (see Attachment 1). In a letter dated 10 December 2009 (see Attachment 2), Kelly Sitch of your office responded to this November 2009 submittal with a request to perform surveys for specific species of concern. On 26 February 2010, WESTON submitted correspondence addressed to Joy Van Dervort-Sneed which included the results of requested botanical surveys on a reduced project footprint (see Attachment 3).

On 30 March 2010, DCNR requested mitigation and monitoring for four (4) species or resources of concern identified during the botanical surveys detailed in the 26 February 2010 letter (Attachment 4). And finally, after learning the Joint Permit Application and supporting documents submitted on 16 July 2010 to the USACE, PADEP, and federal and state resource agencies, including DCNR, had not yet been received by the environmental reviewer (i.e. Ms. Emilee Boyer), WESTON submitted the DRAFT EA to Ms. Emilee Boyer on 1 February 2011 (see Attachment 5). Shortly after the submittal in February 2011, the project was delayed due to the acquisition of the real estate taking longer than expected, and no additional correspondence was sent to the DCNR or received by the DCNR.

Mitigation Site

On 24 February 2011, WESTON submitted a PNDI Search Receipt for the proposed mitigation site, Jack's Marina (see Attachment 6). As stated above, shortly after this submittal, PADGS put the project on hold and no additional correspondence was sent to the DCNR.

Current Status of Project

On a recent telephone call, WESTON notified DCNR that efforts to complete the permitting for the Southport project have begun again and PADGS, PRPA, and WESTON are interested in the status of the clearance letters for this project and when they can be expected. During this call WESTON was informed that the DCNR is assigning a new environmental reviewer to this project. In order to assist the new environmental reviewer, DCNR requested that WESTON re-submit background information on the project and the documents previously submitted for the original PNDI review since the documents originally submitted by WESTON are not available to the new reviewer.

In order to facilitate the completion of your review for this project and hopefully expedite DCNR's decision process for issuance of clearance letters, we are providing all pertinent background information. Please find enclosed two CDs that each contain the previous PNDI correspondence, current PNDI Search Receipt for the Southport project site and the mitigation site. Also included are the Draft Final EA and Draft Mitigation Plan for this project (revised September 2012) to address comments on the application from resource agencies and the public (response to comments also included).

WESTON requests that these documents be forwarded to the new environmental reviewer at DCNR. Once this reviewer is identified, WESTON would appreciate DCNR providing us the contact information of the new reviewer so that we can correspond with this individual directly.

Please review the enclosed materials regarding the proposed Southport Marine Terminal Project. If you have any questions concerning this request or need additional information, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@westonsolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

cc: L. Magee (PRPA)
G. Iannarelli (PRPA)
S. Rutkowski (WESTON)
R. Wagoner (DCNR)

ATTACHMENT 1

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

24 November 2009

Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Pennsylvania Natural Diversity Inventory (PNDI) Environmental Resources Review
Proposed Development of Southport, Philadelphia, PA

Dear Sir or Madame:

The Southport project involves the development of a brand-new, approximately 175 acre marine container terminal in Philadelphia, PA. The Commonwealth of Pennsylvania has contracted WESTON Solutions, Inc. (WESTON) to address the environmental permitting for the project including the Federal National Environmental Policy Act (NEPA) permitting requirements (Section 404, Endangered Species Act, and USACE Jurisdictional Determination) and State permitting requirements (401 WQC, Coastal Zone Management Act, Section 106).

A PNDI search (Project Search ID 20090901208135) was conducted by WESTON for the Southport development site. The PNDI search resulted in four potential impacts with your agency. The species listed included *Cuscuta pentagona*, *Juncus dichotomus*, *Lycopus rubellus*, and *Panicum scoparium*. WESTON requests that your agency review this PNDI for the presence of additional species of special concern or critical habitats on or near the site. Enclosed is a copy of the PNDI search conducted by WESTON.

Project Narrative

The Southport site extends along the Delaware River, from the east end of the Philadelphia Naval Yard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal (see attached USGS Philadelphia quadrangle). For over a decade, the site has been vacant and out-of use. Previous activity on the site includes industrial uses and various uses associated with the Naval Base (i.e. housing and runway). The development of Southport will involve assessment and mitigation of the various elements of large scale marine terminal design and construction, including but not limited to, new wharf construction, open-water fill (approximately 25 acres), and loading issues associated with heavy equipment.

At full build-out, Southport will have capacity for 1,000,000+ containers per annum, creating thousands of new, family-sustaining jobs and injecting substantial new business and tax revenue into the regional economy. It is expected that the development of Southport will be competitively

bid among major shipping lines, terminal operators and infrastructure investors, with substantial, ongoing positive economic impact and return to the region. Further, for the second time this decade, the Port of Philadelphia has been designated a Strategic Military Port by the US Surface Deployment and Distribution Command (SDDC). Additionally, the development of Southport is consistent with the region's economic initiatives to take advantage of increased cargoes resulting from widening of the Panama Canal.

The Commonwealth will be responsible for adhering to both the state and the federal aspects of the environmental permitting. Because of the likely impacts to waterways, the Commonwealth has engaged in preliminary conceptual discussions with the United States Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) Wildlife Service, and United States Fish and Wildlife Service (USFWS) from the Federal government as well as the New Jersey Department of Environmental Protection (NJDEP), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission (PAFBC), Pennsylvania Department of Conservation and Natural Resources (PA DCNR), and Pennsylvania Coastal Zone Management (PACZM) from the State government. In addition to the aforementioned federal and state agencies, the Commonwealth has also had discussions with the Delaware River Basin Commission (DRBC) regarding this project. Note that WESTON plans to conduct biological assessments (terrestrial threatened and endangered species, fish and benthic, herpetological) and wetland delineations assessments in support of this project.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information to complete your review, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

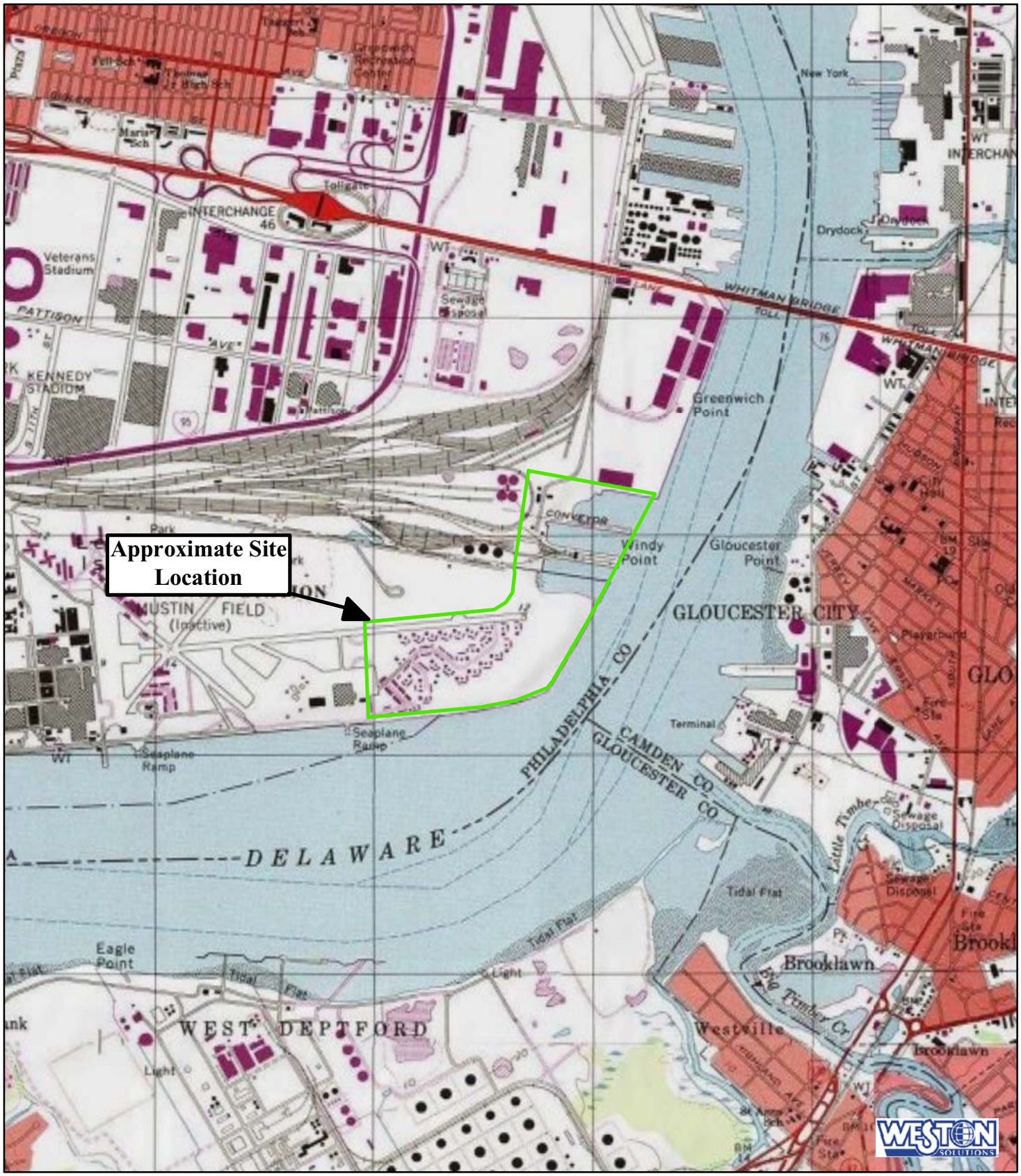
Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
- USGS Quadrangle
- PNDI Review Receipt
- Site Location Figure
- Photolog



Legend

Southport

SOURCE: USGS 7.5 Minute Series
(Topographic) Quadrangle:
Philadelphia PA, 1986, Camden NJ, 1985

N
W E
S

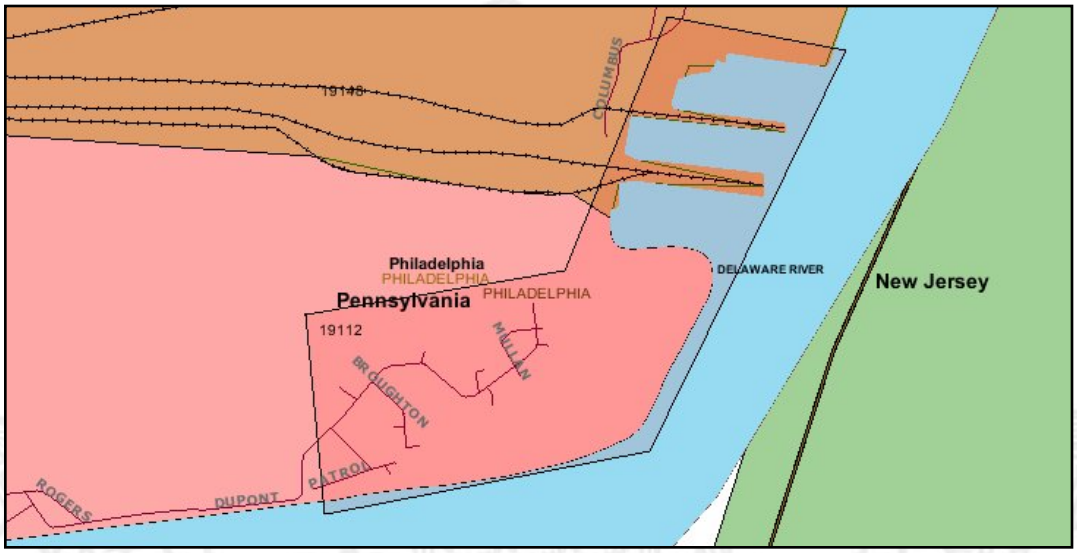
0 1,000 2,000
Feet

Figure 1
USGS Quad
Philadelphia Regional Port Authority
Southport
Philadelphia, Pa

File: \\fsfed01\tig\naval_yard\mxd\southport\USGS_quad_siteloc.mxd, 13-Nov-09 10:37, curtisf

1. PROJECT INFORMATION

Project Name: **PRPA Southport**
Date of review: **9/1/2009 8:55:33 AM**
Project Category: **In-stream / Riverine Activities and Projects,Dock**
Project Area: **169.4** acres
County: **Philadelphia** Township/Municipality: **Philadelphia**
Quadrangle Name: **PHILADELPHIA**
ZIP Code: **19148,19112**
Decimal Degrees: **39.88812 N, --75.15126 W**
Degrees Minutes Seconds: **39° 53' 17.2" N, -75° 9' 4.6" W**



2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Department of Conservation and Natural Resources	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

RESPONSE TO QUESTION(S) ASKED

Q1: "Will any and all on-land (non-aquatic) disturbance occur in or on an existing building, parking lot, driveway, road, road shoulder, street, runway, paved area, railroad bed, maintained (periodically mown) lawn, crop agriculture field or maintained orchard?"
Your answer is: **2. No**

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for one year** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt.

PA Game Commission

PGC Species:
Scientific Name: Sensitive Species**
Common Name:
Current Status: Threatened
Proposed Status: Threatened

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PA Department of Conservation and Natural Resources

DCNR Species:
Scientific Name: Cuscuta pentagona
Common Name: Field Dodder
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Juncus dichotomus
Common Name: Forked Rush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Lycopus rubellus
Common Name: Bugleweed
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Panicum scoparium
Common Name: Velvety Panic-grass
Current Status: Endangered
Proposed Status: Endangered

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PA Fish and Boat Commission

PFBC Species:
Scientific Name: Sensitive Species**
Common Name:
Current Status: Threatened
Proposed Status: Special Concern Species*

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

U.S. Fish and Wildlife Service

RESPONSE: No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be preformed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams
____The DEP permit(s) required for this project

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. For cases where a "Potential Impact" to threatened and endangered species has been identified before the application has been submitted to DEP, the application should not be submitted until the impact has been resolved. For cases where "Potential Impact" to special concern species and resources has been identified before the application has been submitted, the application should be submitted to DEP along with the PNDI receipt, a completed PNDI form and a USGS 7.5 minute quadrangle map with the project boundaries delineated on the map. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. DEP and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at http://www.naturalheritage.state.pa.us.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service
Endangered Species Section
315 South Allen Street, Suite 322, State College, PA. 16801-4851
NO Faxes Please.

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

7. PROJECT CONTACT INFORMATION

Name: Shana Moak, Project Scientist
Company/Business Name: Weston Solutions, Inc.
Address: 1400 Weston Way
City, State, Zip: West Chester, PA 19380
Phone:(610) 701-3089 Fax:(610) 701-3401
Email: Shana.Moak@WestonSolutions.com

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

Katie Rembert for Shana Moak 11/25/09
applicant/project proponent signature date

SURVEY NOTES
(CUSHMAN & WAKEFIELD–1992)

REFERENCE: AERIAL DATA REDUCTION ASSOCIATES, INC.
DATE OF PHOTOGRAPHY: JUNE 22, 1994
DATE OF COMPILATION: NOVEMBER 1994

CONVERSION OF THE NAVD 1988 GROUND ELEVATIONS TO NGVD 1929 IS +0.98'
CONVERSION OF THE NAVD 1988 TIDAL DATA TO NGVD 1929 IS +1.32'

THE EXTENT OF TIDAL JURISDICTION IS BASED UPON TIDAL DATA AS FOLLOWS:
SECTION 10 –– MEAN HIGH WATER –– 2.38' NAVD 1988
SECTION 404 – SPRING HIGH WATER – 2.58' NAVD 1988

NATIONAL OCEANOGRAPHIC AND ATOMSPHERIC ADMINISTRATION
TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE,
PHILADELPHIA PIER 11 NORTH, BASED ON NORTH AMERICAN
VERTICAL DATUM OF 1988 IS AS FOLLOWS:
HIGHEST RECORDED TIDE 7.18' (NOV 1950)
MEAN HIGHER HIGH TIDE 3.14'
MEAN HIGH TIDE 2.73'
MEAN TIDE LEVEL –0.034'
MEAN LOW TIDE –3.42'
MEAN LOWER TIDE –3.61'
LOWEST RECORDED TIDE –10.12' (DEC 1962)

HORIZONTAL DATUM IS THE NORTH AMERICAM DATUM 1983 (NAD 83),
VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988

CONTOUR INTERVAL 2 FOOT

OUTLINED AREAS LABELED "OBSCURED", "DENSE WOODS" OR "SHADOWS" HAVE NO GUARANTEED OR IMPLIED HORIZONTAL AND VERTICAL ACCURACIES

ALL ELEVATIONS ON THE PNBC FINAL PLAT ARE IN NAVD 1988. THE 100 YEAR FLOOD ELEVATION IS 9.0 NAVD 1988 DATUM. THE 100 YEAR FLOOD ELEVATION CONVERTS INTO 4.2 CITY DATUM. THIS INFORMATION SUPPLIED BY WILLIAM ERICKSON (DEVELOPMENT PLANNER – PHILA. CITY PLANNING COMMISION & VERIFIED BY JOSEPH KELLEHER (PROFESSIONAL LAND SURVEYOR), DATED 9–11–03.

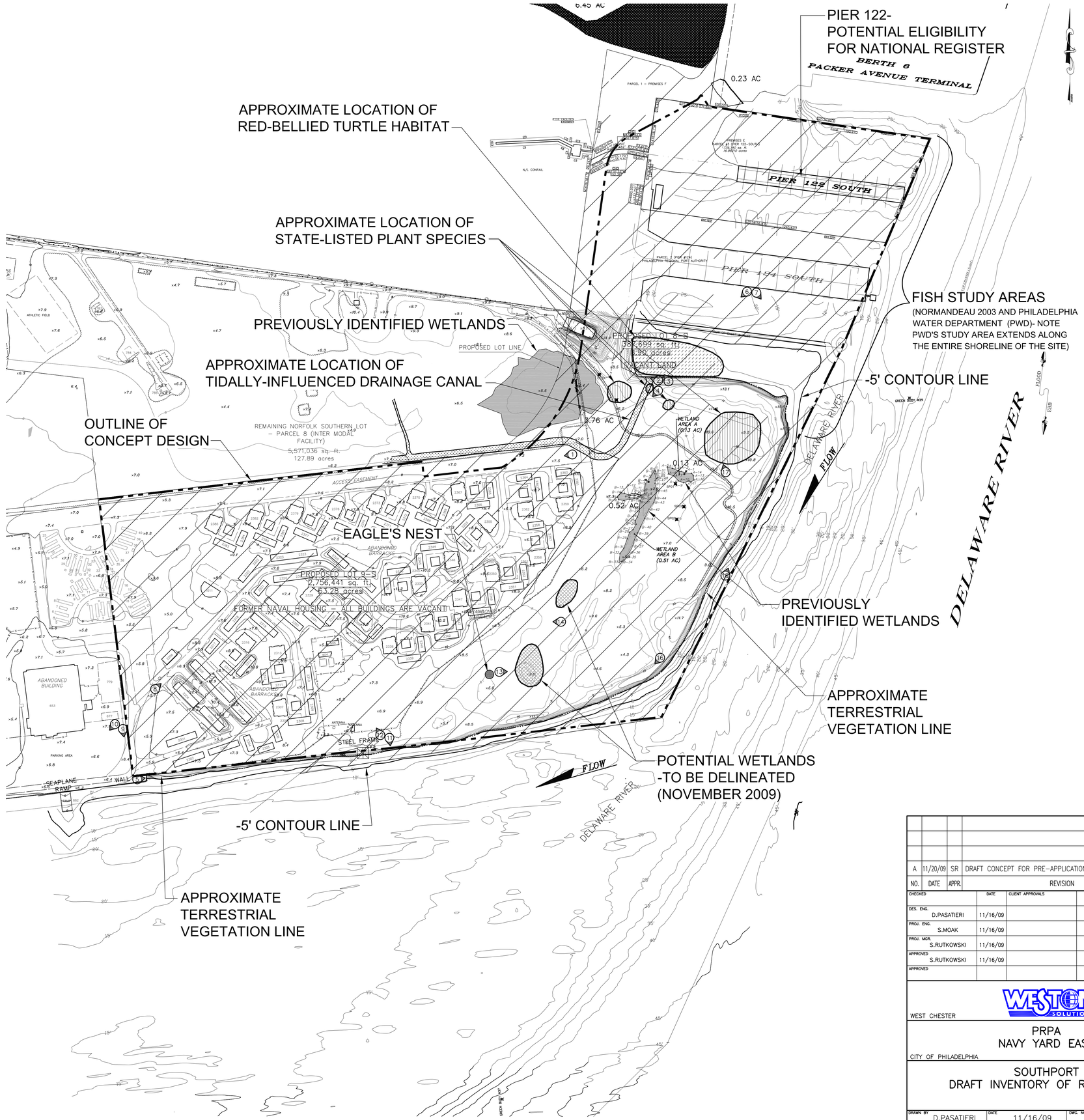
NOTES

- BASE PLAN FROM CUSHMAN & WAKEFIELD OF PA (1992) PNBC TOPOGRAPHY MAP.
- WETLAND DELINEATIONS WERE CONDUCTED IN 2005 AND 2007, BY SCHOOR DEPALMA, INC. AND A–TECH ENGINEERING.
- SITE BOUNDARY ESTIMATED FROM RFP AERIAL (2004).
- APPROXIMATE LOCATIONS OF POTENTIAL HABITATS AND RESOURCES WERE IDENTIFIED BY WESTON SOLUTIONS, INC. AND ARE BEING FURTHER DELINEATED AND/OR ASSESSED AS PART OF THE SOUTHPORT DESIGN AND PERMIT PROCESS.

LEGEND

FENCE
GUIDERAIL
SPOT ELEVATION ×7.8
TOWER
UTILITY POLE
WETLAND FLAG LOCATION
ROUTINE SAMPLE POINT G1
PHOTO LOCATION POINT 11
DENSE VEGETATION/ SHADOWS DENSE WOODS
BUILDING WITH NUMBER 5432
WOODS LINE
SHRUB/BRUSH AREA
INDEX CONTOUR WITH LABEL 10
INTERMEDIATE CONTOUR WITH LABEL 8 6
DRAINAGE
SITE BOUNDARY
TRAIL

200 0 200 400
SCALE: 1"=200'–0"



NO.	DATE	APPR.	REVISION
A	11/20/09	SR	DRAFT CONCEPT FOR PRE–APPLICATION PROCESS

CHECKED		DATE	CLIENT APPROVALS	DATE
DES. ENG.	D.PASATIERI	11/16/09		
PROJ. ENG.	S.MOAK	11/16/09		
PROJ. MGR.	S.RUTKOWSKI	11/16/09		
APPROVED	S.RUTKOWSKI	11/16/09		
APPROVED				

ENGINEER'S SEAL

WESTON SOLUTIONS
WEST CHESTER PENNSYLVANIA

PRPA
NAVY YARD EAST
CITY OF PHILADELPHIA PENNSYLVANIA

SOUTHPORT
DRAFT INVENTORY OF RESOURCES

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	11/16/09	1	A
SCALE 1"=200'–0"	W.O. NUMBER 14637.001.001.0003.07	SHEET 1 OF 1	

Filename: G:\ACAD\PROJ\12769006003 PRPA Southport\PDCX\inventory.dwg

PHOTO 1. View west along runway (Mustin Housing Complex can be seen to the left)

PHOTO 2. View west at inter-tidal area south of Pier 124.

PHOTO 3. View northwest at inter-tidal area south of Pier 124.

PHOTO 4. View southwest at drainage channel.

PHOTO 5. View east along southern edge of site.

PHOTO 6. View southwest from Pier 124.

PHOTO 7. View southeast from Pier 124.

PHOTO 8. View northeast into the Mustin Housing Complex.

PHOTO 9. View southwest to Delaware River (Mustin Housing Complex is on right).

PHOTO 10. View southwest to Delaware River (historic seaplane hangar on the right).

PHOTO 11. View south to Delaware River.

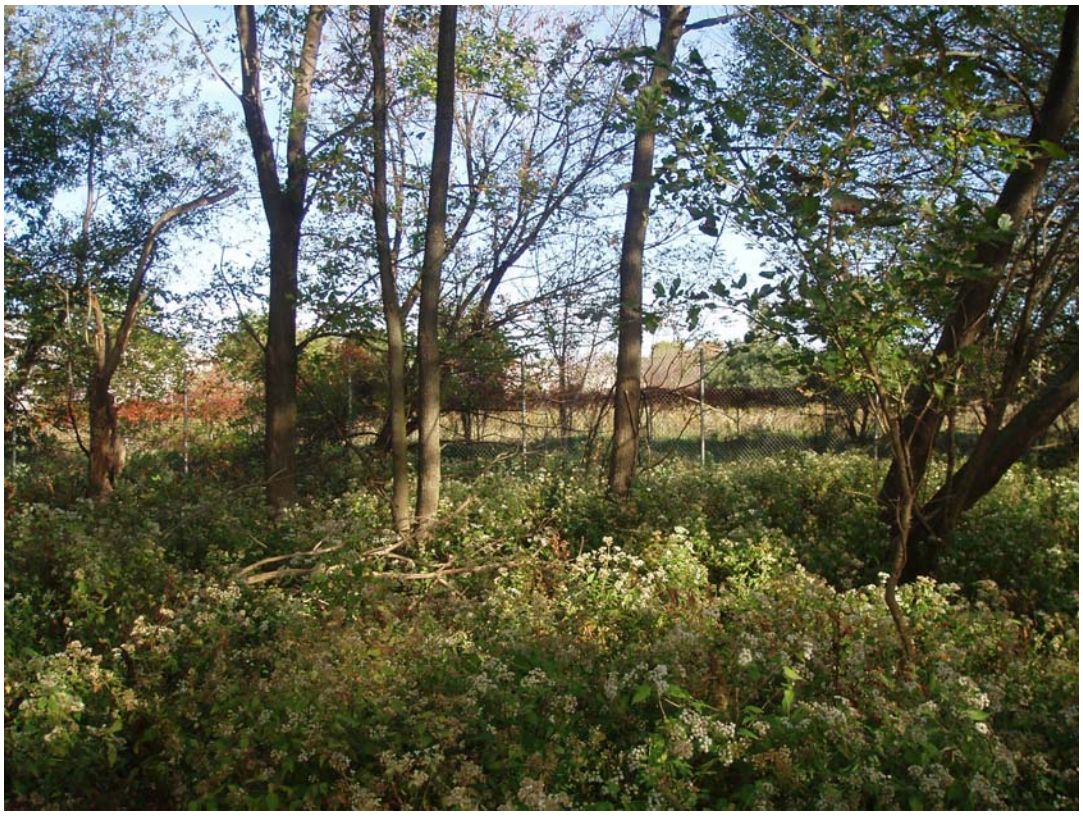


PHOTO 12. View north towards the Mustin Housing Complex.

PHOTO 13. View east from a location south of the Mustin Housing Complex.

PHOTO 14. View east from a location east of the Mustin Housing Complex.

PHOTO 15. View northeast along eastern shore of the site.

PHOTO 16. View southwest along the southern shore of the site.

PHOTO 17. View northwest at a location on the northern boundary of the site.

ATTACHMENT 2

SM 12-10 153

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

BUREAU OF FORESTRY

December 10, 2009

PNDI Number: 20090901208135

Shana Moak
Weston Solutions
FAX: 610-701-3401 (hard copy WILL NOT follow)

Re: Proposed Development of Southport
City of Philadelphia.; Philadelphia County

Dear Shana,

Thank you for submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 20090901208135 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

POTENTIAL IMPACT ANTICIPATED:

PNDI records indicate species or resources of concern are located **within the project area**. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

DCNR requests a survey for the following species:

***Cuscuta pentagona* (Field dodder) Currently unlisted, Proposed PA Threatened:** Found in open woods old fields, thickets and wet banks, parasitic on many hosts; flowering from June to September, fruiting from July to October. **Please have your botanist contact Dr. Ann Rhoads at the Morris Arboretum to coordinate in identifying any *Cuscuta* found on site to the species level.** This species was last found in 2007 growing on *Artemsia vulgaris* on a lower slope along the Delaware River, in a strip of successional old field just inland from the narrow riparian woodland along the bank.

***Lycopus rubellus* (Bugleweed) PA Endangered:** Found in bogs, river banks, pond margins and wet ditches; flowering from June to early September. This species was last found in 2007 along the Delaware River shore growing predominantly in crevices at the bases of trees (mostly *Liriodendron tulipifera)* along the high-water line, in disturbed habitat along the river bank which consisted of a great deal of rubble, masonry debris and alluvium.

***Panicum scoparium* (Velvety panic-grass) PA Endangered:** Found in moist meadows and swales; vernal terminal panicles appear from May to early July. This species was last found in 1991 in the Eastern half of the complex, in flat, open-lighted moist areas.

PNDI records indicate species or resources of concern are located **in the vicinity of the project**. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

DCNR requests a survey for the following species:

***Echinochloa walteri* (Walter's barnyard grass) PA Endangered:** Found in tidal marshes and mudflats; survey from August to September.

***Heteranthera multiflora* (Multi-flowered mud plantain) PA Endangered:** Found on tidal shores and mudflats; flowering from July to early August.

***Juncus dichotomus* (Forked rush) PA Endangered:** Found in moist, sandy, old fields, open woods and gravel pits; flowering and fruiting in Summer.

- A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. Your botanist should *fill out the field survey form while performing their survey*: http://www.naturalheritage.state.pa.us/ InternetFieldSurveyForm.pdf. Your botanist may contact our office prior to the survey for detailed information about the species location(s) within the project area. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.

PNDI Number: 20090901208135

- Any target or non-target state-listed species found during the site visit should be reported. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.

- If the land type(s) does not exist onsite a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types and species found onsite.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. An absence of recorded information does not necessarily imply actual conditions on-site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for an additional year.

This finding applies to impacts to DCNR only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure the U.S. Fish and Wildlife Service, PA Game Commission, and the Pennsylvania Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Mr. Kelly L. Sitch, Environmental Review Specialist FOR Chris Firestone, Wild Plant Program Mgr.
Ph: 717-425-5370 ~ Fax: 717-772-0271 ~ c-ksitch@state.pa.us

BOTANICAL SURVEY REQUIREMENTS for DCNR SPECIES OF SPECIAL CONCERN

This informational sheet has been designed to inform the applicant of all necessary requirements in a botanical survey and survey report. This sheet includes what to send us in your survey report and guidelines on how to conduct a survey for DCNR Species of Special Concern. Please follow these guidelines (or have your botanist follow these guidelines) when surveying and submitting the report. Due to limited time constraints please make sure you have completed the survey properly and that the survey report is complete. If the survey report is incomplete or the survey has not been completed properly, DCNR Bureau of Forestry Ecological Services will request additional information or project area be re-surveyed, resulting in a loss of time for the project.

Guidelines for Conducting Surveys for Species Related to Environmental Reviews

The surveys must include an evaluation of all habitats within the proposed project area, or the portions indicated by BOF needing evaluation. Surveys are to be conducted during the period when the phenology of the target species allows for identification (preferred) – or, if the survey is conducted at some other time, it must be followed up by a survey at the appropriate time of year if the presence of the target species cannot be ruled out on the basis of lack of suitable habitat.

Documentation of the survey should include PNDI survey forms, including a Botanical Field Survey Form for each Plant of Special Concern in Pennsylvania species encountered, whether or not the species is on the target list. These forms must include the following:

- ☐ Brief descriptions of all major habitat types encountered.
- ☐ A reasonably complete list of the plants for any areas that represent potential habitat for the target species.

In addition, voucher specimens should be collected according to the Vascular Plant Technical Committee guidelines for the following:

- ☐ Species that cannot be positively identified by the surveyor in the field.
- ☐ Species closely related to and/or easily confused with the target species.
- ☐ A permit is required for collection.
- ☐ When a species of special concern is found onsite.

Permits

In order to possess plants or parts of plants classified as Pennsylvania Endangered (PE) or Pennsylvania Threatened (PT) a botanist must have in possession a Wild Plant Management Permit. This annual permit is available from DCNR, Bureau of Forestry, Chris Firestone, Wild Plant Program Manager, P.O. Box 8552, Harrisburg, PA 17105, (717) 783-3227.

Survey Report Checklist (Survey reports MUST include the following):

- ☐ Completed Botanical Field Survey Forms, available at http://www.naturalheritage.state.pa.us/InternetFieldSurveyForm.pdf. This method standardizes information and, if species were found, is able to be input in the Pennsylvania Natural Heritage Program database.
- ☐ Narrative describing in detail how the survey was completed. Explain methods and techniques used.
- ☐ Map showing area surveyed. This is necessary for us to be able to see where the project area/disturbance area is and where the botanist surveyed. If the disturbance area was not surveyed, DCNR will ask for a new survey including area to be disturbed.
- ☐ Inventory list of all plants & trees found in project area. The botanist should keep a running tally of all species encountered during survey and include in report.
- ☐ If species of special concern are found onsite:
  - o Document location on a map. Overlay the location of the species with site plans (if applicable) to show limits of disturbance and proximity to species' location.
  - o Include on map numbers of individuals or populations found, GPS locations of populations and delineate limits of populations.
  - o Estimate number of individuals in populations.
  - o Delineate the immediate potential habitat for the species.
  - o A voucher specimen should be collected.
  - o Photos of specimens and habitats found onsite, showing diagnostic characteristics
- ☐ Botanist resume, credentials or experience.

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County	Quad
Survey Date/s	Surveyor
Amount of time spent surveying area	
Name of site owner	
Directions to site	
GPS (decimal degrees preferred) approximate center point of site	
Scientific name/s of target species	
Site habitat description	
Substrate/soil type	
System: Terrestrial Palustrine Estuarine	
Community Description (describe below)	

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous			
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (**http://www.naturalheritage.state.pa.us/PlantsPage.aspx**) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Identification problems? If yes, explain.
References used (flora, experts, herbaria, etc.)
Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.
Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

Ambiguous directions	Disturbances	Exotics	Habitat destroyed
____ Time of year	____ Unsuitable habitat	____ Weather	____ Insufficiently/incompletely surveyed

Elements may have never occurred here – 1st time area searched

Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC

GPS coordinates (decimal degrees preferred)

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	Flat	Open	Crest	____ Inundated (hydric)	Min
E	0-10%	Partial	Upper slope		Max
S	10-35%	Filtered	Mid-slope	____ Saturated (wet-mesic)	
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	____ Moist (mesic)	
NW					
SE				____ Dry (mesic)	
SW					
None				Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf	1-10		1 YD 2	Annuals	Very feeble
In bud	11-50		1-5 YD 2	% Seedlings	Feeble
In flower	51-100		5-10 YD 2	% Immature	Normal
Immature fruit	101-1000		10-100 YD 2	% 1st year	Vigorous
Mature fruit	1001-10K		100 YD 2 – 2 AC	% Mature	Exceptional vigor
Seed dispersing	10K+		2+ ACRES	% Senescent	
	EST #		EST AREA		

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known)
Age, successional stage of system
____ Known or ____ Inferred land use history
Chemical treatment (known or suspected) with herbicides, pesticides, other
Other anthropogenic or unnatural disturbance
Integrity/fragmentation of community
List of invasive species (alien or native)
Threats (on-site)
Threats (off-site)
List other members of this genus that occur on site. Hybridization?
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

ATTACHMENT 3

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

26 February 2010

Joy VanDervort Sneed
Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Pennsylvania Natural Diversity Inventory (PNDI) Number 20090901208135
Proposed Development of Southport, Philadelphia, PA

Dear Ms. VanDervort Sneed:

On 24 November 2009, WESTON submitted the results of a Pennsylvania Natural Diversity Index (PNDI) search for the proposed Southport project to the office of the Pennsylvania Department of Conservation and Natural Resources for review. On 10 December 2009, WESTON received, via fax, a response letter from the PA DCNR listing the potential impacts to species within the project area and in the vicinity of the project area (see attached letter). The PA DCNR requested a survey for the following species which are known to occur within the project area [*Cuscuta pentagona* (field dodder), *Lycopus rubellus* (bugleweed), and *Panicum scoparium* (velvety panic-grass)], and species which are located in the vicinity of the project area [*Echinochloa walteri* (Walter's barnyard grass), *Heteranthera multiflora* (multi-flowered mud plantain), and *Juncus dichotomus* (forked rush).

WESTON's subcontractor, Joseph Arsenault, completed surveys of the site on 6 and 14 October 2009, and 19 November 2009. Mr. Arsenault compiled the results of each site visit into one package entitled "Botanical Survey Results" (December 2009). This package is enclosed with for your review. Please note that the six (6) species called out in PA DCNR's 10 December 2010 fax are addressed in this document.

It is worthy to note that the project footprint was downsized following WESTON's 24 November 2009 submission to your office. A copy of the new conceptual plan for the Southport site has been attached to this letter for your reference.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
PA DCNR 12/10/09 letter
Botanical Survey Results
Conceptual Design

SM 12-10 153

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

BUREAU OF FORESTRY

December 10, 2009

PNDI Number: 20090901208135

Shana Moak
Weston Solutions
FAX: 610-701-3401 (hard copy WILL NOT follow)

Re: Proposed Development of Southport
City of Philadelphia.; Philadelphia County

Dear Shana,

Thank you for submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 20090901208135 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

POTENTIAL IMPACT ANTICIPATED:

PNDI records indicate species or resources of concern are located **within the project area**. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

DCNR requests a survey for the following species:

***Cuscuta pentagona* (Field dodder) Currently unlisted, Proposed PA Threatened:** Found in open woods old fields, thickets and wet banks, parasitic on many hosts; flowering from June to September, fruiting from July to October. **Please have your botanist contact Dr. Ann Rhoads at the Morris Arboretum to coordinate in identifying any *Cuscuta* found on site to the species level.** This species was last found in 2007 growing on *Artemsia vulgaris* on a lower slope along the Delaware River, in a strip of successional old field just inland from the narrow riparian woodland along the bank.

***Lycopus rubellus* (Bugleweed) PA Endangered:** Found in bogs, river banks, pond margins and wet ditches; flowering from June to early September. This species was last found in 2007 along the Delaware River shore growing predominantly in crevices at the bases of trees (mostly *Liriodendron tulipifera)* along the high-water line, in disturbed habitat along the river bank which consisted of a great deal of rubble, masonry debris and alluvium.

***Panicum scoparium* (Velvety panic-grass) PA Endangered:** Found in moist meadows and swales; vernal terminal panicles appear from May to early July. This species was last found in 1991 in the Eastern half of the complex, in flat, open-lighted moist areas.

PNDI records indicate species or resources of concern are located **in the vicinity of the project**. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

DCNR requests a survey for the following species:

***Echinochloa walteri* (Walter's barnyard grass) PA Endangered:** Found in tidal marshes and mudflats; survey from August to September.

***Heteranthera multiflora* (Multi-flowered mud plantain) PA Endangered:** Found on tidal shores and mudflats; flowering from July to early August.

***Juncus dichotomus* (Forked rush) PA Endangered:** Found in moist, sandy, old fields, open woods and gravel pits; flowering and fruiting in Summer.

- A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. Your botanist should *fill out the field survey form while performing their survey*: http://www.naturalheritage.state.pa.us/ InternetFieldSurveyForm.pdf. Your botanist may contact our office prior to the survey for detailed information about the species location(s) within the project area. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.

PNDI Number: 20090901208135

- Any target or non-target state-listed species found during the site visit should be reported. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.

- If the land type(s) does not exist onsite a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types and species found onsite.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. An absence of recorded information does not necessarily imply actual conditions on-site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for an additional year.

This finding applies to impacts to DCNR only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure the U.S. Fish and Wildlife Service, PA Game Commission, and the Pennsylvania Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Mr. Kelly L. Sitch, Environmental Review Specialist FOR Chris Firestone, Wild Plant Program Mgr.
Ph: 717-425-5370 ~ Fax: 717-772-0271 ~ c-ksitch@state.pa.us

BOTANICAL SURVEY REQUIREMENTS for DCNR SPECIES OF SPECIAL CONCERN

This informational sheet has been designed to inform the applicant of all necessary requirements in a botanical survey and survey report. This sheet includes what to send us in your survey report and guidelines on how to conduct a survey for DCNR Species of Special Concern. Please follow these guidelines (or have your botanist follow these guidelines) when surveying and submitting the report. Due to limited time constraints please make sure you have completed the survey properly and that the survey report is complete. If the survey report is incomplete or the survey has not been completed properly, DCNR Bureau of Forestry Ecological Services will request additional information or project area be re-surveyed, resulting in a loss of time for the project.

Guidelines for Conducting Surveys for Species Related to Environmental Reviews

The surveys must include an evaluation of all habitats within the proposed project area, or the portions indicated by BOF needing evaluation. Surveys are to be conducted during the period when the phenology of the target species allows for identification (preferred) – or, if the survey is conducted at some other time, it must be followed up by a survey at the appropriate time of year if the presence of the target species cannot be ruled out on the basis of lack of suitable habitat.

Documentation of the survey should include PNDI survey forms, including a Botanical Field Survey Form for each Plant of Special Concern in Pennsylvania species encountered, whether or not the species is on the target list. These forms must include the following:

- ☐ Brief descriptions of all major habitat types encountered.
- ☐ A reasonably complete list of the plants for any areas that represent potential habitat for the target species.

In addition, voucher specimens should be collected according to the Vascular Plant Technical Committee guidelines for the following:

- ☐ Species that cannot be positively identified by the surveyor in the field.
- ☐ Species closely related to and/or easily confused with the target species.
- ☐ A permit is required for collection.
- ☐ When a species of special concern is found onsite.

Permits

In order to possess plants or parts of plants classified as Pennsylvania Endangered (PE) or Pennsylvania Threatened (PT) a botanist must have in possession a Wild Plant Management Permit. This annual permit is available from DCNR, Bureau of Forestry, Chris Firestone, Wild Plant Program Manager, P.O. Box 8552, Harrisburg, PA 17105, (717) 783-3227.

Survey Report Checklist (Survey reports MUST include the following):

- ☐ Completed Botanical Field Survey Forms, available at http://www.naturalheritage.state.pa.us/InternetFieldSurveyForm.pdf. This method standardizes information and, if species were found, is able to be input in the Pennsylvania Natural Heritage Program database.
- ☐ Narrative describing in detail how the survey was completed. Explain methods and techniques used.
- ☐ Map showing area surveyed. This is necessary for us to be able to see where the project area/disturbance area is and where the botanist surveyed. If the disturbance area was not surveyed, DCNR will ask for a new survey including area to be disturbed.
- ☐ Inventory list of all plants & trees found in project area. The botanist should keep a running tally of all species encountered during survey and include in report.
- ☐ If species of special concern are found onsite:
  - o Document location on a map. Overlay the location of the species with site plans (if applicable) to show limits of disturbance and proximity to species' location.
  - o Include on map numbers of individuals or populations found, GPS locations of populations and delineate limits of populations.
  - o Estimate number of individuals in populations.
  - o Delineate the immediate potential habitat for the species.
  - o A voucher specimen should be collected.
  - o Photos of specimens and habitats found onsite, showing diagnostic characteristics
- ☐ Botanist resume, credentials or experience.

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County	Quad
Survey Date/s	Surveyor
Amount of time spent surveying area	
Name of site owner	
Directions to site	
GPS (decimal degrees preferred) approximate center point of site	
Scientific name/s of target species	
Site habitat description	
Substrate/soil type	
System: Terrestrial Palustrine Estuarine	
Community Description (describe below)	

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous			
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (**http://www.naturalheritage.state.pa.us/PlantsPage.aspx**) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Identification problems? If yes, explain.
References used (flora, experts, herbaria, etc.)
Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.
Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

Ambiguous directions	Disturbances	Exotics	Habitat destroyed
____ Time of year	____ Unsuitable habitat	____ Weather	____ Insufficiently/incompletely surveyed

Elements may have never occurred here – 1st time area searched

Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC

GPS coordinates (decimal degrees preferred)

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	Flat	Open	Crest	____ Inundated (hydric)	Min
E	0-10%	Partial	Upper slope		Max
S	10-35%	Filtered	Mid-slope	____ Saturated (wet-mesic)	
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	____ Moist (mesic)	
NW					
SE				____ Dry (mesic)	
SW					
None				Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf	1-10		1 YD 2	Annuals	Very feeble
In bud	11-50		1-5 YD 2	% Seedlings	Feeble
In flower	51-100		5-10 YD 2	% Immature	Normal
Immature fruit	101-1000		10-100 YD 2	% 1st year	Vigorous
Mature fruit	1001-10K		100 YD 2 – 2 AC	% Mature	Exceptional vigor
Seed dispersing	10K+		2+ ACRES	% Senescent	
	EST #		EST AREA		

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known)
Age, successional stage of system
____ Known or ____ Inferred land use history
Chemical treatment (known or suspected) with herbicides, pesticides, other
Other anthropogenic or unnatural disturbance
Integrity/fragmentation of community
List of invasive species (alien or native)
Threats (on-site)
Threats (off-site)
List other members of this genus that occur on site. Hybridization?
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Botanical Survey Results
Checklist Materials

For:

Philadelphia Navy Yard: Eastern End
City of Philadelphia
Philadelphia County, Pennsylvania

Contents:

- Survey Method
- Navy Yard Habitats
- Botanical Field Survey Forms
- Species of Special Concern Documentation
- Botanist Resume'

December 2009

Survey Method

Desk Audit
Field Inspection

Survey Methods

Desk Review

Prior to site inspections, a desk audit provided a review of the existing information known about the Navy Yard. The following maps and photographic sources were consulted:

- USGS Topographic Quadrangle, Philadelphia, Pa
- 1995, 2002 False Color Infrared Photos
- 2006 and Historic Air Photos available on Google Earth
- Approximate Location of State-Listed Rare Plan Species at the Philadelphia Naval Base Map, Weston Solutions dated September 30, 1994
- Environmental Constraints map developed by DMJM Harris/AECOM dated 9/18/2008

A review of the suspected species with suitable habitat was made using the following sources:

- Pennsylvania Natural Heritage List for Pennsylvania
- DCNR Information Letter dated February 9, 2004
- Species list from EA Engineering documenting 1991 Nature Conservancy Site Inspection
- A Natural Heritage Inventory of Philadelphia County, Pennsylvania prepared by the Pennsylvania Natural Heritage Program, dated December 2008

The following target species list was created from this existing data, annotated with typical habitat:

- Amaranthus cannabinus-tide marsh
- Andropogon gyrans-old field
- Aristida longespica var. geniculata-dry old field
- Baccharis halimifolia-disturbed areas
- Bidens bidentoides-tidal edges on rubble
- Bidens laevis-tide marsh
- Cirsium horridulum-old field, disturbed areas
- Cuscuta pentagona-upland old field
- Cyperus diandrus-freshwater wetland, puddles
- Echinochloa walteri-tide marsh
- Elatine Americana-lower tide mud flats
- Eleocharis obtusa var. peasei-tide marsh
- Eleocharis parvula-tide and freshwater edges
- Eupatorium rotundifolium-dry old field
- Euthamia tenuifolia-old field
- Heteranthera multiflora-tide mud flats
- Hypericum stragulum-uplands

- Juncus dichotomus-old field
- Lycopus rubellus-tide mud flats
- Panicum commonsianum var. commonsianum-upland
- Panicum polyanthes-moist old field
- Panicum scoparium-old field
- Physalis virginiana-old field
- Sagittaria calycina var. spongiosa
- Sagittaria subulata-tde mud flats
- Schoenoplectus fluviatilis-tide marsh
- Schoenoplectus smithii-pond edges, tide edges
- Strophostyles umbellate-upland old field
- Triplasis purpurea-dry disturbed habitats
- Tripsacum dactyloides-moist open areas
- Zizania aquatic-tide marsh

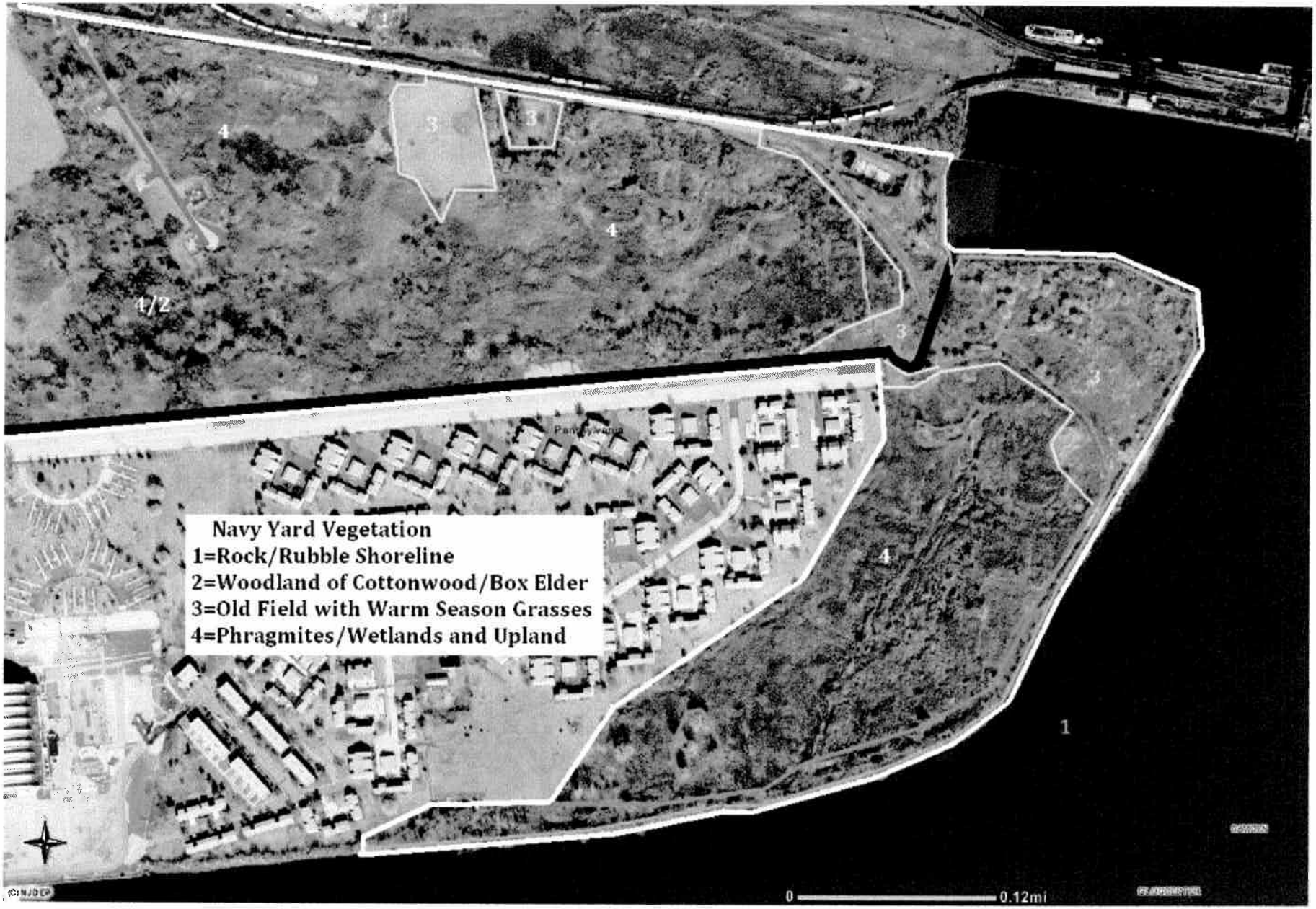
Field Method

The eastern edge of the Naval Yard was surveyed on October 6, 14; November 19, 2009. Using the habitat and species specific information obtained from State Natural Heritage lists and other sources, the inspection proceeded by reviewing the various vegetation communities on the Navy Yard. A running tally species list was made, recording all plants encountered.

Random (wander into available accessible areas) and regular (planned walking transects) inspections were made to locate suitable habitats. Field identifications supplied most of the records. Snippets of unknown plants were returned to the lab for positive identification using local and regional manuals (Fernald, 1950; Gleason, 1991; Flora of North America, 1999). Photos were taken to document species of special concern and to typify the existing conditions. The results are reported in this botanical survey summary.

Navy Yard Habitats

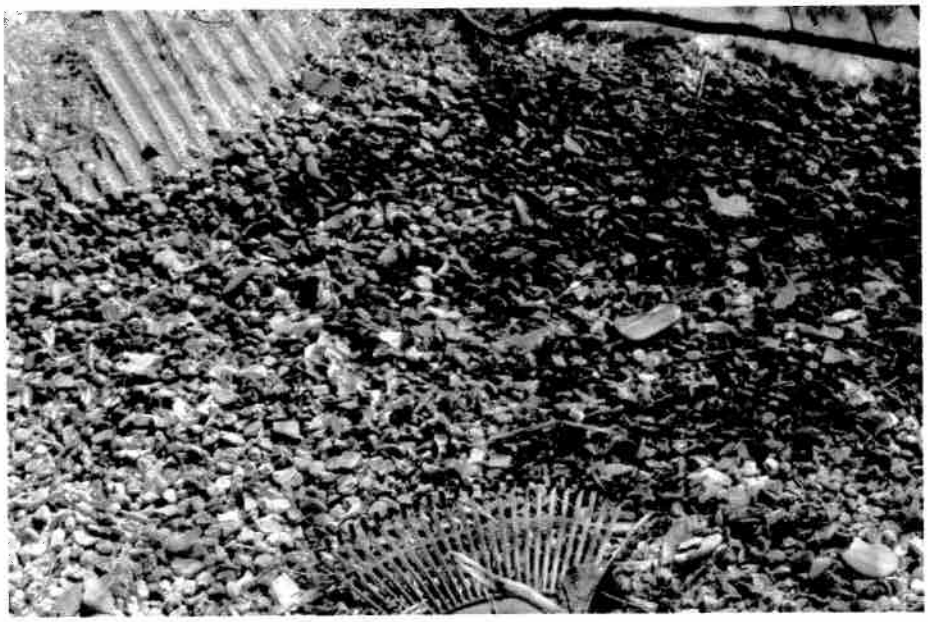
Generalized Vegetation Map
Plants Communities
Pennsylvania Natural Heritage Species List for Philadelphia Co.


Navy Yard Vegetation
1=Rock/Rubble Shoreline
2=Woodland of Cottonwood/Box Elder
3=Old Field with Warm Season Grasses
4=Phragmites/Wetlands and Upland
4/2
4
3
1
0
0.12mi

Navy Yard Vegetation

There are as many as seven plant communities on the eastern end of the Naval Base, ranging from tidal shores to upland woodlands.

Tidal Communities: High Energy, Rocky Shoreline and Mud Flats



Three distinct communities can be found below the tide line: high energy Delaware River shoreline, mud flats on the western end of the ship slip, and low energy rocky shoreline. Each area experiences tidal fluctuation. The Delaware shoreline is primarily a rock and rubble edge with little or no sand or organic substrate. Scour is an issue and the relative lack of any plants along this edge is a testament to the limits exhibited by the fast moving water.

The side channel and storm water ditch experience a slower mild undulation and provides habitat suitable for listed species such as *Bidens bidentoides, Lycopus rubellus* and *Sagittaria subulata*. The condition is found on the south bank of the ship slip and the tidal portion of the storm water ditch. The ditch is covered with 4' rip rap whereas the ship slip bank was created from land filled concrete and similar large fraction material. A significant fine and organic fractions fills the space between the larger rocks, creating suitable sediment conditions for plants. These conditions, however, have a northern aspect and are overshadowed by woody cover

during the growing season, limiting sun light by shade and likewise limiting available space for tidal plants.

The mud flat habitat is a narrow tidal edge on the west end of the ship slip. This provides a gentle slope and very fine silt sediment characteristic of slow moving tidal conditions. The habitat was observed to support only *Nuphar lutea* var. *advena*. The upper edge of the gentle slope is dominated by *Salix nigra* and other opportunistic woody species, reducing the exposed, low tide littoral zone to small fragments between tree cover.

Non-tidal Wetlands: Phragmites Dominated and Emergent Palustrine

Phragmites australis dominates a significant part of the undeveloped dredge spoil area. This is an area between the former base hosuing and the Delaware River shore line. Few plants are found in this monotypic stand.

On occasion, space opens and allows lower growing species such as *Juncus effusus, Lyrthum salicornia, Polygonum punctatum*, and *Eleocharis obtusa*. This emergent habitat occupies less than 10% of the available freshwater non tidal area; the remaining wetlands are reed grass dominated.

Upland Communities: Old Field and Seral Woodlands

Seral woodland community occupies the upper edge of filled along the Delaware River shoreline and scattered patches throughout the undeveloped part of the base. This community is identified by the presence of sapling and young trees of tree of heaven, mulberry, box elder maple, black cherry, princess tree and other opportunistic species. Bush honeysuckle, silky dogwood, Virginia creeper, Japanese honeysuckle and common black berry compete with aggressive perennials such as late goldenrod and common mugwort.

Old field community dominated by species tolerant of filled substrates occupies the open areas within and surrounding the woodland. Many parts of this community are dominated by invasive alien species. Common mugwort and sweet clover are everywhere, limiting space for many plants. Bush-clover dodder is found on the common mugwort in this part of the old field community. A few locations are recovering with common native coastal plain species such as *Andropogon virginicus, Juncus tenuis, Juncus dichotomus, Solidago altissima, Solidago canadensis* and *Tridens flavus*. It is within this native component that velvet rosette panic grass and forked rush are found.

Philadelphia County Plant Species: Local Suitable Habitat; Found on Site

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
Aeschynomene virginica	Sensitive Joint-vetch	G2	SX	PX	PX	
Aletris farinosa	Colic-root	G5	S1	TU	PE	
Alopecurus aequalis	Short-awn Foxtail	G5	S3	N	PT	
Amaranthus cannabinus	Waterhemp Ragweed	G5	S3	PR	PR	
Ammannia coccinea	Scarlet Ammannia	G5	S2	PE	PT	
Andropogon gyrans	Elliott's Beardgrass	G5	S3	N	PR	
Aristida longespica var. geniculata	Spiked Needlegrass	G5T5?	SU	TU	WATCH	
Asclepias rubra	Red Milkweed	G4G5	SX	PX	PX	
Asclepias variegata	White Milkweed	G5	S1	TU	PE	
Asplenium pinnatifidum	Lobed Spleenwort	G4	S3	N	PR	
Baccharis halimifolia	Eastern Baccharis	G5	S3	PR	PR	
Bidens bidentoides	Swamp Beggar-ticks	G3G4	S1	PT	PE	
Bidens laevis	Beggar-ticks	G5	S1	N	PE	
Carex hyalinolepis	Shore-line Sedge	G4G5	SX	PX	PX	
Chamaesyce polygonifolia	Small Sea-side Spurge	G5?	S2	PT	PT	
Chasmanthium laxum	Slender Sea-oats	G5	S1	PE	PE	
Chrysopsis mariana	Maryland Golden-aster	G5	S1	PT	PE	
Cirsium horridulum	Horrible Thistle	G5	S1	PE	PE	
Cladium mariscoides	Twig Rush	G5	S2	PE	PE	
Clitoria mariana	Butterfly-pea	G5	S1	PE	PE	
Collinsia verna	Spring Blue-eyed Mary	G5	S4	PR	WATCH	
Cuscuta campestris	Dodder	G5	S2	N	PT	
Cuscuta pentagona	Field Dodder	G5	S2	N	PT	
Cyperus diandrus	Umbrella Flatsedge	G5	S2	PE	PE	
Cystopteris	Bladder Fern	G5	S1	N	TU	

tennesseensis					
Desmodium laevigatum	Smooth Tick-trefoil	G5	SU	N	TU
Desmodium nuttallii	Nuttalls' Tick-trefoil	G5	S2	TU	TU
Desmodium obtusum	Stiff Tick-trefoil	G4G5	SU	N	TU
Echinochloa walteri	Walter's Barnyard-grass	G5	S1	PE	PE
Elatine americana	Long-stemmed Water-wort	G4	SU	PX	PE
Eleocharis obtusa var. peasei	Wrights Spike Rush	G5TNR	S1	PE	PE
Eleocharis parvula	Little-spike Spike-rush	G5	S1	PE	PE
Elephantopus carolinianus	Elephant's Foot	G5	S3	PE	PR
Ellisia nyctelea	Ellisia	G5	S2	PT	PT
Epilobium strictum	Downy Willow-herb	G5?	S3	PE	PR
Erianthus giganteus	Sugar Cane Plumegrass	G5	SX	PX	PX
Eryngium aquaticum	Marsh Eryngo	G4	SX	PX	PX
Eupatorium rotundifolium	A Eupatorium	G5	S3	TU	TU
Eurybia spectabilis	Low Showy Aster	G5	S1	PE	PE
Euthamia tenuifolia	Grass-leaved Goldenrod	G5	S1	PT	PT
Fimbristylis annua	Annual Fimbry	G5	S2	PT	PT
Galactia regularis	Eastern Milk-pea	G5	SX	PX	PX
Galactia volubilis	Downy Milk-pea	G5	SX	PX	PX
Gentiana saponaria	Soapwort Gentian	G5	S1S2	TU	PE
Glyceria obtusa	Blunt Manna-grass	G5	S1	PE	PE
Gratiola aurea	Golden Hedge-hyssop	G5	S1	TU	PE
Heteranthera multiflora	Multiflowered Mud-plantain	G4	S1	PE	PE
Hydrocotyle umbellata	Many-flowered Pennywort	G5	SH	PX	PX
Hypericum densiflorum	Bushy St. John's-wort	G5	S3	PT	PR

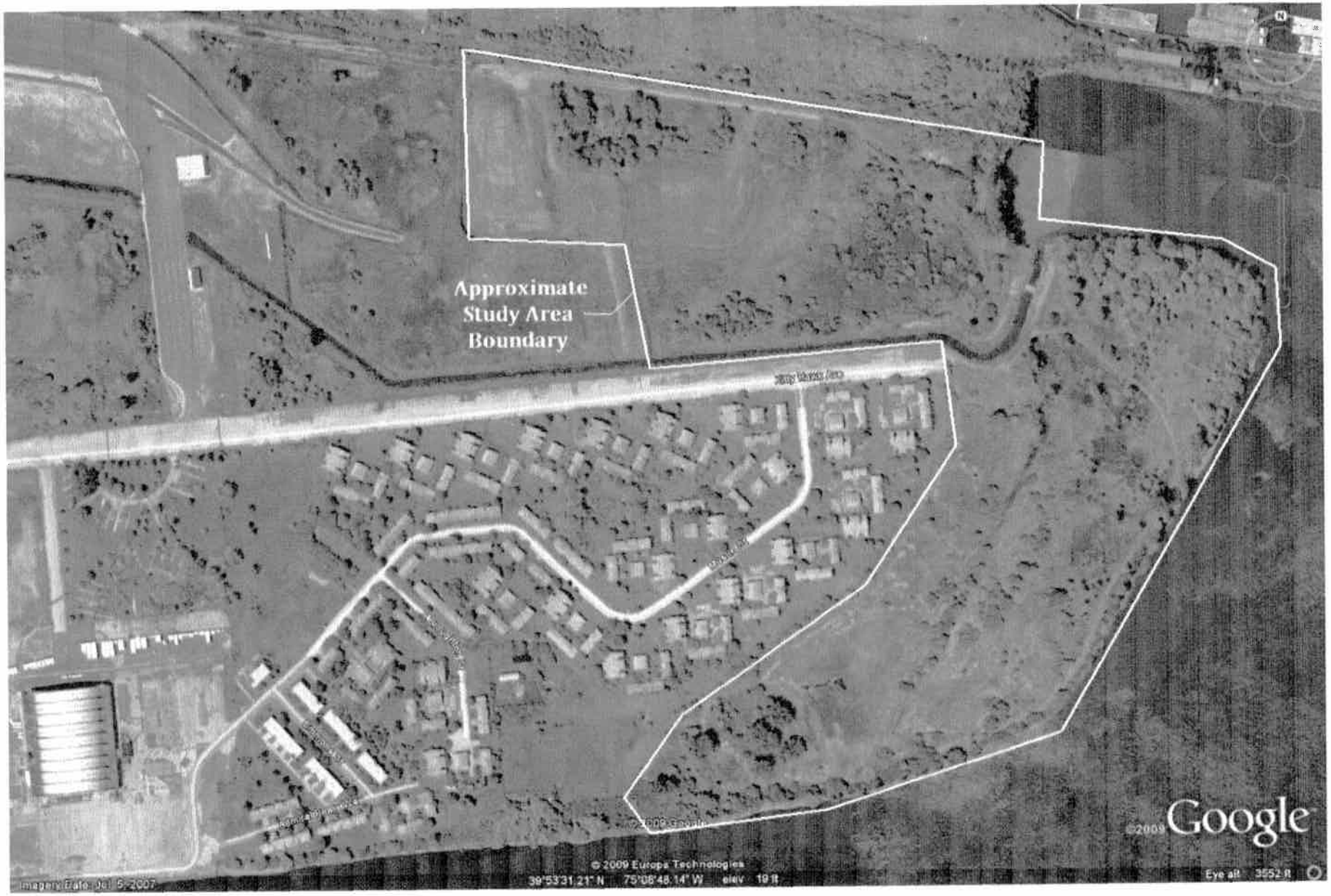
Hypericum stragulum	St Andrew's-cross	G4	S2	N	PT	
Isotria medeoloides	Small-whorled Pogonia	G2	S1	PE	PE	LT
Juncus biflorus	Grass-leaved Rush	G5	S2	TU	PT	
Juncus dichotomus	Forked Rush	G5	S1	PE	PE	
Juncus scirpoides	Scirpus-like Rush	G5	S1	PE	PE	
Juniperus communis	Common Juniper	G5	S2	N	TU	
Lathyrus palustris	Vetchling	G5	S1	TU	PE	
Lathyrus venosus	Veiny Pea	G5	S2	N	PE	
Lemna obscura	Little Water Duckweed	G5	SX	PX	PX	
Lemna perpusilla	Minute Duckweed	G5	S1S3	N	TU	
Lemna valdiviana	Pale Duckweed	G5	SH	PX	PX	
Leucothoe racemosa	Swamp Dog-hobble	G5	S2S3	TU	PT	
Limosella australis	Awl-shaped Mudwort	G4G5	SX	PX	PX	
Lycopodiella appressa	Southern Bog Clubmoss	G5	S2	PT	PT	
Lycopus rubellus	Bugleweed	G5	S1	PE	PE	
Lyonia mariana	Stagger-bush	G5	S1	PE	PE	
Lythrum alatum	Winged-loosestrife	G5	S1	TU	PE	
Matelea obliqua	Oblique Milkvine	G4?	S1	PE	PE	
Micranthemum micranthemoides	Nuttall's Mud-flower	GH	SX	PX	PX	
Monarda punctata	Spotted Bee-balm	G5	SH	PE	PE	
Muhlenbergia uniflora	Fall Dropseed Muhly	G5	S2	PE	PT	
Myriophyllum heterophyllum	Broad-leaved Water-milfoil	G5	S4	PE	SP	
Oenothera oakesiana	Evening-primrose	G4G5Q	S2	N	PT	
Opuntia humifusa	Prickly-pear Cactus	G5	S3	PR	PR	
Oxypolis rigidior	Stiff Cowbane	G5	S2	TU	PT	
Panicum commonsianum var. commonsianum	Commons' Panic-grass	G5TNR	SH	TU	PX	
Panicum polyanthes	Panic-grass	GNR	S4	N	WATCH	
Panicum scoparium	Velvety Panic-	G5	S1	PE	PE	

	grass				
Passiflora lutea	Passion-flower	G5	S2	PE	PT
Phaseolus polystachios	Wild Kidney Bean	G5	S1S2	N	PE
Phlox pilosa	Downy Phlox	G5	S1S2	TU	PE
Phyllanthus caroliniensis	Carolina Leaf-flower	G5	S1	PE	PE
Physalis virginiana	Virginia Ground-cherry	G5	S1S2	TU	PE
Pinus echinata	Short-leaf Pine	G5	S1S2	N	PT
Piptochaetium avenaceum	Blackseed Needlegrass	G5	S1	N	PE
Pluchea odorata	Shrubby Camphor-weed	G5	S1	TU	PE
Poa autumnalis	Autumn Bluegrass	G5	S1	PE	PE
Polygala cruciata	Cross-leaved Milkwort	G5	S1	PE	PE
Potamogeton vaseyi	Vasey's Pondweed	G4	S1	PE	PE
Prenanthes serpentaria	Lion's-foot	G5	S3	N	PT
Ptilimnium capillaceum	Mock Bishop-weed	G5	SX	PE	PX
Pycnanthemum verticillatum var. pilosum	Hairy Mountain-mint	G5T5	SH	TU	PX
Pyrola chlorantha		G5	S1	N	PE
Quercus falcata	Southern Red Oak	G5	S1	PE	PE
Quercus phellos	Willow Oak	G5	S2	PE	PE
Ranunculus aquatilis var. diffusus	White Water-crowfoot	G5T5	S3		PR
Ranunculus flammula	Lesser Spearwort	G5	SH	TU	PX
Ranunculus pusillus	Spearwort	G5	S1	N	PE
Sagittaria calycina var. spongiosa	Long-lobed Arrow-head	G5T4	S1	PE	PE
Sagittaria subulata	Subulate Arrowhead	G4	S3	PR	PR
Schoenoplectus fluviatilis	River Bulrush	G5	S3	PR	PR
Schoenoplectus smithii	Smith's Bulrush	G5?	S1	PE	PE

Scleria pauciflora	Few Flowered Nutrush	G5	S2	PT	PT
Senna marilandica	Wild Senna	G5	S3	TU	PR
Sericocarpus linifolius	Narrow-leaved White-topped Aster	G5	S1	PE	PE
Sisyrinchium fuscatum	Sand Blue-eyed Grass	G5?	SH	PX	PX
Solidago uliginosa	Bog Goldenrod	G4G5	S2	N	PT
Sparganium androcladum	Branching Bur-reed	G4G5	S1	PE	PE
Spiranthes lucida	Shining Ladies'-tresses	G5	S3	N	PT
Spiranthes vernalis	Spring Ladies'-tresses	G5	S1	PE	PE
Strophostyles umbellata	Wild Bean	G5	S2	N	PE
Stylosanthes biflora	Pencilflower	G5	S2	TU	PE
Symphyotrichum novi-belgii	New York Aster	G5	S2	PT	PT
Trichostema setaceum	Blue-curls	G5	S1	PE	PE
Triosteum angustifolium	Horse-gentian	G5	S1	TU	PE
Triphora trianthophora	Nodding Pogonia	G3G4	SH	PE	PE
Triplasis purpurea	Purple Sandgrass	G4G5	S1	PE	PE
Tripsacum dactyloides	Eastern Gamma-grass	G5	S1	TU	PE
Veratrum virginicum	Virginia Bunchflower	G5	S1	N	PE
Vernonia glauca	Tawny Ironweed	G5	S1	PE	PE
Viburnum trilobum	Highbush-cranberry	G5T5	S3S4	TU	PR
Viola brittoniana	Coast Violet	G4G5	S1	PE	PE
Woodwardia areolata	Netted Chainfern	G5	S2	N	PT
Zizania aquatica	Indian Wild Rice	G5	S3	PR	PR

Botanical Field Survey

Study Area Map
Philadelphia Navy Yard Species List
Field Survey Forms: Absence


Approximate
Study Area
Boundary
©2009 Google
© 2009 Europa Technologies
39°53'31.21" N 75°08'48.14" W elev 19 ft
Eye alt 3552 ft
Imagery Date: Jul 5, 2007

Cyperus difformis L. Variable Flat Sedge
Cyperus erythrorhizos Muhl. Red-Root Flat Sedge
Cyperus odoratus L. Rusty Flat Sedge
Cyperus squarrosus L. Awned Flat Sedge
Dactylis glomerata L. Orchard Grass
Daucus carota L. Queen Anne's-Lace
Dennstaedtia punctilobula (Michx.) T. Moore Eastern Hay-Scented Fern
Dianthus armeria L. Deptford Pink
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark Tapered Rosette Grass
Dichanthelium acuminatum var. *lindheimeri* (Nash) Gould & C.A. Clark
Dichanthelium scoparium (Lam.) Gould Velvet Rosette Panic Grass
Digitaria ischaemum (Schreb.) Schreb. Ex Muhl. Smooth Crab Grass
Digitaria sanguinalis (L.) Scop. Hairy Crab Grass
Eleocharis obtusa (Willd.) J.A. Schultes Blunt Spike-Rush
Elymus riparius Wieg. River-Bank Wild Rye
Eragrostis pectinacea (Michx.) Nees ex Steud. Purple Love Grass
Eragrostis spectabilis (Pursh) Steud. Petticoat-Climber
Erechtites hieraciifolia (L.) Raf. Ex DC. American Burnweed
Eupatorium hyssopifolium L. Hyssop-Leaf Thoroughwort
Eupatorium serotinum Michx. Late-Flowering Thoroughwort
Euthamia graminifolia (L.) Greene Flat-Top Goldentop
Forsythia x intermedia Zabel Showy Forsythia
Fraxinus americana L. White Ash
Gymnocladus dioicus (L.) K. Koch Kentucky Coffeetree
Helianthus tuberosus L. Jerusalem Artichoke
Helenium autumnale L. Common Sneezeweed
Hieracium pilosella L. Mouse-Ear Hawkweed
Hibiscus moscheutos L. Marsh Mallow
Hibiscus syricus L. Rose of Sharon
Hordeum jubatum L. Fox-Tail Barley
Hypericum punctatum Lam. Spotted St. John's-Wort
Impatiens capensis Meerb. Spotted Touch-Me-Not
Iris pseudoacorus L. Yellow Iria
Juncus dichotomus Elliot Forked Rush
Juncus effusus L. Lamp Rush
Juncus tenuis Willd. Poverty Rush
Latuca spp. Wild Lettuce
Lemna minor L.
Leersia oryzoides (L.) Sw. Rice Curt Grass
Lobelia chinensis Lour. Chinese Lobelia
Lolium arundinaceum (Schreb.) S.J. Darbyshire Tall Rye Grass
Lonicera japonica Thunb. Japanese Honeysuckle
Lonicera morrowii Gray Morrow's Honeysuckle
Lycopus americanus Muhl. Ex W. Bart. Cut-Leaf Water-Horehoud
Lycopus rubellus Moench. Taper-leaf Water horehound
Lythrum salicaria L. Purple Loosestrife
Melilotus officinalis (L.) Lam. Yellow Sweet-Clover

Morus alba L. White Mulberry
Nuphar lutea (L.) Sm. ssp. *advena* (Aiton) Kartesz & Gandhi Yellow Pond Lily
Oenothera biennis L. King's-Cureall
Onoclea sensibilis L. Sensitive Fern
Osmunda regalis L. Royal Fern
Oxalis stricta L. Upright Yellow Wood-Sorrel
Panicum capillare L. Common Panic Grass
Panicum dichotomiflorum Michx. Fall Panic Grass
Panicum virgatum L. Wand Panic Grass
Parthenocissus quinquefolia (L.) Planch. *Virginia*-Creeper
Paulownia tomentosa (Thunb.) Sieb. & Zucc. Ex Steud. Princesstree
Petrorhagia prolifera (L.) P.W. Ball & Heywood Childing-Pink
Phragmites austrais (Cav.) Trin. Ex Steud. Common Reed
Phytolacca americana L. American Pokeweed
Pilea pumila (L.) A. Gray Clearweed
Plantago lanceolata L. English Plantain
Platanus hybrida Brot. London Planetree
Polygonum cuspidatum Sieb. & Zucc. Japanese Knotweed
Polygonum hydropiperoides Michx. Swamp Smartweed
Polygonum lapathifolium L. Dock-Leaf Smartweed
Polygonum perfoliatum L. Asiatic Tearthumb
Polygonum punctatum Elliot Dotted Smartweed
Populus deltoids Bartr. Ex Marsh. Eastern Cottonwood
Potentilla erecta (L.) Raeusch. Erect Cinquefoil
Prunus serotina Erh. Black Cherry
Pseudognaphalium obtusifolium (L.) Hilliard & Burtt Blunt-Leaf Rabbit-Tobacco
Pyrus calleryana Dcne. Bradford Pear
Quercus palustris L. Pin Oak
Rhus copallinum L. Winged Sumac
Rhus typhina L. Stag-Horn Sumac
Robinia pseudoacacia L. Black Locust
Rudbeckia hirta L. Black Eyed Susan
Rubus allegheniensis Porter Allegheny Blackberry
Rubus flagellaris Willd. Northern Dewberry
Rubus laciniatus Willd. *Cut-Leaf Blackberry*
Rumex altissimus Alph. Wood Pale Dock
Rumex crispus L. Curly Dock
Rumex obtusifolius L. Bitter Dock
Salix fragilis L. Fragile Willow
Salix nigra Marsh. Black Willow
Sambucus nigra L. var. *Canadensis* (L.) R. Bolli American Elderberry
Scirpus cyperinus (L.) Kunth Cottongrass Bulrush
Setaria parviflora (Poir.) Kerguélen Marsh Bristle Grass
Setaria pumila (Poir.) Roemer & J.A. Schultes Yellow Bristle Grass
Sisyrinchium angustifolium P. Mill. Narrow-Leaf Blue-Eyed-Grass
Solidago altissima L. Tall Goldenrod
Solidago canadensis L. Canadian Goldenrod

Solidago gigantea Ait. Late Goldenrod
Solidago rugosa P. Mill. Wrinkle-Leaf Goldenrod
Solidago sempervirens L. Sea-Side Goldenrod
Sporobolus vaginiflorus (Torr. Ex Gray) Wood Poverty Dropseed
Symphyotrichum novae-angliae (L.) G.L. Nesom New England Aster
Symphyotrichum pilosum (Willd.) Nesom White Oldfield American-Aster
Thelypteris palustris Schott Eastern Marsh Fern
Toxicodendron radicans (L.) Kuntze Eastern Poison-Ivy
Tridens flavus (L.) A.S. Hitchc. Tall Redtop
Trifolium pratense L. Red Clover
Trifolium repens L. White Clover
Ulmus pumila L. Siberian Elm
Ulmus rubra Muhl. Slippery Elm
Urtica dioica L. Stinging Nettle
Vaccinium corymbosum L. Highbush Blueberry
Verbascum blattaria L. White Moth Mullein
Verbascum thapsus L. Great Mullein
Verbena urticifolia L. White Vervain

Approximately 158 species

Yellow Names are PA Listed Species

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

SPECIES ABSENCE FORM

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia
Survey Date/s 10/6, 14; 11/19/2009	Surveyor J.R. Arsenault
Amount of time spent surveying area 11.5 manhours	
Name of site owner Department of the Navy	
Directions to site Broad Street, Philadelphia to Navy Yard, access east end	
GPS (decimal degrees preferred) approximate center point of site N039.8913638 W075.1430851	
Scientific name/s of target species SEE ATTACHED TARGET SPECIES LIST	
Site habitat description Various: upland old field, woodland, tidal & non-tidal wetland	
Substrate/soil type Fill: Dredge spoil + land fill	
System: ✓ Terrestrial ✓ Palustrine ✓ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy	<25'	60%	BOX ELDER, TREE OF HEAVEN
Tree sub-canopy			
Tall shrub(>1 m)	<10	20%	SILKY DOGWOOD, ELDERBERRY
Short shrub(<1 m)	<5	20-50	Common + Cut Leaf Blackberry
Herbaceous		10-100	Phragmites, late Goldenrod
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

SEE ATTACHED TARGET SPECIES LIST

Estimate of immediate area that is potential habitat for target SOSC

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

FERNALD (1950) Gleason (1991) FNA (1999)

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	✓ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

✓ Elements may have never occurred here – 1st time area searched

Other: succession

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC

GPS coordinates (decimal degrees preferred)

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	Flat	Open	Crest	___ Inundated (hydric)	___ Min
E	0-10%	Partial	Upper slope		___ Max
S	10-35%	Filtered	Mid-slope	___ Saturated (wet-mesic)	
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	___ Moist (mesic)	
NW					
SE				___ Dry (mesic)	
SW					
None				___ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf		1-10	1 YD 2	Annuals	Very feeble
In bud		11-50	1-5 YD 2	% Seedlings	Feeble
In flower		51-100	5-10 YD 2	% Immature	Normal
Immature fruit		101-1000	10-100 YD 2	% 1st year	Vigorous
Mature fruit		1001-10K	100 YD 2 - 2 AC	% Mature	Exceptional vigor
Seed dispersing		10K+	2+ ACRES	% Senescent	
		EST #	EST AREA		

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Species of Special Concern: Absence and Rationale

The following species do not have habitat on the Navy Yard due to the lack of tide marsh:

- Amaranthus cannabinus-tide marsh
- Bidens laevis-tide marsh
- Echinochloa walteri-tide marsh
- Schoenoplectus fluviatilis-tide marsh
- Zizania aquatic-tide marsh

The following tidal mud flat species do not have suitable habitat on the Navy Yard Delaware River shoreline due to high energy tidal flow:

- Bidens bidentoides-tidal edges, plenty of rubble, no plnats
- Elatine Americana-lower tide mud flats
- Eleocharis obtusa var. peasei-tide marsh
- Eleocharis parvula-tide and freshwater edges
- Heteranthera multiflora-tide mud flats
- Lycopus rubellus-tide mud flats
- Sagittaria calycina var. spongiosa
- Sagittaria subulata-tde mud flats
- Schoenoplectus smithii-pond edges, tide edges

The following tidal mud flat species have very limited habitat in the ship slip on the northern edge of the Navy Yard, and were not found during the site inspections:

- Bidens bidentoides-tidal edges on rubble
- Elatine Americana-lower tide mud flats
- Eleocharis obtusa var. peasei-tide marsh
- Eleocharis parvula-tide and freshwater edges
- Heteranthera multiflora-tide mud flats
- Sagittaria calycina var. spongiosa
- Sagittaria subulata-tde mud flats
- Schoenoplectus smithii-pond edges, tide edges

The following old field species have limited habitat yet were not found during the site inspections:

- Andropogon gyrans-old field
- Aristida longespica var. geniculata-dry old field
- Baccharis halimifolia-disturbed areas
- Cirsium horridulum-old field, disturbed areas
- Euthamia tenuifolia-old field

- Hypericum stragulum-uplands
- Juncus dichotomus-old field
- Panicum commonsianum var. commonsianum-upland
- Panicum polyanthes-moist old field
- Physalis virginiana-old field
- Strophostyles umbellate-upland old field
- Triplasis purpurea-dry disturbed habitats
- Tripsacum dactyloides-moist open areas

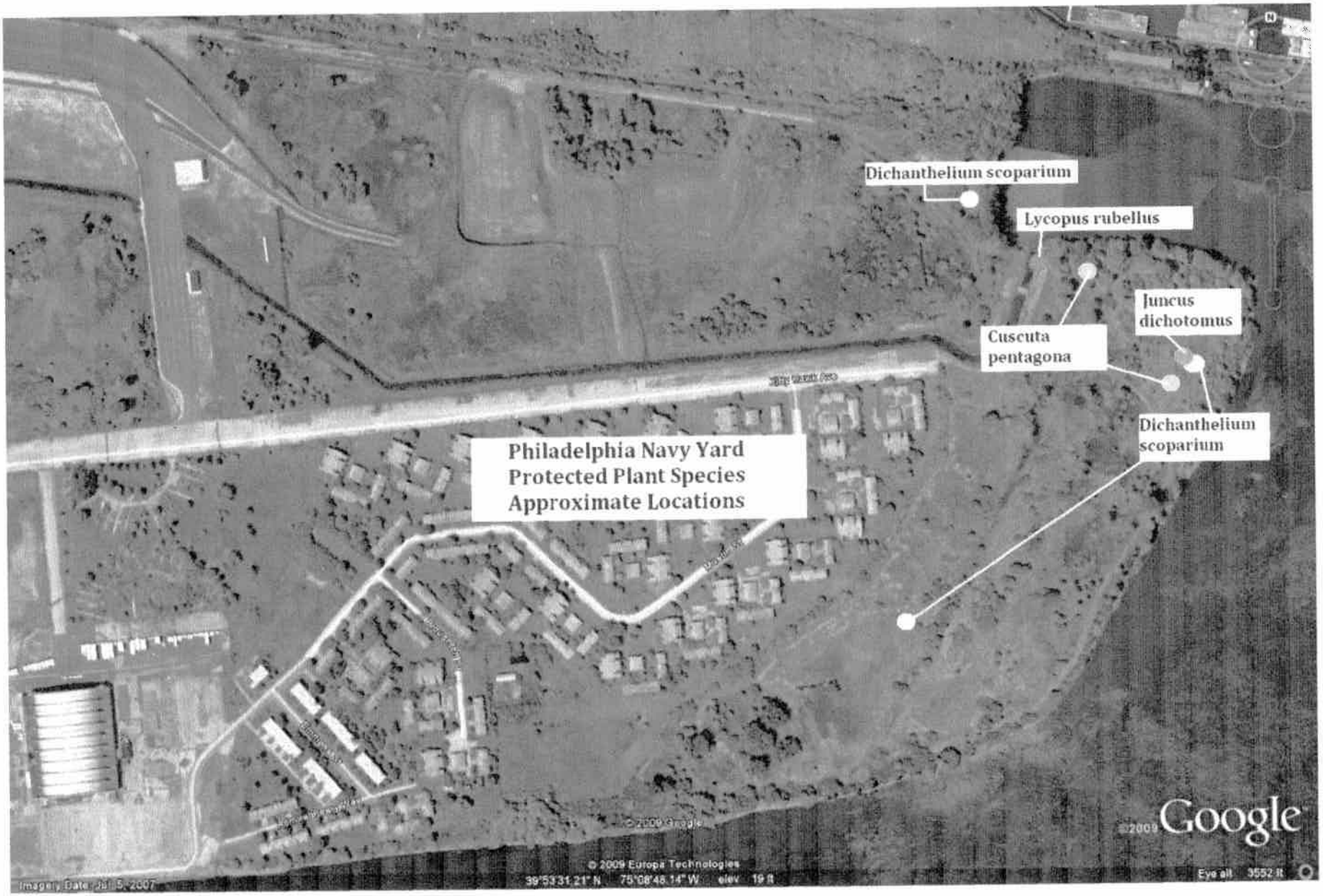
The following non-tidal wetland species were not discovered during the site inspections:

- Cyperus diandrus-freshwater wetland, puddles
- Tripsacum dactyloides-moist open areas

Navy Yard - October 6, 14, November 19, 2009
Acer negundo L. Ash-Leaf Maple
Acer rubrum L. Red Maple
Acer saccharinum L. Silver Maple
Achillea millefolium L. Common Yarrow
Ageratina altissima (L.) King & H.E. Robins. White Snakeroot
Agrimonia parviflora Aiton Harvest Lice
Agrostis perennans (Walt.) Tuckerman Upland Bent
Agrostis stolonifera L. Spreading Bent
Ailanthus altissima (P. Mill.) Swingle Tree-of-Heaven
Alliaria petiolata (M. Bieb.) Cavara & Grande Garlic mustard
Allium vineale L. Crow Garlic
Ambrosia artemisiifolia L. Annual Ragweed
Amorpha fruticosa L. False Indigo-Bush
Ampelopsis brevipedunculata (Maxim.) Trautv. Porcelainberry
Andropogon virginicus L. Broom-Sedge
Apocynum cannabinum L. Indian-Hemp
Aristida oligantha Michx. Prairie Three-Awn
Artemisia annua L. Annual Wormwood
Artemisia vulgaris L. Common Wormwood
Asclepias incarnata L. Swamp Milkweed
Asclepias syriaca L. Common Milkweed
Asplenium platyneuron (L.) B.S.P. Ebony Spleenwort
Barbarea vulgaris W.T. Aiton Yellow Rocket
Betula populifolia Marsh. Gray Birch
Bidens frondosa L. Devil's Beggartick
Boehmeria cylindrical (L.) Sw. Small-Spike False Nettle
Bromus japonicus Thunb. Ex Murr. Japanese Brome
Carex scoparia Schkuhr ex Willd. Pointed Broom Sedge
Carex sp. Unidentified river bank species
Carex annectens E.P. Bicknell Yellow Fruited Sedge
Carex frankii Kunth. Frank's Sedge
Carex longii Mackenzie Long's Sedge
Carex scoparium Schkuhr ex Willd. Broom Sedge
Celastrus orbiculata Thunb. Asian Bittersweet
Celtis occidentalis L. Common Hackberry
Cethalanthus occidentalis L. Buttonbush
Cirsium arvense L. Canada Thistle
Chamaesyce maculata (L.) Small Spotted Sandmat
Chenopodium album L. Lamb's-Quarters
Chenopodium ambrosioides L. Mexican-Tea
Clematis terniflora DC. Sweet Autumn Virgin's-Bower
Conyza canadensis (L.) Cronq. Canadian Horseweed
Cornus amomum P. Mill. Silky Dogwood
Coronilla varia L. Purple Crown-Vetch
Cuscuta pentagona Emgelm. Five Angle Dodder
Cyperus amuricus Maxim. Asian Flat Sedge

Species of Special Concern Descriptions

Approximate Species Location Graphic
Field Survey Forms: Presence
Species Specific Documentation


Philadelphia Navy Yard
Protected Plant Species
Approximate Locations
Dichanthelium scoparium
Lycopus rubellus
Cuscuta pentagona
Juncus dichotomus
Dichanthelium scoparium
© 2009 Google
© 2009 Europa Technologies
39°53'31.21" N 75°08'48.14" W elev 19 ft
Eye alt 3552 ft
Imagery Date: Jul 5, 2007

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County PHILADEPHIA	Quad PHILADELPHIA, PA
Survey Date/s 10/6, 14; 11/19/2009	Surveyor J. Arsenault
Amount of time spent surveying area 11.5 man hours	
Name of site owner Department of Navy	
Directions to site Follow Broad St. South into Navy Yard. ACCESS EAST END OF KITTY HAWK AVE.	
GPS (decimal degrees preferred) approximate center point of site 1) N39.8932270, W75.1425998 2) N39.8928308, W75.1421771	
Scientific name/s of target species Cuscuta pentagona Engelm.	
Site habitat description dry oldfield	
Substrate/soil type Fill: landfill	
System: ✓ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5'	80%	GOLDENRODS, warm/cool season grasses
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC < 1.5 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.) Plants database
Fernald (1950) G&C (1950; 1991) USDA (2009)

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Follow gravel road east from Kitty Hawk (approx 800'), turn left (N) into old field.

GPS coordinates (decimal degrees preferred) 2 separate sites.
1) N39.8932270 W75.1425982
2) N39.8928308 W75.1421771

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	✓ Flat	✓ Open	Crest	___ Inundated (hydric)	___ Min
E	✓ 0-10%	Partial	Upper slope		19 Max
✓ S	10-35%	Filtered	✓ Mid-slope	___ Saturated (wet-mesic)	(USGS)
W	35+%	Shaded	Lower slope		
NE	Vertical		Bottom	___ Moist (mesic)	
NW					
SE				___ Dry (mesic)	
SW					
None				✓ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]		*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
In leaf	✓	1-10		1 YD 2	✓ Annuals	Very feeble
In bud		11-50		✓ 1-5 YD 2	% Seedlings	✓ Feeble
✓ In flower		51-100		✓ 5-10 YD 2	% Immature	✓ Normal
Immature fruit		101-1000		10-100 YD 2	% 1st year	Vigorous
Mature fruit		1001-10K		100 YD 2 – 2 AC	% Mature	Exceptional vigor
Seed dispersing		10K+		2+ ACRES	% Senescent	
		EST #		EST AREA		

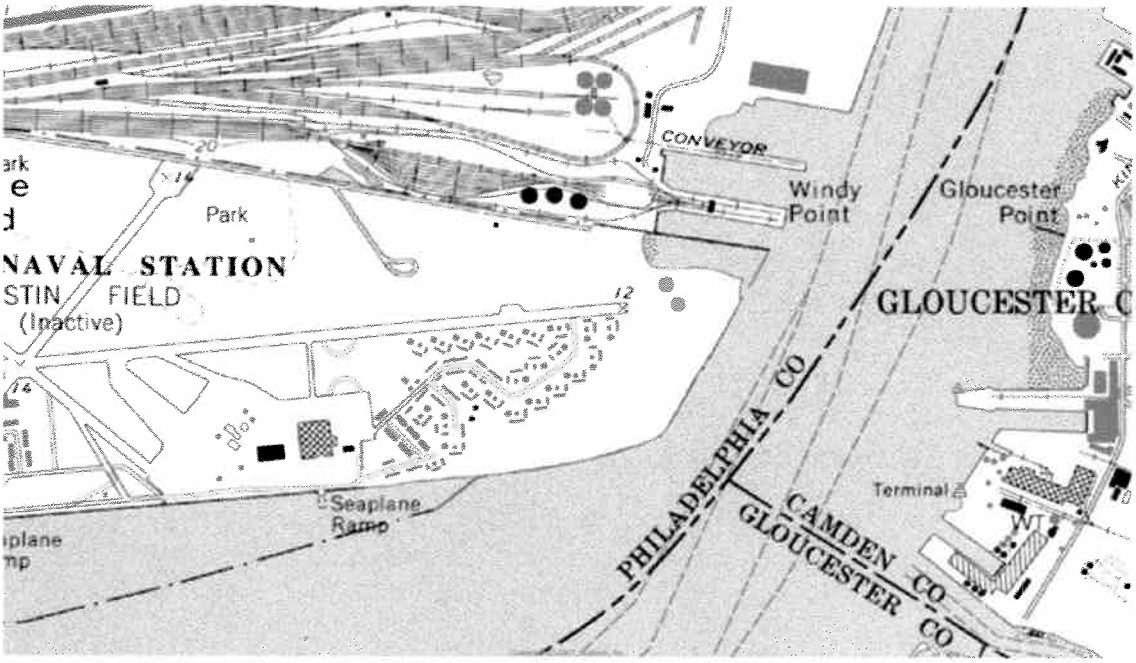
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) small, few individuals on small area
Age, successional stage of system oldfield, age 39 years +/- 7 years
____ Known or ____ Inferred land use history OPEN WATER IN 1963, filled by 1970, abandoned
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance Landfill & dredge spoil site
Integrity/fragmentation of community weakly connected to other old fields in the water front, otherwise fragmented
List of invasive species (alien or native) (see site species list) extensive invasive flora
Threats (on-site) development
Threats (off-site) industrial zoning
List other members of this genus that occur on site. Hybridization? none
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Cuscuta pentagona Engelm.

Bush-Clover Dodder

Location of 2 Populations on Philadelphia, PA USGS Topographic Map



1: 039.8932270N, 075.1425998W
2. 039.8928308N, 075.1421771W

Bush-clover dodder has two populations in the old field habitat, at east end of Navy Yard.

Population Size:

#1: One small intertwined cluster of plants near fence.

#2: Less than 5 twining clusters.

Navy Yard Habitat:

This species is found exclusively on common mugwort in an upland old field habitat.

Bush-Clover Dodder Photos

View of old field habitat. Mugwort in foreground supports population #2

Cuscuta pentagona on *Artemisia vulgaris* at population #2

Close view of *Cuscuta pentagona* showing 5-merous flowers.

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia, PA
Survey Date/s 10/6, 14; 11/19/2009	Surveyor J. Arseneault
Amount of time spent surveying area 11.5 man hours	
Name of site owner Department of the Navy	
Directions to site Broad Street south into Navy Yard, access east end of Kitty Hawk Avenue.	
GPS (decimal degrees preferred) approximate center point of site N 039.8913638 ; W075.1430851	
Scientific name/s of target species Dichanthelium scoparium (Lam) Gould	
Site habitat description old field	
Substrate/soil type fill: land fill	
System: ✓ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5	80%	warm/cool season grasses, goldenrods
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC < 3 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

Flora North America VOL 25

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Follow gravel road at east end Kitty Hawk Ave 800' east, plant found in numerous old field patches.

GPS coordinates (decimal degrees preferred) 3 SITES ESTIMATED AT:
1) 039.8929514N W 075.1414873 2) N 39.8940195 W 75.1435120 3) N 39.8905915 W 75.1432896

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	___ Flat	✓ Open	___ Crest	___ Inundated (hydric)	19 Min
E	✓ 0-10%	___ Partial	___ Upper slope		___ Max
✓ S	___ 10-35%	___ Filtered	✓ Mid-slope	___ Saturated (wet-mesic)	USGS
W	___ 35+%	___ Shaded	___ Lower slope		
NE	___ Vertical		___ Bottom	___ Moist (mesic)	
NW					
SE				✓ Dry (mesic)	
SW					
None				✓ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]		*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
✓ In leaf		1-10		1 YD 2	Annuals	Very feeble
In bud		11-50		1-5 YD 2	% Seedlings	Feeble
In flower	✓	51-100		5-10 YD 2	% Immature	Normal
Immature fruit		101-1000		✓ 10-100 YD 2	% 1st year	✓ Vigorous
✓ Mature fruit		1001-10K		100 YD 2 – 2 AC	100 % Mature	Exceptional vigor
Seed dispersing		10K+		2+ ACRES	% Senescent	
		EST #		EST AREA		

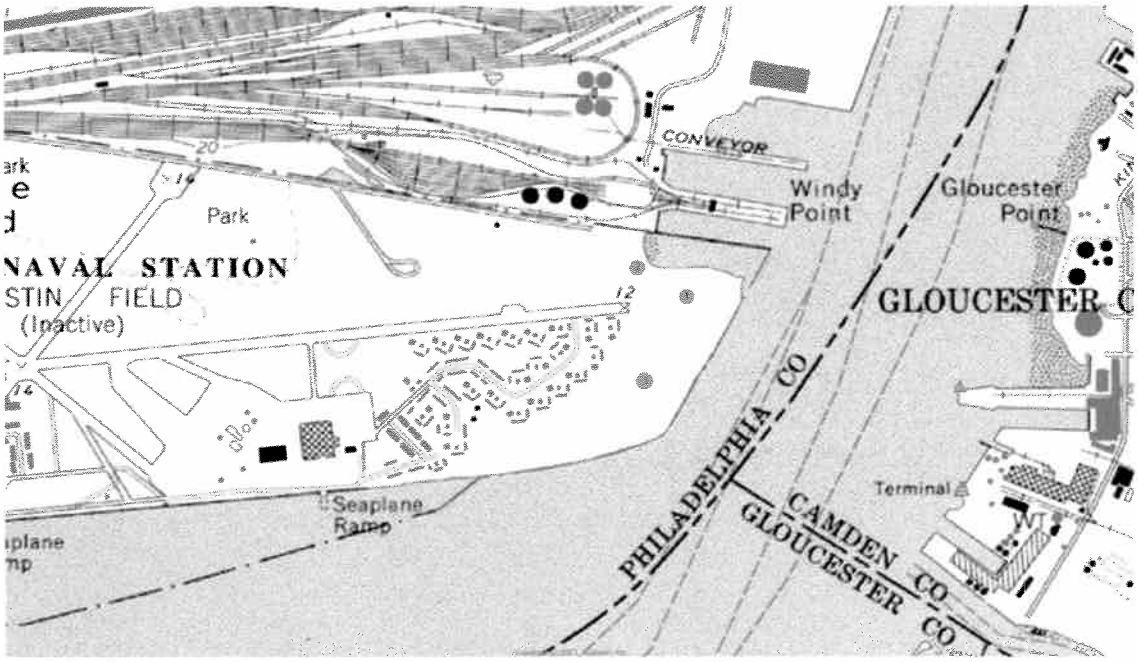
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) similar population size & distribution to others S&E on Coastal Plain
Age, successional stage of system old field, 39 years +/- 7 years
✓ Known or ____ Inferred land use history OPEN WATER in 1965, Filled by 1970, abandoned
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance Fill: Land Fill & dredge spoil
Integrity/fragmentation of community Fragmented by urban setting
List of invasive species (alien or native) many invasive species in flora, see attached species list.
Threats (on-site) development
Threats (off-site) industrial zoning
List other members of this genus that occur on site. Hybridization? Dichanthelium acuminatum, clandestinum
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Dichanthelium scoparium (Lam.) Gould

Velvet Rosette Panic Grass

Location of 3 Populations on Philadelphia, PA USGS Topographic Map



1: N039.8929514/W075.1414873 2: 039.8940195/075.1435120 3: 039.8905915/075.1432896

Three separate Velvet Rosette Panic Grass populations in open, old field habitats

Population Size:

#1: An unknown number of individual rosette scattered within a ~50' X 100' space at the northern end of the old field.

#2: Less than twenty individual clumps within a space of 4' X 10'. These plants occupy a narrow overgrown road cut, east of the Navy Yard's shooting range backstop.

#3: Small cluster of rosettes, multiple stems from a ~10' X 10' patch within an otherwise *Phragmites australis* dominated area.

Navy Yard Habitat:

Old field plant community dominated by *Andropogon virginicus, Dactylis glomerata, Melilotus officinalis, Artemisia vulgaris, Solidago altissima* established on a spoil and land fill substrates.

Velvet Rosette Panic Grass Habitat and Species Specific Photos

View of old field habitat located on east end of Navy Yard, north of gravel access road

Fall habit of *Dichanthelium scoparium*: multiple branches from an unknown number of plants

Close view of Velvet Rosette Panic Grass

Return to Deb Fisler, Ecological Services Section, DCNR/BOF/PNDI, P.O. Box 8552, Harrisburg, PA 17105-8552

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia, PA
Survey Date/s 10/6,14; 11/19/2009	Surveyor J. Arsenault
Amount of time spent surveying area 11.5 manhours	
Name of site owner Department of the Navy	
Directions to site Follow Broad Street south into Navy Yard, access east end Kitty Hawk Avenue.	
GPS (decimal degrees preferred) approximate center point of site N 039.8913638 W 075.1430851	
Scientific name/s of target species Juncus dichotomus Ell.	
Site habitat description old Field	
Substrate/soil type Fill	
System: ✓ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5	80	warm & cool season Grasses
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC <1.5 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

Fernald (1950) FNA vol 22

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Follow gravel road east 800' from Kitty Hawk Ave terminus, turn left (N) ~200' into old field, marked with orange ribbon

GPS coordinates (decimal degrees preferred)

N039.8929514 W075.141873

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
___ N	___ Flat	✓ Open	___ Crest	___ Inundated (hydric)	19 Min
___ E	✓ 0-10%	___ Partial	___ Upper slope		___ Max
✓ S	___ 10-35%	___ Filtered	✓ Mid-slope	___ Saturated (wet-mesic)	USGS
___ W	___ 35+%	___ Shaded	___ Lower slope		
___ NE	___ Vertical		___ Bottom	___ Moist (mesic)	
___ NW					
___ SE				___ Dry (mesic)	
___ SW					
___ None				✓ Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]		*Genets*[2]	*Population Area*	*Age Structure*	*Vigor*
___ In leaf	✓	1-10		✓ 1 YD 2	___ Annuals	___ Very feeble
___ In bud		11-50		___ 1-5 YD 2	___ % Seedlings	✓ Feeble
___ In flower		51-100		___ 5-10 YD 2	___ % Immature	___ Normal
___ Immature fruit		101-1000		___ 10-100 YD 2	___ % 1st year	___ Vigorous
✓ Mature fruit		1001-10K		___ 100 YD 2 – 2 AC	100 % Mature	___ Exceptional vigor
✓ Seed dispersing		10K+		___ 2+ ACRES	___ % Senescent	
		EST #		EST AREA		

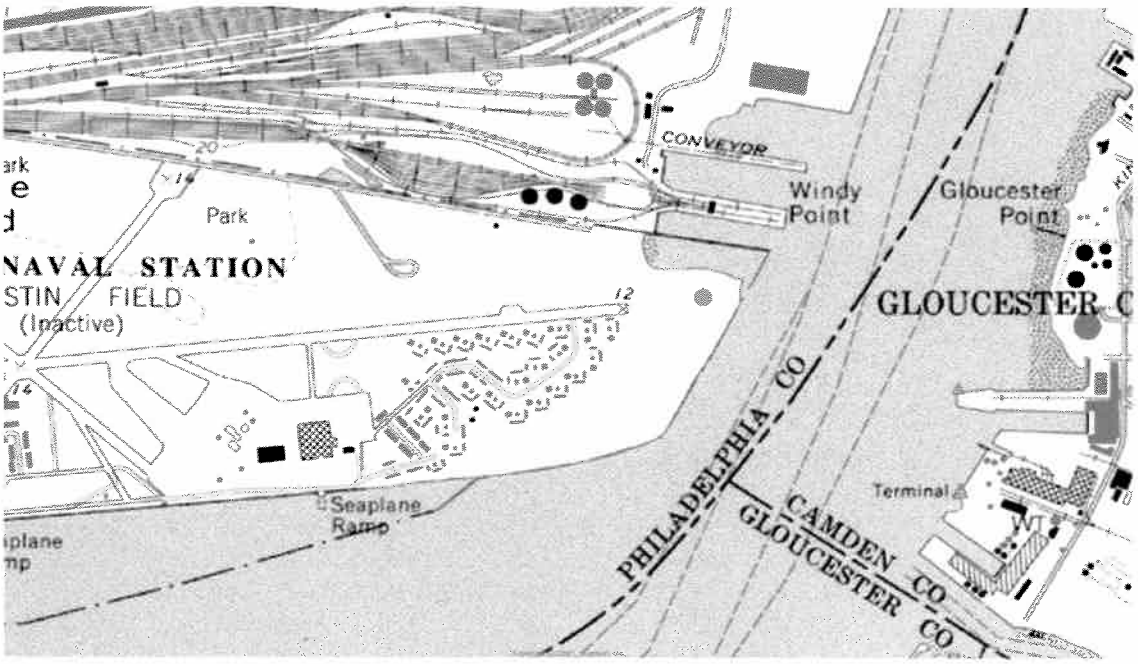
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) small, one 2'x2' clump.
Age, successional stage of system oldfield, 39 years +/- 7 years
✓ Known or ____ Inferred land use history OPEN WATER IN 1963; filled by 1970, abandoned
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance Fill
Integrity/fragmentation of community Fragmented
List of invasive species (alien or native) numerous invasive species in flora, see species list.
Threats (on-site) development
Threats (off-site) industrial zoning
List other members of this genus that occur on site. Hybridization? Juncus tenuis, J. effusus
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Juncus dichotomus Ell.

Forked Rush

Location of 1 Population on Philadelphia, PA USGS Topographic Map



1: N039.8929514/W075.1414873

Forked Rush population is in open, old field habitat at east end of Navy Yard

Population Size:

#1: A small cluster, found within a ~2' X 2' area within the Velvet Rosette Panic Grass colony #1. The number of plants is estimated under 10 plants.

Navy Yard Habitat:

Old field plant community dominated by *Andropogon virginicus, Dactylis glomerata*, *Melilotus officinalis, Artemisia vulgaris, Solidago altissima* established on a spoil and land fill substrates. The Forked Rush is located in the center of the *Dichanthelium scopariun* population #1.

Forked Rush Habitat and Species Specific Photos

View of old field habitat located on east end of Navy Yard, north of gravel access road

Fall view of *Juncus dichotomus* Ell., Forked Rush: Upright stems from a cluster of plants

Botanical Field Survey Form for Environmental Review

If botanist finds species of special concern on site, immediately contact our office at 717-787-3444 or dfisler@state.pa.us as we will likely want to revisit the population while it is still an appropriate time. Failure to contact our office immediately may result in a delay until next year's growing season.

Fill out form multiple times if searched different habitats for species of special concern (SOSC).

PNDI #	
County Philadelphia	Quad Philadelphia, PA
Survey Date/s 10/6, 14, 11/19/2009	Surveyor J. Arsenault
Amount of time spent surveying area 11.5 man hours	
Name of site owner Department of the Navy	
Directions to site Follow Broad Street south into Navy Yard, access east end of Kitty Hawk Avenue.	
GPS (decimal degrees preferred) approximate center point of site N039.8913638 W075.1430851	
Scientific name/s of target species Lycopus rubellus Moench.	
Site habitat description low energy rock/rubble tidal shoreline.	
Substrate/soil type Fill	
System: ___ Terrestrial ___ Palustrine ___ Estuarine	

Community Description (describe below)

Strata/life form	*Height*	*% Cover*	*Most abundant/characteristic species*
Emergent tree			
Tree canopy			
Tree sub-canopy			
Tall shrub(>1 m)			
Short shrub(<1 m)			
Herbaceous	<5	<10%	smartweed, dock, false indigo
Non-vascular			
Epiphyte/liana			

Other PA listed species that were not targeted for survey but may potentially exist on site-review PNDI list (http://www.naturalheritage.state.pa.us/PlantsPage.aspx) for species with similar preferred habitat

Estimate of immediate area that is potential habitat for target SOSC < 1.5 acres

Identification problems? If yes, explain.

NO

References used (flora, experts, herbaria, etc.)

Fernald (1950) G&C (1950, 1991)

Include topographic map with development site, potential target species habitat, and found populations of SOSC all clearly delineated. Additional detail is welcome.

Include photographs of habitat and, if found, SOSC. Submit digital photos electronically.

If SOSC was/were not found, check all reasons that apply:

___ Ambiguous directions	___ Disturbances	___ Exotics	___ Habitat destroyed
___ Time of year	___ Unsuitable habitat	___ Weather	___ Insufficiently/incompletely surveyed

___ Elements may have never occurred here – 1st time area searched

___ Other:

If previously known from this site, do you believe the species is/are now extirpated? ____ yes ____ no
Explain:

Botanist only needs to continue if SOSC was/were found on site. Fill out form that follows multiple times if more than one SOSC was located.

Directions (within site) to SOSC Northern, down stream terminus of stormwater ditch N. Kittyhawk Ave.

GPS coordinates (decimal degrees preferred)

N039.8936577 W075.1428223

Small populations – GPS center point and list radius necessary to enclose whole population
Large populations – GPS multiple points around population perimeter

Habitat of SOSC (describe below)

Aspect	*Slope*	*Light*	*Topo Position*	*Moisture*	*Elevation*
N	✓ Flat	Open	Crest	✓ Inundated (hydric)	3 Min
E	0-10%	✓ Partial	Upper slope		Max
S	10-35%	Filtered	Mid-slope	Saturated (wet-mesic)	
✓ W	35+%	Shaded	Lower slope		
NE	Vertical		✓ Bottom	Moist (mesic)	
NW					
SE				Dry (mesic)	
SW					
None				Dry (xeric)	

Plant Biology (describe below)

Phenology	*Ramets*[1]	*Genets*[2]		*Population Area*	*Age Structure*	*Vigor*
In leaf	✓	1-10		✓ 1 YD 2	Annuals	Very feeble
✓ In bud		11-50		1-5 YD 2	% Seedlings	✓ Feeble
✓ In flower		51-100		5-10 YD 2	% Immature	Normal
✓ Immature fruit		101-1000		10-100 YD 2	% 1st year	Vigorous
✓ Mature fruit		1001-10K		100 YD 2 – 2 AC	100 % Mature	Exceptional vigor
Seed dispersing		10K+		2+ ACRES	% Senescent	
		EST #		EST AREA		

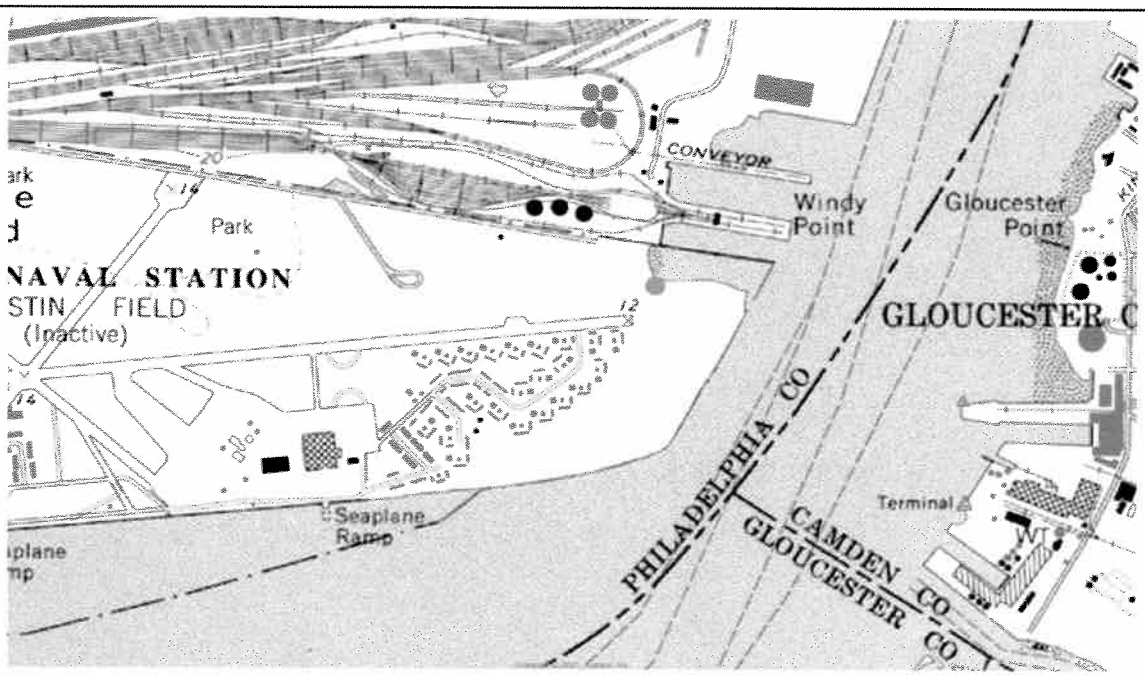
[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Biology comments
Population size, relative to other occurrences you have observed (state whether full extent of occurrences is known) small, 1 plant
Age, successional stage of system 7 years, rock/riprap tiledge
✓ Known or ____ Inferred land use history ditch created open water 1965, fill by 1970, between 2003-2004
Chemical treatment (known or suspected) with herbicides, pesticides, other unknown
Other anthropogenic or unnatural disturbance excavations
Integrity/fragmentation of community fragment
List of invasive species (alien or native) Amorpha fruticosa
Threats (on-site) scour
Threats (off-site) development
List other members of this genus that occur on site. Hybridization?
Specimen taken? Specimen label data, repository and number
Conservation recommendations (include details on how to best avoid, minimize, and mitigate impacts)

Lycopus rubellus Moench.

Taper-leaf Water-Horehound

Location of 1 Population on Philadelphia, PA USGS Topographic Map



1: N039.8936577/W075.1428223

Water-horehound population at mouth of storm water ditch, on south bank, at east end of Navy Yard

Population Size:

#1: One small cluster, found within a 6" x 6" area. Two plants discovered at top of the high tide line, in a rip-rap rubble and mud substrate.

Navy Yard Habitat:

This species is found at the upper edge of the freshwater tide line on a muddy bank, with *Rumex altissima* and *Polygonum punctatum*.

Taper-leaf Water Horehound Photos

View of tidal habitat located in ditch on east end of Navy Yard. *Lycopus rubellus* was identified on bank in lower left of photo.

Most of the Navy Yard river shoreline is a high energy tidal system.

Substrate on river edge is scoured with few suitable sites for *Lycopus*

Botanist Resume'

Joseph Arsenault

2009 Summary Resume'

Joseph R. Arsenault

Environmental Consultant

961 Clark Avenue
Franklinville, New Jersey 08322
856-697-6044, facsimile 697-6050, e-Mail: NJ Plants@AOL.COM

Education

BA 1978, Rutgers-Camden College of Arts and Sciences: Biology
MS 1981, Graduate School -Rutgers University-New Brunswick: Biology

Experience

1980 to 1987 *NJ Department of Environmental Protection, Office of Environmental Analysis.* Position: Senior Environmental Specialist. Position required air photo interpretation, historical landscape reconstruction of New Jersey's tidelands, as well as natural resource identification, and estuarine wetland delineation.

1987 to 2009 *Environmental Consultant.* Provide professional ecological consultation for public and private concerns for projects requiring natural resource identification and environmental permitting. Wetland delineation, protected species inventory / survey, preliminary site assessment, historical site interpretations, natural resource analysis, and environmental regulation & permitting are some of the services rendered. My skills have been used for numerous projects under many circumstances across tens of thousands of acres in New Jersey and surrounding states of Pennsylvania, Delaware and Maryland.

Expertise & Skills

Aerial Photographic Interpretation: A basic tool to understand landscapes, change analysis and large-scale vegetation mapping, this skill has been applied to many projects to obtain crucial historic land use and natural resource data. I am skilled using high and low altitude photography, from panchromatic to digital color infrared on optics or computer based analytical systems.

Botany and Plant Sciences: Educated as a plant ecologist, botany plays a key role in community based decisions for projects impacting wide landscapes and specific sites. In this capacity I provided specimen identification, site-specific plant surveys, vegetation assessment, classification, plant propagation and other services related to the botanical sciences. Landscape restoration is one of the tasks that use my plant and ecosystem skills. I teach Rutgers University Continuing Education *Southern New Jersey Vegetation* developed for professional wetland certifications. I am the current chairperson for the *Flora of New Jersey Project*, a co-operative effort headquartered in Rutgers University's Chrysler Herbarium that gathers the State's botanical experts to create a modern record

of all plant distribution, modern nomenclature and rarity. Additionally, I am the honorary herbarium curator for the Philadelphia Botany Club.

Environmental Permitting Services: The intersection of science and regulation, environmental permitting is an integral part of the day-to-day activities as a consulting environmental specialist. Most permit and regulatory activities are associated with environmental regulations administered by New Jersey's Department of Environmental Protection. I have experience as well with federal and state agency regulations other than NJ DEP. In New Jersey, my skills are used for projects such as Freshwater Wetland Protection Act permits and waivers, Site Remediation activities, Coastal Area Facility Review Act (CZM), Waterfront Development, Pinelands Commission applications as well as county & township ordinance compliance.

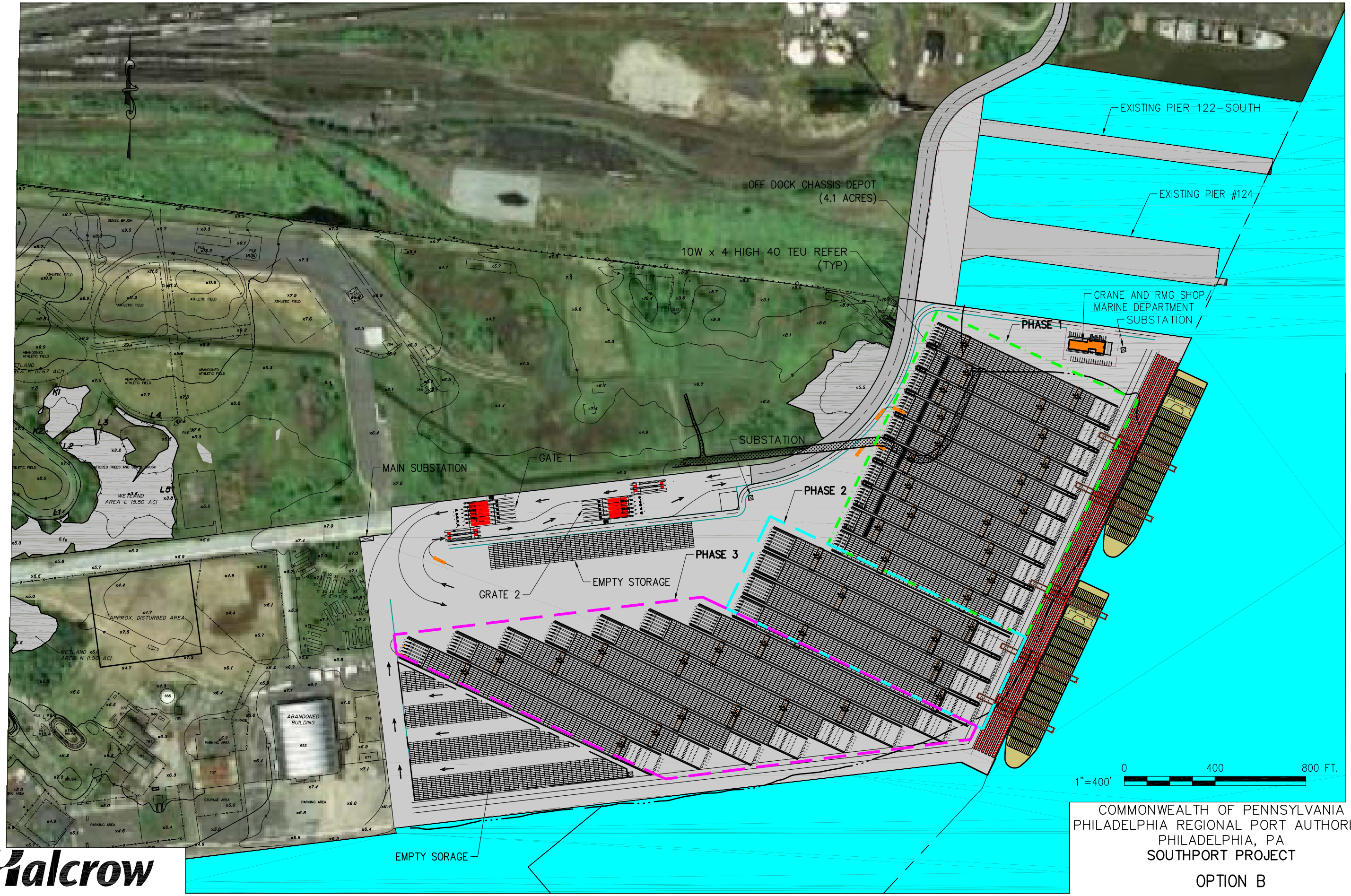
Natural Resource Inventory Services: Natural resources inventories are an important segment of my environmental services. I provide detailed landscape analysis where I provide services to locate important natural resource characters, important issues when land use decisions are made. This includes investigations into site geology and soils, vegetation analysis as well as vertebrate wildlife studies. I provide protocol development and search efforts for threatened or endangered avian and amphibian species in addition to the general fauna characterizations.

Wetland Services: This specific landscape feature is one of the most far-reaching site conditions that affect land evaluation and uses. This requires specific skills to identify vegetation and soils, provide a correct delineate and defend wetland determinations. I provide wetland services that include overlapping topics such as education, delineation, documentation, mitigation, restoration, monitoring and permitting.

Professional Associations & Appointments (*) - Partial Listing

a) American Association for the Advancement of Science
b) American Institute of Biological Sciences
c) Archaeological Society of New Jersey
d) Eastern States Archaeological Federation
e) Ecological Society of America
f) Flora of NJ Project, *Chair*
g) Franklin Township Environmental Commission*
h) New Jersey Academy of Sciences
i) New Jersey Invasive Species Council*
j) New Jersey Natural Area Council*
k) Philadelphia Botanical Club, *Honorary Herbarium Curator*
l) Society of Wetland Scientists
m) Torrey Botanical Society

References Available Upon Request



COMMONWEALTH OF PENNSYLVANIA
PHILADELPHIA REGIONAL PORT AUTHORITY
PHILADELPHIA, PA
SOUTHPORT PROJECT

OPTION B

Halcrow

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ATTACHMENT 4

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 30, 2010 **PNDI Numbers:20090901208135**

Shana Moak
Weston Solutions, Inc.
E-mail: Shana.moak@westonsolutions.com (hard copy will NOT follow)
C.C.: Sonny Rutkowski, Sonny.Rutkowski@WestonSolutions.com

Re: Philadelphia Navy Yard, SouthPort project
Philadelphia Township, Philadelphia County,

Dear Mrs. Moak,

Thank you for submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Numbers **20090901208135** for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

Potential Impacts Anticipated

PNDI records indicated species or resources of concern were located in the vicinity of the project which led DCNR to request a survey. Four species of special concern were found on the SouthPort Navy Yard site during the surveys performed by Joseph Arsenault in 2009. The species found on the SouthPort Navy Yard site included *Dichanthelium scoparium*, *Lycopus rubellus*, *Cuscuta pentagona* and *Juncus dichotomus*. DCNR has determined that impact to these species of special concern is anticipated with the development of the SouthPort project.

Next Steps

Mitigation and Monitoring:
It is our understanding that Weston Solutions plans to mitigate for the loss of tidal wetlands by replacing in kind and therefore, we believe that *Lycopus rubellus* (bugleweed), which uses shoreline habitat, can be mitigated in that process. We anticipate receiving more information on the mitigation sites and the proposed mitigation.

Cuscuta pentagona (field dodder), *Panicum scoparium* (velvety panic-grass) and *Juncus dichotomus* (forked rush), will need additional mitigation efforts since they are upland species and will not benefit from the tidal wetland mitigation. Based on the biology of these three species we recommend the collection of seed material from the individuals found on the SouthPort Navy Yard site. Transplanting plant species is rarely an effective preservation method and thus would not be suggested for this project. However, the three upland plant species found at the SouthPort site are early successional or annual and thus the collection of ripe seed and the planting of that seed in suitable habitat may facilitate better protection of the species. Therefore, we recommend that a qualified botanist visit the SouthPort site during the summer and early fall to collect all of the available seeds from *Cuscuta pentagona* (field dodder), *Panicum scoparium* (velvety panic-grass) and *Juncus dichotomus* (forked rush). We recommend

that your botanist visit the site in 2010 and 2011 prior to the start of construction to collect as much seed as possible. Once the seed is collected it should be spread at an early successional site that has been approved by our office. Ideally the location will currently have these species known on site and is therefore proven suitable habitat, or the location can be verified as suitable habitat by our office.

Because habitat for plant species of concern is also going to be taken, we request that Weston Solutions conserve suitable habitat either through the purchase and protection of suitable habitat, or by enhancing other protected sites that have exotic invasive plant species that are reducing the size and occurrence of the existing suitable habitat. This protection and enhancement may be done at the site where the seeds are planted, or at another agreed upon location.

Monitoring of the seed dispersal site and the intertidal wetland site should be conducted once a year for five years to determine if the re-location of the plant species of concern was successful. Monitoring reports may lead to suggestions for management of other populations of these species. Please know that your information and input will be put to good use.

This response represents the most up-to-date summary of the PNDI data files and is valid for one (1) year from the date of this letter. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for an additional year.

This finding applies to impacts to DCNR only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure the U.S. Fish and Wildlife Service, PA Game Commission, and the Pennsylvania Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,

Joy VanDervort-Sneed, Environmental Review Manager FOR Chris Firestone, Wild Plant Program Mgr.
Ph: 717-705-2822 ~ F: 717-772-0271 ~ c-jvanderv@state.pa.us

ATTACHMENT 5

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

1 February 2011

Emily Boyer
Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Pennsylvania Natural Diversity Inventory (PNDI) Number 20090901208135
Proposed Development of Southport, Philadelphia, PA

Dear Ms. Boyer:

On behalf of the Commonwealth of Pennsylvania Department of General Services (PADGS) and the Philadelphia Regional Port Authority (PRPA), Weston Solutions, Inc. (WESTON®) prepared an Environmental Assessment (EA) which details the affected environment and potential impacts resulting from the proposed Southport Marine Terminal Project (Southport). This EA includes a Conceptual Mitigation Plan to identify mitigation for the applicable impacts.

On 16 July 2010 WESTON submitted this EA as part of the Joint Permit Application to PADEP and USACE for review. A copy of this EA was sent to the Pennsylvania Department of Conservation and Natural Resources (DCNR) to address the questions and concerns outlined at various project meetings which included DCNR and other state and federal resource agencies, and the Pennsylvania Natural Diversity Inventory (PNDI) search (20090901208135) conducted for the project. The EA was sent to Rachel Wagoner as she was identified as the point of contact for the project. It has recently come to our attention that Ms. Wagoner did not inform you of this submittal and, therefore, that you have not had an opportunity to review this EA as it specifically pertains to the PNDI search (20090901208135) that was performed for this project and submitted to your attention. Therefore, please find the enclosed CD containing a copy of the EA and the associated project drawings (updated in December 2010) for your review. This EA includes copies of vegetation studies performed on the project site.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@westonsolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments:

Southport EA

DCNR_EA Cover letter.doc

ATTACHMENT 6

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

24 February 2011

Ms. Emily Boyer
Pennsylvania Department of
Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552

Re: Pennsylvania Natural Diversity Inventory (PNDI) Environmental Resources Review
Proposed Mitigation for the Southport Development Project, Philadelphia, PA

Dear Ms. Boyer:

The Commonwealth of Pennsylvania ("Commonwealth"), acting through its Department of General Services (DGS) and in conjunction with the Philadelphia Regional Port Authority (PRPA), is proposing to develop a new marine terminal (Southport) to be located in the City of Philadelphia, PA. The proposed Southport Marine Terminal (Southport) site extends along the Delaware River, from the east end of the former Philadelphia Naval Shipyard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal.

Wetlands and other waters regulated under federal and state law will be either temporarily or permanently impacted as a result of the proposed Southport project, requiring compensatory mitigation. Two PNDI searches (Project Search ID 20110128280491 and 2010128280499) were conducted by WESTON for the two areas originally proposed to contain the mitigation sites (Neshaminy State Park and Jack's Marina). The PNDI searches resulted in potential impacts with your agency. The species listed included *Amaranthus cannabinus, Andropogon glomeratus, Bidens bidentoides, Bidens laevis, Cuscuta campestris, Cuscuta polygonorum, Echinochloa walteri, Eleocharis obtusa var. peasei, Eleocharis parvula, Heteranthera multiflora, Ilex opaca, Lycopus rubellus, Polygonella articulate, Ptelea trifoliate, Quercus phellos, Sagittaria calycina var. spongiosa, Sagittaria subulata, Schoenoplectus fluviatilis, Schoenoplectus smithii, Strophostyles umbellate, Triplasis purpurea,* and *Zizania aquatic.* Note that the list of potential impacts included freshwater intertidal mudflats and wild rice – water hemp tidal marsh. WESTON requests that your agency review this PNDI for the presence of additional species of special concern or critical habitats on or near the site. Enclosed is a copy of the PNDI search conducted by WESTON. Also enclosed with this PNDI is a Revised Mitigation Plan including the additional studies requested by DCNR and other agencies to obtain PNDI clearance for the proposed mitigation site.

WESTON prepared and submitted an Environmental Assessment for the Proposed Southport Development Project (EA), dated July 2010. This EA included a Draft Mitigation Plan proposed

to be implemented on portions of Neshaminy State Park and the former Jack's Marina, both located at the confluence of the Neshaminy Creek and the Delaware River in Bucks County, PA. Please note the off-site mitigation currently proposed wholly occurs at the former Jack's Marina site pursuant to comments from DCNR and other resource agencies during state and federal permitting processes.

Project Narrative

Pursuant to federal and state regulatory programs and policies, it has been determined that compensatory mitigation is required to offset unavoidable impacts to wetlands and other waters of the United States, and documented sensitive species and habitats. Impacts at Southport were calculated based on the acreages of regulated wetland/water habitat within the footprint which would be either temporarily or permanently affected by construction activities.

Habitats and regulated areas within the Southport project footprint from the wharf edge inland, which will require compensatory mitigation, include the following:

- 3.75 acres of isolated, non-tidal freshwater wetlands, which are primarily dominated by common reed;
- 5.88 acres of intertidal area which consists of mostly mudflat at the north end of the project footprint and steep rocky shoreline around the periphery of the Navy Yard. The intertidal area includes 0.20 acre of emergent wetland. Also included in the 5.88 acres of intertidal impacts are 0.73 acres of a tidally influenced stormwater channel which currently exists on the Southport site. This channel will be realigned on the Southport Marine Terminal and replicated with similar rock substrate and vegetated banks to serve as habitat for eel;
- 7.24 acres of subtidal habitat that includes 1.08 acres of SAV and 0.23 acres within the dredging footprint between the federal navigation channel and east wharf edge;
- 4.71 acres of deep water habitat within the project footprint. The 4.71 acres of deep water habitat excludes the proposed dredging footprint between the federal navigation channel and wharf face;
- Upland fields containing several individuals of state-listed plant species; and
- Sensitive species' habitats include striped bass spawning area located off the southern and eastern portions of the Southport site and an abandoned bald eagle nest located in the north-central portion of the site.

The mitigation originally proposed included two primary components 1) design considerations at the Southport site to minimize the loss of deep water habitat and 2) compensation at the Neshaminy State Park and an adjacent abandoned marina (referred to as Jack's Marina) for impacts to Southport's terrestrial, wetland (non-tidal and tidal) and shallow water habitats. The Neshaminy State Park and Jack's Marina are located at the confluence of the Delaware River and Neshaminy Creek approximately 20 river miles upstream from the Southport site. Again, off-site mitigation for Southport will be implemented wholly on the Jack's Marina site.

The Commonwealth will be responsible for adhering to both the state and the federal aspects of the environmental permitting. Because of the likely impacts to waterways, the Commonwealth has engaged in preliminary conceptual discussions with the United States Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) Wildlife Service, and United States Fish and Wildlife Service (USFWS) from the Federal government as well as the New Jersey Department of Environmental Protection (NJDEP), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Game Commission (PGC), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Department of Conservation and Natural Resources (PA DCNR), and Pennsylvania Coastal Zone Management (PACZM) from other stakeholder and commenting agencies such as Delaware River Basin Commission (DRBC) and New Jersey Department of Environmental Protection (NJDEP) .

Included with the original EA was a PNDI Environmental Resources Review. Per request, another copy of the EA was sent to your attention the week of January 31. The enclosed Revised Mitigation Plan details the avoidance, minimization and proposed mitigation at Jack's Marina including the additional studies and reports completed at the request of DCNR, PFBC, PGC, USFWS, NMFS, and the EPA to further characterize and demonstrate the suitability of this site for mitigation of permanent impacts resulting from the proposed Southport Marine Terminal. This includes ecological and environmental surveys of fish, benthic, vegetation, soils, and herpetological habitats conducted at both Neshaminy State Park and Jack's Marina in response to agency comments during the summer and fall of 2010. In general, the results of these surveys support previous investigations of these sites. Copies of the available prior investigations are also provided on the enclosed CD.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information to complete your review, please do not hesitate to contact me by email at Shana.Moak@WestonSolutions.com or by phone at (610) 701-3089.

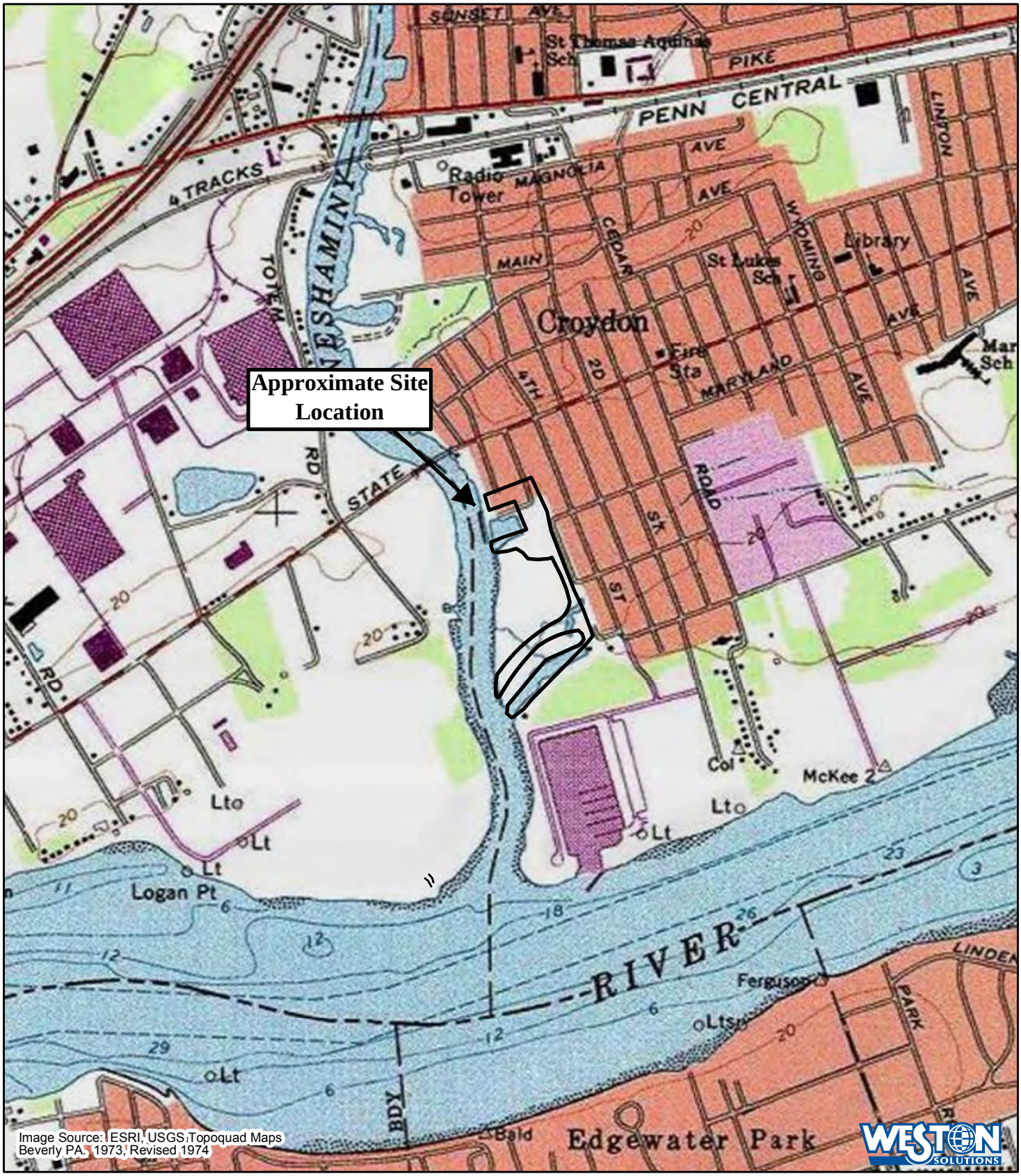
Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
- USGS Quadrangle
- PNDI Review Receipts
- Revised Mitigation Plan



Legend

Jack's Marina

N
W E
S

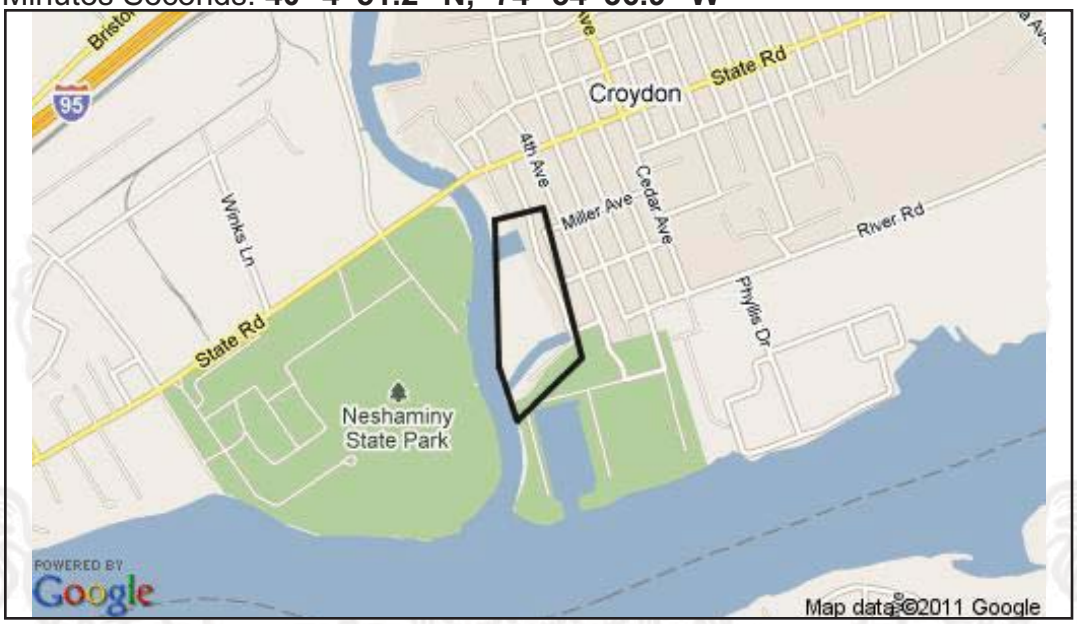
0 1,250 Feet

Southport Mitigation Site –
Jack's Marina
Bensalem, Pa

File: \\fsfed01\tig\Neshaminy State Park\MXD\quad_jacks_marina.mxd, 23-Feb-11 11:19, ricksc

1. PROJECT INFORMATION

Project Name: **Jack's Marina Mitigation Site**
Date of review: **1/28/2011 12:54:54 PM**
Project Category: **Habitat Conservation and Restoration,Wetland Restoration, Wetland Creation, or Wetland Enhancement**
Project Area: **39.6** acres
County: **Bucks** Township/Municipality: **Bristol Twp**
Quadrangle Name: **BEVERLY** ~ ZIP Code: **19021**
Decimal Degrees: **40.080878 N, -74.910256 W**
Degrees Minutes Seconds: **40° 4' 51.2" N, -74° 54' 36.9" W**



2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

Note that regardless of PNDI search results, projects requiring a Chapter 105 DEP individual permit or GP 5, 6, 7, 8, 9 or 11 in certain counties (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill and York) must comply with the bog turtle habitat screening requirements of the PASPGP.

RESPONSE TO QUESTION(S) ASKED

Q1: Accurately describe what is known about wetland presence in the project area or on the land parcel. "Project" includes all features of the project (including buildings, roads, utility lines, outfall and intake structures, wells, stormwater retention/detention basins, parking lots, driveways, lawns, etc.), as well as all associated impacts (e.g., temporary staging areas, work areas, temporary road crossings, areas subject to grading or clearing, etc.). Include all areas that will be permanently or temporarily affected -- either directly or indirectly -- by any type of disturbance (e.g., land clearing, grading, tree removal, flooding, etc.). Land parcel = the lot(s) on which some type of project(s) or activity(s) are proposed to occur .
Your answer is: **2. The project area (or land parcel) has not been investigated by someone qualified to identify and delineate wetlands, or it is currently unknown if the project or project activities will affect wetlands.**

Q2: Aquatic habitat (stream, river, lake, pond, etc.) is located on or adjacent to the subject property and project activities (including discharge) may occur within 300 feet of these habitats
Your answer is: **1. Yes**

Q3: "Will the entire project area (including any discharge), plus a 300 feet buffer around the project area, all occur in or on an existing building, parking lot, driveway, road, road shoulder, street, runway, paved area, railroad bed, maintained (periodically mown) lawn, crop agriculture field or maintained orchard?"
Your answer is: **2. No**

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for one year** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send

project information to this agency for review (see WHAT TO SEND).

DCNR Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)
Scientific Name: Amaranthus cannabinus
Common Name: Waterhemp Ragweed
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Andropogon glomeratus
Common Name: Bushy Bluestem
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Bidens bidentoides
Common Name: Swamp Beggar-ticks
Current Status: Threatened
Proposed Status: Endangered

Scientific Name: Bidens laevis
Common Name: Beggar-ticks
Current Status: Special Concern Species*
Proposed Status: Endangered

Scientific Name: Cuscuta campestris
Common Name: Dodder
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Cuscuta polygonorum
Common Name: Smartweed Dodder
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Echinochloa walteri
Common Name: Walter's Barnyard-grass
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Eleocharis obtusa var. peasei
Common Name: Wrights Spike Rush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Eleocharis parvula

Common Name: Little-spike Spike-rush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Freshwater intertidal mudflat
Common Name: Freshwater Intertidal Mudflat
Current Status: Special Concern Resource*
Proposed Status: Special Concern Resource*

Scientific Name: Heteranthera multiflora
Common Name: Multiflowered Mud-plantain
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Ilex opaca
Common Name: American Holly
Current Status: Threatened
Proposed Status: Threatened

Scientific Name: Lycopus rubellus
Common Name: Bugleweed
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Polygonella articulata
Common Name: Eastern Jointweed
Current Status: Special Concern Species*
Proposed Status: Endangered

Scientific Name: Ptelea trifoliata
Common Name: Common Hop-tree
Current Status: Threatened
Proposed Status: Threatened

Scientific Name: Quercus phellos
Common Name: Willow Oak
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Sagittaria calycina var. spongiosa
Common Name: Long-lobed Arrow-head
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Sagittaria subulata
Common Name: Subulate Arrowhead
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Schoenoplectus fluviatilis
Common Name: River Bulrush
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Schoenoplectus smithii
Common Name: Smith's Bulrush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Strophostyles umbellata
Common Name: Wild Bean
Current Status: Special Concern Species*
Proposed Status: Endangered

Scientific Name: Triplasis purpurea
Common Name: Purple Sandgrass
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Wild rice - water-hemp tidal marsh
Common Name:
Current Status: Special Concern Resource*
Proposed Status: Special Concern Resource*

Scientific Name: Zizania aquatica
Common Name: Indian Wild Rice
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

PA Fish and Boat Commission

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)
Scientific Name: Sensitive Species**

Common Name:
Current Status: Threatened
Proposed Status: Special Concern Species*

U.S. Fish and Wildlife Service

RESPONSE: No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams
____The DEP permit(s) required for this project

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. For cases where a "Potential Impact" to threatened and endangered species has been identified before the application has been submitted to DEP, the application

should not be submitted until the impact has been resolved. For cases where "Potential Impact" to special concern species and resources has been identified before the application has been submitted, the application should be submitted to DEP along with the PNDI receipt, a completed PNDI form and a USGS 7.5 minute quadrangle map with the project boundaries delineated on the map. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. DEP and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at http://www.naturalheritage.state.pa.us.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources

Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service

Endangered Species Section
315 South Allen Street, Suite 322, State College, PA. 16801-4851
NO Faxes Please.

PA Fish and Boat Commission

Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission

Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

7. PROJECT CONTACT INFORMATION

Name:_____
Company/Business Name:_____
Address:_____
City, State, Zip:_____
Phone:(_____)_____Fax:(_____)_____
Email:_____

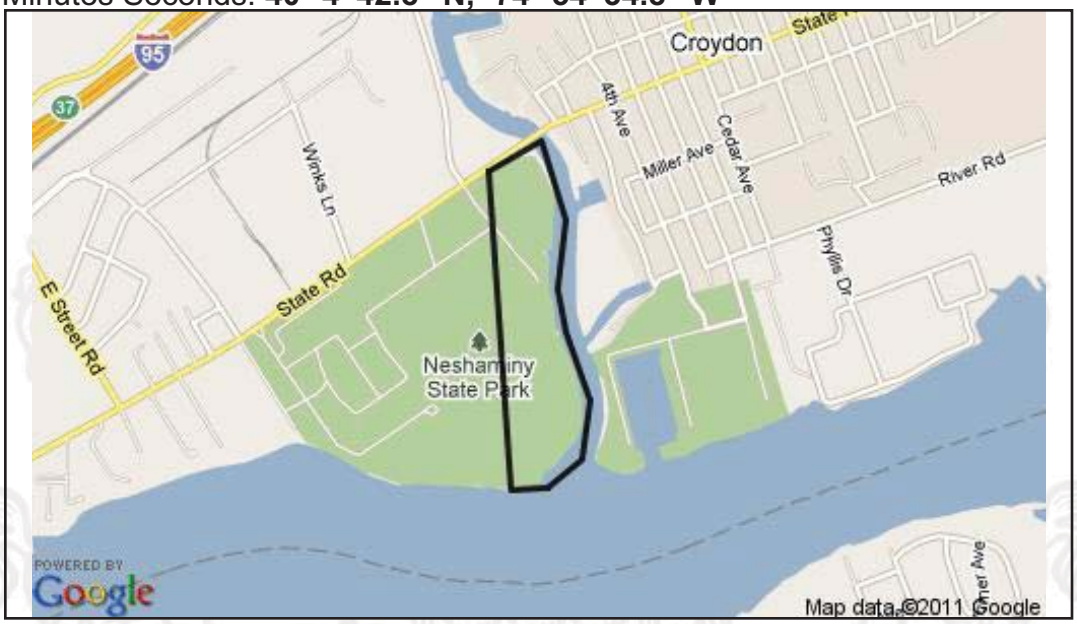
8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

_____ _____
applicant/project proponent signature date

1. PROJECT INFORMATION

Project Name: **Neshaminy State Park Mitigation Site**
Date of review: **1/28/2011 1:04:01 PM**
Project Category: **Habitat Conservation and Restoration,Wetland Restoration, Wetland Creation, or Wetland Enhancement**
Project Area: **73.9** acres
County: **Bucks** Township/Municipality: **Bensalem**
Quadrangle Name: **BEVERLY** ~ ZIP Code: **19020,19021**
Decimal Degrees: **40.078563 N, -74.909677 W**
Degrees Minutes Seconds: **40° 4' 42.8" N, -74° 54' 34.8" W**



2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

Note that regardless of PNDI search results, projects requiring a Chapter 105 DEP individual permit or GP 5, 6, 7, 8, 9 or 11 in certain counties (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill and York) must comply with the bog turtle habitat screening requirements of the PASPGP.

RESPONSE TO QUESTION(S) ASKED

Q1: Accurately describe what is known about wetland presence in the project area or on the land parcel. "Project" includes all features of the project (including buildings, roads, utility lines, outfall and intake structures, wells, stormwater retention/detention basins, parking lots, driveways, lawns, etc.), as well as all associated impacts (e.g., temporary staging areas, work areas, temporary road crossings, areas subject to grading or clearing, etc.). Include all areas that will be permanently or temporarily affected -- either directly or indirectly -- by any type of disturbance (e.g., land clearing, grading, tree removal, flooding, etc.). Land parcel = the lot(s) on which some type of project(s) or activity(s) are proposed to occur .
Your answer is: **2. The project area (or land parcel) has not been investigated by someone qualified to identify and delineate wetlands, or it is currently unknown if the project or project activities will affect wetlands.**

Q2: Aquatic habitat (stream, river, lake, pond, etc.) is located on or adjacent to the subject property and project activities (including discharge) may occur within 300 feet of these habitats
Your answer is: **1. Yes**

Q3: "Will the entire project area (including any discharge), plus a 300 feet buffer around the project area, all occur in or on an existing building, parking lot, driveway, road, road shoulder, street, runway, paved area, railroad bed, maintained (periodically mown) lawn, crop agriculture field or maintained orchard?"
Your answer is: **2. No**

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for one year** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send

project information to this agency for review (see WHAT TO SEND).

DCNR Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)
Scientific Name: Amaranthus cannabinus
Common Name: Waterhemp Ragweed
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Andropogon glomeratus
Common Name: Bushy Bluestem
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Bidens bidentoides
Common Name: Swamp Beggar-ticks
Current Status: Threatened
Proposed Status: Endangered

Scientific Name: Bidens laevis
Common Name: Beggar-ticks
Current Status: Special Concern Species*
Proposed Status: Endangered

Scientific Name: Cuscuta campestris
Common Name: Dodder
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Cuscuta polygonorum
Common Name: Smartweed Dodder
Current Status: Special Concern Species*
Proposed Status: Threatened

Scientific Name: Echinochloa walteri
Common Name: Walter's Barnyard-grass
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Eleocharis obtusa var. peasei
Common Name: Wrights Spike Rush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Eleocharis parvula

Common Name: Little-spike Spike-rush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Freshwater intertidal mudflat
Common Name: Freshwater Intertidal Mudflat
Current Status: Special Concern Resource*
Proposed Status: Special Concern Resource*

Scientific Name: Heteranthera multiflora
Common Name: Multiflowered Mud-plantain
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Ilex opaca
Common Name: American Holly
Current Status: Threatened
Proposed Status: Threatened

Scientific Name: Lycopus rubellus
Common Name: Bugleweed
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Polygonella articulata
Common Name: Eastern Jointweed
Current Status: Special Concern Species*
Proposed Status: Endangered

Scientific Name: Ptelea trifoliata
Common Name: Common Hop-tree
Current Status: Threatened
Proposed Status: Threatened

Scientific Name: Quercus phellos
Common Name: Willow Oak
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Sagittaria calycina var. spongiosa
Common Name: Long-lobed Arrow-head
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Sagittaria subulata
Common Name: Subulate Arrowhead
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Schoenoplectus fluviatilis
Common Name: River Bulrush
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

Scientific Name: Schoenoplectus smithii
Common Name: Smith's Bulrush
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Strophostyles umbellata
Common Name: Wild Bean
Current Status: Special Concern Species*
Proposed Status: Endangered

Scientific Name: Triplasis purpurea
Common Name: Purple Sandgrass
Current Status: Endangered
Proposed Status: Endangered

Scientific Name: Wild rice - water-hemp tidal marsh
Common Name:
Current Status: Special Concern Resource*
Proposed Status: Special Concern Resource*

Scientific Name: Zizania aquatica
Common Name: Indian Wild Rice
Current Status: Special Concern Species*
Proposed Status: Special Concern Species*

PA Fish and Boat Commission

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)
Scientific Name: Sensitive Species**

Common Name:
Current Status: Threatened
Proposed Status: Special Concern Species*

U.S. Fish and Wildlife Service

RESPONSE: No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams
____The DEP permit(s) required for this project

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. For cases where a "Potential Impact" to threatened and endangered species has been identified before the application has been submitted to DEP, the application

should not be submitted until the impact has been resolved. For cases where "Potential Impact" to special concern species and resources has been identified before the application has been submitted, the application should be submitted to DEP along with the PNDI receipt, a completed PNDI form and a USGS 7.5 minute quadrangle map with the project boundaries delineated on the map. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. DEP and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at http://www.naturalheritage.state.pa.us.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources

Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service

Endangered Species Section
315 South Allen Street, Suite 322, State College, PA. 16801-4851
NO Faxes Please.

PA Fish and Boat Commission

Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission

Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

7. PROJECT CONTACT INFORMATION

Name:_____
Company/Business Name:_____
Address:_____
City, State, Zip:_____
Phone:(_____)_____Fax:(_____)_____
Email:_____

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

_____ _____
applicant/project proponent signature date

PENNSYLVANIA FISH AND BOAT COMMISSION (PFBC) CORRESPONDENCE

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

24 November 2009

Natural Diversity Section
Pennsylvania Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane
Bellefonte, PA 16823

Re: Pennsylvania Natural Diversity Inventory (PNDI) Environmental Resources Review
Proposed Development of Southport, Philadelphia, PA

Dear Sir or Madame:

The Southport project involves the development of a brand-new, approximately 175 acre marine container terminal in Philadelphia, PA. The Commonwealth of Pennsylvania has contracted WESTON Solutions, Inc. (WESTON) to address the environmental permitting for the project including the Federal National Environmental Policy Act (NEPA) permitting requirements (Section 404, Endangered Species Act, and USACE Jurisdictional Determination) and State permitting requirements (401 WQC, Coastal Zone Management Act, Section 106).

A PNDI search (Project Search ID 20090901208135) was conducted by WESTON for the Southport development site. The PNDI search resulted in a potential impact with your agency. WESTON requests that your agency review this PNDI for the presence of species of special concern or critical habitats on or near the site. Enclosed is a copy of the PNDI search conducted by WESTON.

Project Narrative

The Southport site extends along the Delaware River, from the east end of the Philadelphia Naval Yard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal (see attached USGS Philadelphia quadrangle). For over a decade, the site has been vacant and out-of use. Previous activity on the site includes industrial uses and various uses associated with the Naval Base (i.e. housing and runway). The development of Southport will involve assessment and mitigation of the various elements of large scale marine terminal design and construction, including but not limited to, new wharf construction, open-water fill (approximately 25 acres), and loading issues associated with heavy equipment.

At full build-out, Southport will have capacity for 1,000,000+ containers per annum, creating thousands of new, family-sustaining jobs and injecting substantial new business and tax revenue into the regional economy. It is expected that the development of Southport will be competitively bid among major shipping lines, terminal operators and infrastructure investors, with substantial, ongoing positive economic impact and return to the region. Further, for the second time this

decade, the Port of Philadelphia has been designated a Strategic Military Port by the US Surface Deployment and Distribution Command (SDDC). Additionally, the development of Southport is consistent with the region's economic initiatives to take advantage of increased cargoes resulting from widening of the Panama Canal.

The Commonwealth will be responsible for adhering to both the state and the federal aspects of the environmental permitting. Because of the likely impacts to waterways, the Commonwealth has engaged in preliminary conceptual discussions with the United States Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) Wildlife Service, and United States Fish and Wildlife Service (USFWS) from the Federal government as well as the New Jersey Department of Environmental Protection (NJDEP), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission (PAFBC), Pennsylvania Department of Conservation and Natural Resources (PA DCNR), and Pennsylvania Coastal Zone Management (PACZM) from the State government. In addition to the aforementioned federal and state agencies, the Commonwealth has also had discussions with the Delaware River Basin Commission (DRBC) regarding this project. Note that WESTON plans to conduct biological assessments (terrestrial threatened and endangered species, fish and benthic, herpetological) and wetland delineations assessments in support of this project.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information to complete your review, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@WestonSolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments
- USGS Quadrangle
- PNDI Review Receipt
- Site Location Figure
- Photolog

Pennsylvania Fish & Boat Commission

established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620
(814) 359-5147 Fax: (814) 359-5175

December 21, 2009

IN REPLY REFER TO:
SIR# 33031

WESTON SOLUTIONS
SHANA MOAK
1400 WESTON WAY
PO BOX 2653
WEST CHESTER, PA 19380

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search Number: 20090901208135
PROPOSED SOUTHPORT MARINE TERMINAL DEVELOPMENT
PHILADELPHIA, PHILADELPHIA County, Pennsylvania

Dear Ms. MOAK:

I have examined the map accompanying your recent correspondence, which shows the location for the above-referenced project. Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files, the following rare or protected species are known from the vicinity of the project site:

Common Name	Scientific Name	PA Status
Red-bellied turtle	*Pseudemys rubriventris*	threatened
Coastal plain leopard frog	*Rana utricularia*	endangered
New Jersey chorus frog	*Pseudacris feriarum kalmi*	endangered
Eastern mudminnow	*Umbra pygmaea*	candidate

We request a habitat assessment be conducted for the two frog species in any wetlands and surrounding habitats on site, as well as for the eastern mudminnow if any impacts to the drainage canal or similar habitats are proposed. Although we do not currently have a list of qualified surveyors for these species, we recognize the qualifications of several herpetologists to do this assessment. We suggest that you contact Bob Zappalorti or Michael Torocco of Herpetological Associates, Inc., Scott Bush of Conestoga-Rovers Associates, or Brandon Ruhe (contact information on the enclosed). These herpetologists have conducted several of this kind of survey in the southeastern part of the Commonwealth and are qualified and recognized for conducting habitat assessments and presence/absence surveys for the New Jersey chorus frog and the Coastal Plain leopard frog. A copy of the habitat assessment report should be directed to this office for review. Please note that if presence/absence surveys for these species become necessary, the critical survey window begins in April for the frogs.

You have identified wetlands, open water bodies, as well as potential red-bellied turtle habitat within the project area. The project proposes to fill approximately 25 acres of open water as well as impact the surrounding acreage that could be used by red-bellied turtles for foraging, brumating, or nesting. **Therefore, we recommend that a herpetologist who is qualified/recognized to survey for the species of special**

concern conduct red-bellied turtle presence-absence and nesting surveys on-site. A qualified biologist, who possesses the necessary Scientific Collector's Permit issued by the Pennsylvania Fish and Boat Commission, must conduct this presence/absence survey. A list of biologists recognized as qualified by the Pennsylvania Fish and Boat Commission to perform red-bellied turtle surveys is enclosed.

Red-bellied turtle presence/absence surveys should be conducted using a combination of visual surveys and turtle trapping, as well as nesting surveys. These surveys should be conducted no sooner than April 15 of the survey year and should conclude by October 15th of the survey year. Visual surveys should be conducted during the appropriate times of the day when turtle basking is at a peak. The turtle trapping should include the use of basking traps (3 traps per ac) and hoop traps (2 traps per acre baited with corn and sardines) set for at least 20 days. These traps should be set during appropriate climatic conditions and checked every 24 hours. All captured red-bellied turtles and any non-native turtle species should be sexed, weighed, measured (carapace and plastron straight-line length), marked using the Ernst et al. method, and a digital photograph of the carapace and plastron should be taken of each captured turtle. Nesting surveys should be conducted from June 1st through July 31st. Potential nesting areas should be visited at least 4 times. All types of nesting activity must be recorded (nest construction, completed nests, predated nests, semi-completed nests, egg laying) of all turtle species present on site.

The survey report submitted to the Commission should include the following information:

- Name of surveyors and brief summary of their qualifications for all surveyors (leader and assistants)
- Dates of surveys (including start and end times) for each survey method
- Time spent per acre per visit
- A description of the survey methodology
- Types, numbers, locations, and frequency of inspection of all turtle traps
- Exact number and location (latitude/longitude coordinates) for all turtles and nests observed
- Weather conditions (including the starting and ending air and water temperatures)
- Detailed physical characterization (i.e., size, depth, flow velocity, submerged aquatic vegetation present, basking habitat available, substrate type) of the wetland, pond/lake or stream habitat and surrounding nesting habitat in question.
- Presence or absence of red-bellied turtles
- A list of other reptile and amphibian species, and the number of each, observed on-site, and incidentally trapped
- A site map with all herpetofauna sightings, including red-bellied turtles, annotated

If the presence of red-bellied turtles is confirmed within or near the project area, then additional consultation with this office (Natural Diversity Section) will be necessary.

If you have any questions regarding this response, please contact Kathy Gipe at 814-359-5186 and **refer to the SIR number** at the top of this letter. Thank you for your cooperation and attention to this matter of nongame species conservation.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/mr
Enclosure (1)

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3401
www.westonsolutions.com

26 February 2010

Kathy Gipe
Natural Diversity Section
Pennsylvania Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane
Bellefonte, PA 16823

Re: Pennsylvania Natural Diversity Inventory (PNDI) Number 20090901208135
Proposed Development of Southport, Philadelphia, PA

Dear Ms. Gipe:

On 24 November 2009, Weston Solutions, Inc. (WESTON) submitted the results of a Pennsylvania Natural Diversity Index (PNDI) search for the proposed Southport project to the office of the Pennsylvania Fish and Boat Commission for review (see attached letter). On 21 December 2009, WESTON received a response letter from the PAFBC regarding rare or protected species known from the vicinity of the project site. These species included the red-bellied turtle (*Pseudemys rubriventris*), the coastal plain leopard frog (*Rana utricularia*), New Jersey chorus frog (*Pseudacris feriarum kalmi*), and the eastern mudminnow (*Umbra pygmaea*).This letter requested a habitat assessment be conducted for the two frog species as well as for the eastern mudminnow if any impacts to the stormwater drainage ditch or similar habitats are proposed. Regarding the red-bellied turtle, WESTON was requested to conduct presence-absence and nesting surveys on-site.

WESTON's subcontractor, Herpetological Associates, Inc. (HA) conducted a Phase I habitat evaluation for threatened and endangered amphibian and reptile species on 6 October 2009 at the Southport site. The targeted species were the red-bellied turtle, the coastal plain leopard frog, the New Jersey chorus frog, and the bog turtle (*Glyptemys muhlenbergii*). A copy of HA's report is enclosed with this letter and provides their findings in detail. In summary:

- None of the investigated wetlands provide suitable bog turtle habitat;
- The site is considered extremely marginal by HA for the targeted frog species; and
- The River and the cove and stormwater drainage ditch provide suitable aquatic habitat for the red-bellied turtle although the turtles would be forced from the cove and ditch during low tide and during the overwintering months. Suitable nesting habitat is available on the study site in the upland, dry fields were *Phragmites* is absent. However, due to the debris that lines the west bank of the River, access to the site by nesting turtles is likely limited to the cove and ditch.
- Regarding the request for the trapping surveys for the red-bellied turtle, WESTON understands that the turtle has been documented in the Delaware River and in the vicinity of the drainage ditch on-site. Please confirm if the trapping survey must be performed if

the species has previously been documented in this range of the Delaware River and, more specifically, on the Southport site.

- Note that WESTON will be working with HA to perform the nesting surveys on-site during the times of year specified in your 21 December 2009 letter. More specifically, HA has proposed that these nesting surveys be conducted within 1000 ft of on-site deep streams, river, man-made or natural ponds and lakes, and wetlands to determine construction constraints on land. Searches for nests will begin in early May 2010 and be completed no later than 31 July 2010. Soil texture and canopy closure will be used to identify potential nesting sites. Locations (coordinates) of nests, eggshell fragments, and if possible individual turtle sightings will be recorded and indicated on the field survey map. Time-constrained searches will be conducted in specific areas identified as preferred red-bellied turtle habitat. All natural and artificial debris, logs, stones, or any other suitable cover type will be overturned to search for hidden reptiles and other non-target species. Open areas along streams, ponds, and lakes will be surveyed for basking turtles or for active turtle movements. WESTON believes that these studies will satisfy the PFBC requirements.

- Regarding the eastern mudminnow, WESTON will be performing a fish study in the spring of 2010. As previously discussed with the PFBC, a technical fish study plan will be submitted to Michael Kaufman of your office prior to the commencement of this study. The results of the study, which will be performed using electrofishing and seining methods, will also be submitted to Mr. Kaufman for his review. The methods proposed in this study will be suitable for determining if the mudminnow is present in the vicinity of the project site.

It is worthy to note that the project footprint was downsized following WESTON's 24 November 2009 submission to your office. A copy of the new conceptual plan for the Southport site has been attached to this letter for your reference.

Please review the enclosed materials regarding the proposed project. If you have any questions concerning this request or need additional information, please do not hesitate to contact me by phone at (610) 701-3089 or by email at Shana.Moak@westonsolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Shana Moak

Shana Moak
Project Scientist

Attachments:

PAFBC 12/21/09 letter
Herpetological Associates, Inc. Habitat Evaluation
Conceptual Design

Pennsylvania Fish & Boat Commission

established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620
(814) 359-5147 Fax: (814) 359-5175

March 24, 2010

IN REPLY REFER TO:
SIR# 33031

WESTON SOLUTIONS
SHANA MOAK
1400 WESTON WAY
PO BOX 2653
WEST CHESTER, PA 19380

RE: Secondary Species Impact Review (SIR) #33031
PNDI Search Number: 20090901208135
PROPOSED SOUTHPORT MARINE TERMINAL DEVELOPMENT
City of PHILADELPHIA, PHILADELPHIA County, Pennsylvania

Dear Ms. MOAK:

I have examined the additional information you sent regarding the above-referenced project and its potential to impact the species of concern identified in my earlier correspondence. Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files, the following rare or protected species are known from the vicinity of the project site:

Common Name	Scientific Name	PA Status
Redbelly turtle	*Pseudemys rubriventris*	threatened
Coastal plain leopard frog	*Rana utricularia*	endangered
New Jersey chorus frog	*Pseudacris feriarum kalmi*	endangered
Eastern mudminnow	*Umbra pygmaea*	candidate

Herpetological Associates conducted a habitat assessment of the site in October 2009 with these species in mind. According to their report, the site is unlikely to support the two frog species of concern. I concur with these conclusions and do not foresee the proposed project resulting in adverse impacts to the New Jersey chorus frog or Coastal Plain leopard frog.

You have stated that presence/absence surveys for the eastern mudminnow will be conducted in 2010. Please forward a copy of the results to this office for our review. If the presence of fish species of concern is confirmed within or near the project area, then additional consultation with this office (Natural Diversity Section) will be necessary.

Herpetological Associates determined that the site does not provide year-round habitat for the redbelly turtle. In particular, the wetlands within the upland portion of the site proposed for development would not be expected to support redbelly turtles. Therefore, a survey for the presence of aquatic redbelly turtles will not be necessary. Measures to avoid impacts to turtles within the cove or river may be needed when we review the full development plan. However, there is potential for redbelly turtles to access the site

for nesting in the areas identified by Herpetological Associates. **Therefore, we recommend that a herpetologist who is qualified/recognized to survey for the species of special concern conduct redbelly turtle nesting surveys on-site.** A qualified biologist, who possesses the necessary Scientific Collector's Permit issued by the Pennsylvania Fish and Boat Commission, must conduct this presence/absence survey. A list of biologists recognized as qualified by the Pennsylvania Fish and Boat Commission to perform redbelly turtle surveys is enclosed.

Nesting surveys should be conducted from June 1st through July 31st. Potential nesting areas should be visited at least 4 times. All types of nesting activity must be recorded (nest construction, completed nests, predated nests, semi-completed nests, egg laying) of all turtle species present on site.

The survey report submitted to the Commission should include the following information:

- Name of surveyors and brief summary of their qualifications for all surveyors (leader and assistants)
- Dates of surveys (including start and end times) for each survey method
- Time spent per acre per visit
- A description of the survey methodology
- Exact number and location (latitude/longitude coordinates) for all turtles and nests observed
- Weather conditions (including the starting and ending air and water temperatures)
- Detailed physical characterization of the nesting habitat in question.
- Presence or absence of redbelly turtles
- A list of other reptile and amphibian species, and the number of each, observed on-site, and incidentally trapped
- A site map with all herpetofauna sightings, including redbelly turtles, annotated

If the presence of redbelly turtles is confirmed within or near the project area, then additional consultation with this office (Natural Diversity Section) will be necessary.

We look forward to continuing our review of this project upon receipt of the species survey reports. If you have any questions regarding this response, please contact Kathy Gipe at 814-359-5186 and **refer to the SIR number** at the top of this letter. Thank you for your cooperation and attention to this matter of nongame species conservation.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

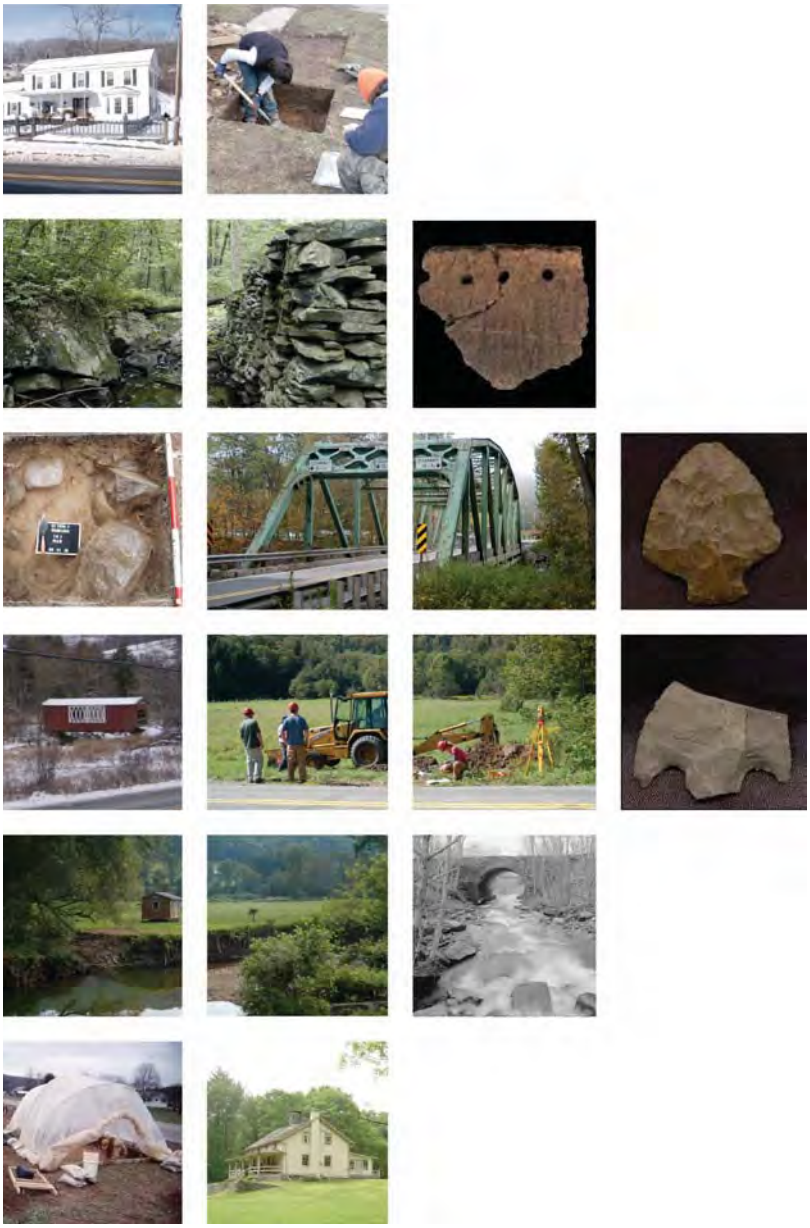
CAU/KDG/mr

APPENDIX H

CULTURAL RESOURCES

Proposed Southport Development Project
The City of Philadelphia, Philadelphia County, Pennsylvania

Phase IA Cultural Resources Assessment



Prepared for:

Weston Solutions, Inc.
1400 Chester Way, P.O. Box 2653
West Chester, PA 19380

And

The Pennsylvania Department of General Services
515 North Office Building
Harrisburg, PA 17125

By:

THE LOUIS BERGER GROUP, INC.
412 Mount Kemble Ave.
PO Box 1946
Morristown, NJ 07962
Tel 973 407-1000
Fax 973 267-6154

June 2010

Proposed Southport Development Project

Phase IA Cultural Resources Assessment

The City of Philadelphia, Philadelphia County, Pennsylvania

Prepared for:

Weston Solutions, Inc.
1400 Chester Way, P.O. Box 2653
West Chester, PA 19380

And

The Pennsylvania Department of General Services
515 North Office Building
Harrisburg, PA 17125

Prepared by:

Kristofer M. Beadenkopf, RPA
Deborah Van Steen
Zachary J. Davis, RPA

The Louis Berger Group, Inc.
412 Mount Kemble Avenue
Morristown, NJ 07960

June 2010

EXECUTIVE SUMMARY

The Louis Berger Group, Inc. (Berger), of Morristown, New Jersey, conducted a Phase IA cultural resources survey for the proposed Southport Development Project in the City of Philadelphia, Pennsylvania (Project). The Project is located to the east of the former Philadelphia Naval Shipyard on League Island and south of the Walt Whitman Bridge. The proposed project will use funds provided by the Commonwealth of Pennsylvania Department of General Services (DGS), the Philadelphia Regional Port Authority (PRPA), and by a to-be-determined tenant partner or lessee. Construction and operation of the terminal will be privately funded.

The proposed Project involves the development of an approximately 116 acre marine container terminal with a yearly throughput of approximately 1.34 million twenty-foot equivalent units (TEUs). The development of the terminal is expected to create more than 7,000 new direct jobs, new business, and tax revenue for the region. The Project will involve the development of the eastern end of the former Philadelphia Naval Shipyard, including the construction of paved areas for container storage, a new terminal wharf and wharf expansion area, maintenance buildings, parking areas and crane areas. Temporary improvements related to construction staging and parking is also proposed as part of the Project.

The Phase I cultural resource assessment was conducted in January 2010 with the objective of investigating the potential for previously undocumented archaeological resources to exist within the Project Area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP) within the Project Area.

The Project Area was historically marshland and open water until between 1940 and 1957 when additional land was created from marshland and open water with dredged materials and fill. The area assumed its current manufactured configurations as late as between 1963 and 1970. Development within the northern portion of the Project Area began in 1929 with the construction of rail spurs and industrial buildings associated with the Pennsylvania Railroad and the mid-twentieth century Ore Pier 122. The southern portion of the Project Area had been developed as military housing between 1970 and 1985. Additionally, no shipwrecks are documented in the Delaware River within the Project Area. Pedestrian reconnaissance of the Project Area confirmed the presence of late twentieth century former military housing, paved areas and wetlands. As a result, due to the mid-to-late twentieth century development/land use history, the Project Area is considered to have no potential for containing significant historic archaeological remains.

Although the area of the Delaware River between Marcus Hook and Allegheny Avenue in Philadelphia has been characterized as having a “medium-high” potential for the presence of submerged cultural resources, dredging in the Delaware River in that area “has probably seriously disturbed or destroyed many of these resources” (Cotter et al. 1992:465). Areas of the Delaware River that are exceptions to this assumption include the vicinity of Pier 78, the channel at Tinicum Island, and the back channel of Pettys Island –all of which are located beyond the boundaries of the Project Area. Therefore, the Project Area does not possess the potential to contain submerged archaeological resources.

Berger has conducted a survey of historic architectural resources greater than 50 years of age within the Project Area and immediate vicinity. This survey was based on the pedestrian reconnaissance conducted within the Project Area on January 13, 2010, as well as the historic and background research conducted for the Project. Potential effects to historic architectural resources that have been previously listed on, or opinioned eligible for inclusion on the National Register of Historic Places, and recommendations for further documentation and intensive level survey are also provided for the Project Area below.

The Project Area is currently dominated by former military housing that was constructed between 1970 and 1985. The housing, which consists of garden apartments and townhouses, is representative of clustered, attached housing typically contained at military installations. Previous Philadelphia Naval Complex survey and evaluation did not recommend eligibility (John Milner and Associates 1994; Department of the Navy 1995). Although a separate remedial action project will result in the demolition of the former military housing, these buildings do not meet the 50 year criteria for listing on the National Register of Historic Places and do

not appear to be of exceptional importance required to meet Criteria Consideration g for properties achieving significance within the past 50 years. Therefore, no further investigations are recommended for the former military housing within the Project Area.

The abandoned Mustin Airfield is also located in the northwestern portion of the Project Area. Previous survey of the airfield as part of the Philadelphia Naval Complex survey and evaluation did not recommend eligibility (John Milner and Associates 1994; Department of the Navy 1995). Although the proposed Project will result in the demolition of a portion of the abandoned airfield, no further investigations are recommended for the airfield due to its previous designation as ineligible.

The National Register listed Philadelphia Naval Shipyard Historic District (CRGIS Key# 86856) is located to the west of the Project Area. Although the central core of the district is located 1.5 miles to the west of the Project Area, the World War II era Seaplane Hangar (Building 653), which is a discontiguous portion of the historic district, is located immediately west of the Project Area. The Seaplane Hangar, constructed in 1943, is a contributing resource to the Philadelphia Naval Shipyard Historic District and has significance in the areas of architecture and history. The proposed Project, however, will not physically alter the Seaplane Hangar and will not have an adverse effect on this resource.

The northern portion of the Project Area is characterized by two piers and related buildings, structures, and trackage. The northern-most pier is Pier 122, a bulk export pier built circa 1953 for iron ore (Society for Industrial Archeology 1990:3). The pier consisted of its four traveling unloaders, former rail line spurs extending to the pier, and support buildings related to the historic function of Pier 122. As a result of ongoing demolition of the structures on the pier, notably the unloaders, the National Register-eligible Pier 122 and associated buildings no longer possess sufficient integrity of design, setting, materials, and association. As a result of Berger's reevaluation of Pier 122, Berger recommends that the pier is no longer eligible for listing on the National Register and that the proposed Project will not result in adverse impacts.

The Greenwich Coal Pier (Pier 124) is a former coal export pier constructed by the Pennsylvania Railroad in the late 1920s and modernized circa 1980. The pier formerly consisted of two parallel rotary dumpers and a 5,000 ton/hour traveling shiploader, ramped rails set on arched concrete piers, and support structures extending the length of the pier (Society for Industrial Archaeology, 1990: 3; Pennsylvania Railroad, 1949: 10). Beyond Pier 124 is a two-story brick building constructed by the Pennsylvania Railroad and supporting structures of more recent construction. As with Pier 122, Pier 124 and many of the associated structures are in the process of being dismantled. Due to the resulting loss of historic fabric and architectural integrity, no additional work is recommended for Pier 124.

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1.0 INTRODUCTION

1.1 DESCRIPTION OF PROJECT

This report presents the results of Phase I cultural resource investigations conducted by The Louis Berger Group, Inc. (Berger) for the proposed Southport Development Project in the City of Philadelphia, Pennsylvania (Project) (Figure 1). The Project consists of a total of approximately 116 acres (Figure 1) and involves permanent improvements and dredging within the Delaware River along the shoreline. The Project Area is within 304 to 608 meters (1,000 to 2,000 feet) of the Delaware River and will be directly affected through ground disturbance associated with the proposed Project (Figure 2).

The Project will be funded by the Commonwealth of Penssylvania Department of General Services (DGS), the Philadelphia Regional Port Authority (PRPA) and by a to-be-determined tenant partner or lessee. Construction and operation of the terminal will be privately funded.

The proposed Project involves the development of an approximately 116 acre marine container terminal with a yearly throughput of approximately 1.34 million TEUs. The development of the terminal is expected to create more than 7,000 new direct jobs, new business, and tax revenue for the region. The Project will involve the development of the eastern end of the former Philadelphia Naval Shipyard on League Island, including the construction of paved areas for container storage, a new terminal wharf and wharf expansion area, maintenance buildings, parking areas, and crane areas. Temporary improvements related to construction staging and parking is also proposed as part of the Project.

The Phase I cultural resource assessment was conducted with the objective of investigating the potential for previously undocumented archaeological resources to exist within the Project Area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP) within the Project Area and immediate vicinity.

These cultural resource investigations have been conducted in accordance with the instructions and intent of the National Historic Preservation Act of 1966, as amended; Public Law 93-291; 36 CFR 800 (Preservation of Historic Properties; the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (Federal Register, 1983, Volume 18, Number 1990, pp. 44716-44742; and the Pennsylvania Historical and Museum Commission/Bureau for Historic Preservation (PHMC/BHP) Guidelines for Archaeological Investigations (November 2008). The cultural resource specialists who performed the investigations meet the standards specified in 36 CFR 66.3(b)(2) and 36 CFR 61.

1.2 PROJECT SETTING

The Proposed Project will cover a portion of League Island in Philadelphia, Pennsylvania (see Figure 1), east of the former Philadelphia Naval Shipyard on League Island and south of the Walt Whitman Bridge. The vicinity of the Project is characterized by commercial and transportation (rail line) development.

1.3 SCOPE OF WORK AND PROJECT PERSONNEL

The historical and archaeological assessment consisted of background research, an architectural assessment of the existing structures, and a pedestrian survey of the Project Area. Background research, conducted in January 2010, included the examination of survey reports and historic and archaeological site files at the PHMC/BHP, in Harrisburg, on-line cartographic clearing houses such as the Greater Philadelphia GeoHistory Network, the David Rumsey collection, and the Library of Congress, and maps and other documents held at the Philadelphia Free Public Library.

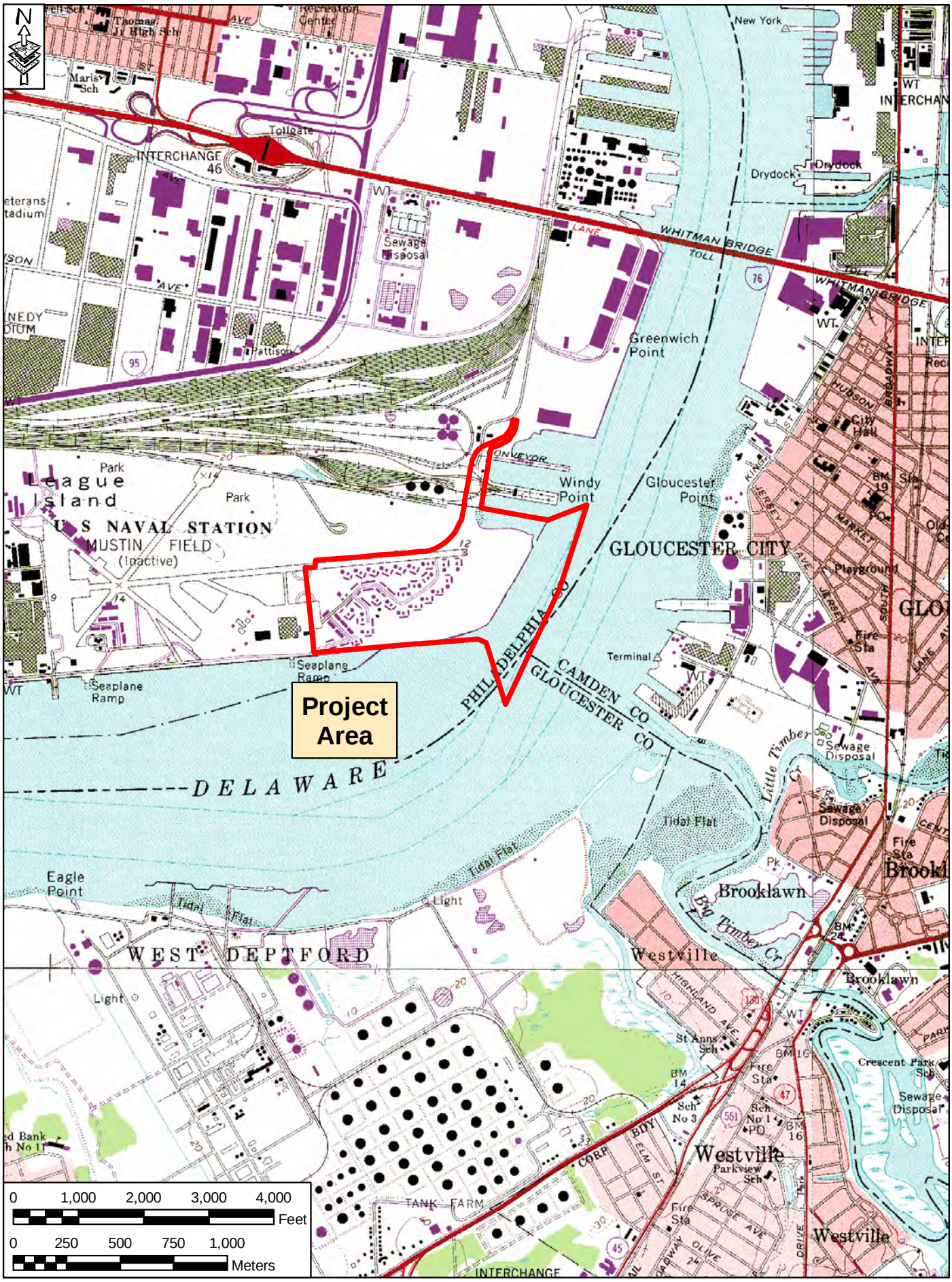

FIGURE 1: Overview of the Proposed Southport Development Project Area

SOURCE: USGS 7.5' Series Quads, Philadelphia, PA-NJ, Camden, NJ-PA, Woodbury, NJ & Runnemede, NJ, 1979

FIGURE 2: Aerial View of the Proposed Southport Development Project Area

SOURCE: City of Philadelphia, Division of Technology, 2008 http://www.pasda.psu.edu/

A pedestrian survey was conducted on January 13, 2010 to document the current conditions of the Project Area to assist in the assessment of the archaeological potential of this Project. An historic architectural field survey was also conducted on January 13, 2010 to photo-document extant structures and buildings within the Project Area and vicinity that are greater than 50 years of age and/or historic properties that have been previously listed in or previously determined eligible for listing in the National Register of Historic Places listed or eligible historic properties by the PHMC/BHP.

Mr. Zachary J. Davis, an RPA-certified archaeologist served as the Project Manager, Mr. Kristofer M. Beadenkopf, RPA, served as Principal Investigator, and Ms. Deborah Van Steen served as the architectural historian for this Project. Background research was conducted by Mr. Beadenkopf and Ms. Van Steen. The report was written by Mr. Beadenkopf, Ms. Van Steen, and Mr. Davis. Mr. Davis created the report's graphics.

1.4 RESEARCH OBJECTIVES

The objectives of the Phase IA cultural resource investigations included:

- Development of an historic, prehistoric, and environmental background for the Project Area, and its immediate vicinity;
- Identification of all previously documented archaeological resources in the Project Area and vicinity;
- Description of previously documented archaeological resources including their horizontal and vertical extent, structure, artifact and feature content and distributions, temporal and cultural associations, soil characteristics, and environmental variables;
- Assessment of the prehistoric and historic archaeological potential of the Project Area;
- Assessment of potential Project effects to possible archaeological resources within the Project Area;
- Identification of all historic architectural properties listed in and/or previously determined eligible for listing in the National Register of Historic Places;
- Identification of historic architectural resources greater than 50 years within the Project Area and vicinity which have not been previously surveyed/documented;
- Assessment of potential Project effects to National Register listed or previously determined eligible historic architectural resources within the Project Area;
- Preparation of a report that describes, in detail, the purpose, methods, and findings of the investigations and recommendations for any further investigations that may be necessary.

2.0 BACKGROUND

Background research was conducted using CRGIS - the internet map-based inventory of the historic and archaeological sites and surveys maintained by the PHMC/BHP and at the Free Library of Philadelphia (central branch). Additional cartographic resources and historic photographs were obtained from internet clearinghouses such as the Greater Philadelphia GeoHistory Network, the David Rumsey Map Collection, the Library of Congress, and historicaerials.com.

2.1 ENVIRONMENTAL BACKGROUND

The environmental variables characteristic of the proposed Project's setting and its vicinity determine to some extent the suitability of the area for prehistoric and historic human use. The following descriptions of the area's environmental characteristics are abridged directly from Soil survey of Bucks and Philadelphia Counties (Tompkins 1975) and the NRCS web-based soil survey (websoilsurvey.nrcs.usda.gov/app/HomePage.htm).

2.1.1 Physiography and Geology

The Project Area is located within the Lowland Section of the Atlantic Coastal Plain Province and consists of a flat upper terrace surface that is cut by numerous short streams. Most of these stream valleys range from very narrow and steep sided to those with wider bottoms and less steep slopes. The upper terrace surface is underlain by unconsolidated to poorly consolidated sand and gravel overlying various metamorphic rocks of the Wissahickon schist formation that were deposited during the Precambrian Age. Local relief is very low in this section with elevations ranging from sea level to 200 feet above mean sea level. The floodplain of the Delaware River is included in this Section.

At the end of the Wisconsin glaciation (ca. 12,000 B.C.) the Delaware River Basin was flooded with glacial meltwater and increased the level of the river by as much as 18 meters (Kraft 1977). As a result, sand and gravel was eroded from the Appalachian Mountains and were subsequently re-deposited throughout the Project Area through stream action (Cuff et al. 1989). In addition, the shoreline of Philadelphia, including the Project Area, was further modified in the historic period (since the 1870s) by the deposition of dredged material from the Delaware River onto marsh lands to create additional areas for development (Cotter et al. 1992; McHugh 1983).

The numerous native (original) wetlands within and to the west of the Project Area would have provided valuable nutritional and technological resources for prehistoric and historic human populations which have occupied mainland areas (non-marsh land) with higher elevations.

The climate of Philadelphia is one of long cold winters and pleasantly mild summers. An ample supply of precipitation is received throughout the year. Since prevailing winds are from the west, the weather systems affecting this area originate in continental regions. As a result, Philadelphia is subject to a wide variety of weather. Several successive days of very warm temperatures in summer and of near 0 degrees Fahrenheit in winter are not uncommon. One climatic feature of considerable persistence is that of cloudy skies during winter and early in spring. The average temperature is 55°F with average low temperatures in January (32.5° F) and high temperatures in August (76° F). Average rainfall is between 40 and 46 inches per year and the frost free growing period is between 161 and 215 days per year.

The climate of Philadelphia was suitable for permanent human presence, although due to the long and occasionally severe winters, early inhabitants may have selected the area only for seasonal use (late spring through early fall).

2.1.2 Soils

According to the National Resources Conservation Service (NRCS), soils within the Project Area are classified as Urban land (Ub). Slopes range from 0 to 8 percent and the depth to restrictive material is approximately 10 inches. Review of historic cartographic sources from the mid-nineteenth through the mid-twentieth centuries indicates that the Project Area was marshland until between 1922 and 1951 when the area was filled with material dredged from the Delaware River and elsewhere (Sanborn 1922-1951).

2.1.3 Hydrology

The principal drainage within the Project Area is the Delaware River, which is located between 304 and 608 meters (1,000 to 2,000 feet) to the east of the Project Area and flows from the north to the south. Historically, Hollanders Creek crossed north of the Project Area on a west-east axis along with an off shoot of that creek. Each of these creeks drained into the marshland that bordered the Delaware River in the historic period (prior to 1922-1951).

2.1.4 Current Conditions

The Project Area is currently dominated by former military housing that was constructed between 1970 and 1985 (Figure 3; Plates 1 and 2). Paved roadways were also observed throughout. An asphalt paved parking area (Plate 3) was also observed to the east of the Seaplane hangar (Building 653) (located to the west of the former military housing). Wetlands were observed to the east of the former military housing in the Project Area. The northern portion of the Project Area is characterized by former rail line spurs extending to Pier 122, paved areas, and support buildings related to the historic function of Pier 122 (Figure 4; Plates 3 - 5).

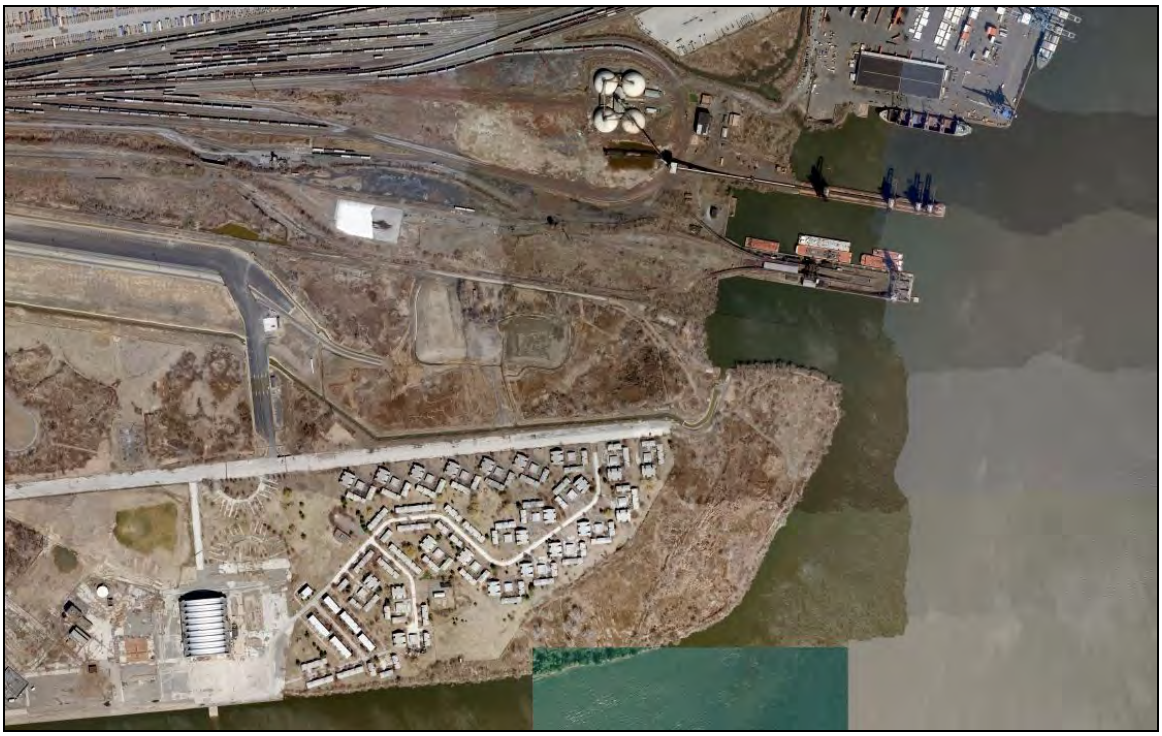

Figure 3: Aerial Image of the Project Area Showing the Location of the Former Military Housing, Paved Areas, and Wetlands. *Source: www.bing.com/maps*

Plate 1: Former Military Housing within the Project Area. View Southeast
Photo by: D. Van Steen January 13, 2010.

Plate 2: Former Military Housing within Project Area. View Northwest.
Photo by: D. Van Steen January 13, 2010

Plate 3: Paved Area within the Project Area East of the Seaplane Hangar. View Southeast.
Photo by: D. Van Steen January 13, 2010

Figure 4: Aerial View of the Northern Portion of the Project Area. *Source: www.bing.com/maps*

Plate 4: Abandoned Pier 122 Ore Conveyor Support Building within the Northern Portion of the Project Area Located West of Pier 122. View Northwest. *Photo by: D. Van Steen January 13, 2010*

Plate 5: Abandoned Office Building to the Southwest of the Pier 122 Ore Conveyor Support Building within the Project Area. View Southwest. *Photo by: D. Van Steen January 13, 2010*

2.2 PREHISTORIC BACKGROUND

The prehistory and history of the Pennsylvania is traditionally divided into six cultural periods:

Paleoindian Period	prior to 8,000 BP
Archaic Period	8,000 - 3,750 BP
Transitional Period	3,750 - 2,750 BP
Woodland Period	2,750 BP - AD 1500
Protohistoric Period	1,500 BP - AD 1650
Contact Period	AD 1650 – AD 1737

The prehistoric cultural periods are understood to reflect temporally and culturally distinct occupations and are defined on the assumption that changes in artifact types and styles mirror cultural changes. Stylistic variation in projectile points, other stone tools, and later, ceramics define the traditional cultural periods (Coe 1964; Kinsey et al. 1972).

A reorganization of the traditional chronology above, based on ecological adaptation, was proposed by Gardner (1978) and applied to Pennsylvania's Eastern Plateau and Poconos Study Unit by Raber (1986). This alternative chronology views changes in adaptive strategies rather than artifact styles as the milestones in cultural chronology (see also Custer and Wallace [1982] and Custer [1996]).

The discussion below of the prehistoric period derives from a review of published reports and the "gray literature" resulting almost exclusively from compliance-driven archaeological efforts. The descriptions and interpretations included are based on investigations in areas selected largely by the dictates of infrastructure and commercial development and not by reference to a regional sampling strategy. As a result, the existing knowledge base is focused on areas that are not statistically representative of actual prehistoric site distributions in the region during any period.

Furthermore, the majority of site-specific archaeological studies so far undertaken have not been methodically consistent or systematic. The investigations have employed such a wide variety of sampling, recovery, analytical, and reporting methods that their findings are difficult or impossible to compare. The result is a corpus of site descriptions and interpretations variously gathered, analyzed, and reported that do not constitute statistically reliable or comparable data.

The archaeological record in itself is not fully representative of past cultural activity as it is incomplete. For example, prehistoric people likely spent much of their time in the riparian/woodland ecotonal areas taking advantage of the relative abundance and variety of resources therein. However, the Late Pleistocene and Early Holocene rivers were much more energetic than in the middle and late Holocene, and many Paleoindian and Early Archaic floodplain sites have likely been substantially scoured and/or buried by river action. Older sites have been exposed to erosion, sedimentation, and decomposition for longer periods of time, which tend to obscure and/or destroy sites and their contents. An older site exposed to such processes will yield less cultural material than originally deposited; unless the processes depleting the site are taken into consideration, the low volume of material might suggest that the culture represented by that material was less populous than it actually was.

Because of gaps in the archaeological record, it is difficult for archaeologists to test diachronic and synchronic site distribution models and to present a reliable characterization of prehistoric sites and the cultures that created them. Current population estimates, settlement distribution models, and interpretations of their behavioral correlates are based on unsystematic regional and site sampling and should be considered untested and very preliminary.

The characteristics of the surviving artifact/ecofact assemblages—their forms, distributions, and ecological associations—constitute the bulk of the evidence for the presence and behavior of prehistoric people. Their projectile points, ceramic vessels, tools, debris, intra-site feature distributions, and site distributions varied over

time and space. Similar constellations of these characteristics found at different places or dating to different times are almost certainly indicative of the relatedness of the people who left them. These similarities are indicative of related social and technological adaptations. Conversely, diachronic and synchronic variations in the characteristics of artifact assemblages are indicative of strategic and/or overall cultural differences. Changes through time resulting from a mix of in situ innovation, diffusion, and migration are not yet clearly understood. Nevertheless, the following discussion reflects current understandings.

2.2.1 Paleoindian Period

Paleoindian sites are recognized archaeologically by distinctive fluted projectile points that have been found throughout North America. In the east these points have been recovered from contexts with radiocarbon dates that range between 10,600 BC at the Duchess Quarry Cave in Orange County, New York (Funk 1977), and 8000 to 6000 BC at the St. Albans Site in Kanawah County, West Virginia (Broyles 1971). Approximately 30 miles northeast of the proposed Project, the Shawnee-Minisink Site in the Upper Delaware Valley yielded a fluted point with an associated radiocarbon date of between 8640 and 8880 BC (McNett et al. 1977:198). This site represents the earliest reliably dated Paleoindian occupation of eastern Pennsylvania.

Along with fluted projectile points, toolkits of the period include bifacial knives, drills, gravers, burins, flake cores, scrapers, and flake tools with no formalized shapes. These assemblages display a consistent preference for high-quality cryptocrystalline lithic materials. Gardner (1977) has suggested that sources of these raw materials may have influenced the distribution of settlements and the overall size and shape of exploitative territories.

Paleoindian subsistence strategies appear to have emphasized the hunting of game. Few traces of additional economic activities, such as the collection and processing of plant foods, have been detected. At the Shawnee-Minisink Site, however, the Paleoindian component produced fish bones and remains of edible seeds and plants, indicating the use of such resources by these populations (McNett et al. 1977).

Paleoindian settlement/subsistence patterns are thought to be the result of seasonal migrations by small groups. Gardner (1978) has asserted that seasonal rounds would have focused on sources of lithic raw materials. Groups would have returned to these outcrops once or several times a year to replenish their tool supplies. Where primary outcrops of lithic materials were unavailable, Custer (1996) has suggested that groups would have obtained raw materials from glacially deposited cobbles and pebbles. Because this strategy would allow procurement of materials while pursuing other subsistence activities, groups would not necessarily focus on specific sources. Hunter Research, Inc. (1990) has suggested, however, that in areas where cobbles and pebbles accumulated in localized concentrations, Gardner's model might apply.

Paleoindian sites in this region of Pennsylvania consist primarily of isolated point finds and surface sites that contain low frequencies of projectile points and other hunting-related artifacts. These sites tend to lie in lowland settings within river valleys and appear to represent short-term camps used by single individuals or very small groups. It is suggested that Paleoindian populations in Pennsylvania consisted of small groups that moved frequently across the landscape. The patchy distribution of exploitable resources in the region during this period would have favored small and highly mobile groups that could shift repeatedly from one location to another. A further influence on settlement was the behavior of elk and caribou, which were likely the large game preference of Paleoindian. These species migrate between isolated food sources seasonally and this behavior would have provided an impetus for highly mobile human populations (Hunter Research, Inc. 1990:IV-11).

Traditional wisdom suggests that Paleoindians were quite mobile and that their settlements were relatively short-term encampments. Sites, such as hunting camps, devoted to the seasonal procurement of specialized resources were situated to allow exploitation seasonally available resources (Ritchie and Funk 1973). However, Raber (1986) suggests that Paleoindians may have been somewhat less mobile than previously believed. He argues that instead of randomly ranging over a wide and ill-defined geographic expanse in search

of food and raw materials, Paleoindians exploited a well-defined "home range" that provided consistently adequate resources.

There is little direct evidence for the details of Paleoindian culture. Paleoenvironmental reconstructions suggest that the rivers were highly variable before circa 6000 years BP. River channels meandered, and probably destroyed much evidence of early prehistoric occupation and use (Bergman et al 1994:160-161). Subsequent floodplain sediment accumulation has been substantial and has probably buried additional evidence of Paleoindian presence (Stewart 1990).

Based on the locations of known Paleoindian sites in adjacent regions, the types of settings that were probably attractive to these groups included high well-drained ground near streams or wetlands. These settings offered vantage points for observing game. Paleoindian sites have also been identified in rock shelters, areas near lithic sources, and on lower river terraces.

2.2.2 Archaic Period

The warming Holocene climate resulted in environmental changes that encouraged population migrations and the development of new subsistence strategies. These developments characterize the Archaic period, dating from circa 6000 to 1750 BC. Compared to the preceding Paleoindian period, the Archaic period produced greater varieties of artifact types, suggesting that new and varied technologies were employed in the exploitation of more diverse resources.

Early Archaic Period

The Early Archaic appears to represent an elaboration of earlier Paleoindian lifeways. The Early Archaic is traditionally divided from the Paleoindian period on the basis of distinctive projectile point types that include corner-notched, stemmed, and bifurcated stemmed varieties (Broyles 1971; Coe 1964). Cavallo (1980) and Gardner (1978), however, have argued that cultural adaptations during the Early Archaic were not substantially different from those of the preceding period. Based on similar overall technologies, site distributions, and other adaptations, these researchers contend that Early Archaic cultures represent a continuation of Paleoindian traditions (Cavallo 1980; Custer 1996; Gardner 1978). The primary difference in the tool assemblage from the Paleoindian period is the introduction of new projectile point forms. The balance of the toolkit remained essentially the same.

The location and distribution of sites suggest that group territories and general settlement rounds were comparable to those of the Paleoindian period. There was an increasing proportion of deciduous vegetation in the region, and these new environments may have been attractive to Early Archaic populations. The presence of higher frequencies of Early Archaic sites relative to those of the preceding period suggests population increases or a greater use of the general region.

Because Paleoindian and Early Archaic lifeways are thought to represent a continuum, similar influences would have affected the subsistence/settlement strategies of both groups. However, as noted above, higher numbers of Early Archaic sites suggest the exploitation of new environments that began to form in the early Holocene. Early Archaic sites likely reflect the same functions and activities as Paleoindian sites. Base camps, if established, were presumably located in lowlands along larger rivers and streams, where environmental diversity, and in turn, exploitable resources were greater (Hunter Research, Inc. 1990).

Middle Archaic Period

The Middle Archaic is problematic because of unclear typological definitions for the period. The paucity of information on the Middle Archaic in the region frequently leads researchers to combine this period with either the Early or Late Archaic (Hunter Research, Inc. 1990). Diagnostic projectile points dating to the Middle Archaic include Kirk-like, Stanly Stemmed, Morrow Mountain, Neville, and Stark points (Kinsey et al. 1972; Kraft 1986; Ritchie 1971). These designations are based largely on formal similarities to projectile point types

of the southeast or New England. Efforts to understand the Middle Archaic in southeastern Pennsylvania have been hindered by an absence of stratified deposits yielding diagnostic artifacts.

In addition to diagnostic projectile points of this period, the Middle Archaic toolkit includes hunting and butchering-related objects similar to those of the preceding periods. Additions to the assemblage include atlatl weights, chipped-stone axes or celts, adzes for woodworking, and netsinkers. Flat and pitted stones that may represent milling equipment are found associated with Middle Archaic sites.

The subsistence/settlement strategies that prevailed during the Middle Archaic in southeastern Pennsylvania were most likely influenced by changes in local environmental conditions. After 5000 BC, a variety of hardwood species, including birch, maple, beech, and hemlock, and later hickory, supplanted the coniferous-deciduous forests. Elk, deer, and moose were the primary large game animals in this habitat. Until circa 5500 BC, human populations probably followed essentially the same subsistence/settlement patterns as described for the Paleoindian/Early Archaic populations, that is, with small mobile groups exploiting seasonal resources such as elk. With the onset of warmer conditions and greater floral and faunal diversity after 5500 BC, shifts in settlement and subsistence strategies were required. Such shifts most likely included an increase in the use of aquatic resources along with the collection and processing of wild plant foods. The processing of these materials is suggested by the presence in the region of fire-cracked rock features, and charred hickory nuts and pounding and crushing tools found in association with these features. Nuts, fish, and bones were most likely boiled to render their nutritious oils and grease.

The settlement patterns of the Middle Archaic period in general are reflected in the remains of residential base camps located in settings with easy access to diverse resources. High artifact density and variety characterizes such sites. Small groups or individuals would have made forays from these camps to other areas to procure resources or to accomplish other tasks. Little variety in artifact types and relatively sparse artifact distribution would be expected at such sites.

Late Archaic Period

The Late Archaic period is marked by a greater number of sites and, possibly, growing human populations. The changes that occurred during this period have been correlated with climatic changes that resulted in the introduction of chestnut trees into the region around 3500 BC, followed by the introduction of hardwood forests such as birch and oak that dominate the region today. Estuarine and riverine habitats stabilized by 2000 BC, and environmental conditions in the region approached those of the present. Changes in the environment presented new options for Late Archaic groups. Archaeological sites of the period reflect the new adaptive strategies employed by these populations.

Diagnostic projectile points of the Late Archaic include a variety of narrow-bladed notched and stemmed specimens. Among these are Lackawaxen, Poplar Island, Brewerton, Lamoka, and Normanskill points. Late Archaic artifact assemblages reflect the variety of exploitative activities practiced during the period and the diversity of habitats that were utilized. Artifacts found include knives, drills, atlatl weights, axes, celts, grinding and pounding implements, and netsinkers. The variety of lithic resources employed in tool manufacture indicates an emphasis on materials such as quartzite and vein quartz, which were previously used only infrequently.

Relative to earlier periods archaeological sites are more common for the Late Archaic and are present in a variety of upland and lowland settings. The marked increase in the frequency, size, and depositional intensity of Late Archaic sites suggests the growth of human populations and the exploitation of new resources. By the Late Archaic environmental conditions fostered the appearance of nut-bearing trees, such as hickory, oak, and chestnut, and animal species dependent on them (e.g., deer, bear, and turkey). The stabilization of riverine habitats would have provided constant supplies of aquatic resources as well.

In contrast to the preceding periods, the Late Archaic appears to be characterized by hunter-gatherer groups with well-defined and scheduled settlement and subsistence patterns. Residential base camps continued to be

primary components of the settlement pattern. Three alternative models for Late Archaic settlement are probable. The first of these involves a central-based wandering system wherein a fixed base camp is occupied on a semi-sedentary basis. Seasonal or constant forays to other camps would occur, with the base camp periodically or seasonally abandoned and reoccupied during the later parts of the annual cycle. A second alternative settlement pattern involves a shifting base-camp location. This model suggests that base-camp positions would move when local resource bases became depleted or as seasonal resources became available. The third alternative model proposes restricted wandering inside a given territory with periodic group consolidation at changing base-camp locations as resource availability allowed. In all three of these alternative models, base-camp locations would most likely be located along larger water courses. As in the preceding period, local variations of these models could have occurred in response to regional topography.

2.2.3 Transitional Period

Marked changes occurred in certain procurement and processing implements and sociocultural organization in approximately 2000 BC (Snethkamp et al. 1982). Large, thin, broad-bladed stemmed and notched points, and carved soapstone vessels, made their initial appearance in the regional archaeological record, and so form the basis upon which the Transitional period is defined. Diagnostic points of the Transitional period in the Project vicinity include Susquehanna Broad, Lehigh-Snook Kill, and Perkiomen. Lithic raw materials used in their manufacture included locally available high-quality jaspers and cherts. The appearance of new technologies and toolkits in the region has been subject to various interpretations; these include the migration of new populations northward and the incorporation of new technologies into an existing technological tradition.

2.2.4 Woodland Period

It is likely that by the beginning of the Woodland period, regional climates and environments were rough approximations of historic/modern conditions. The productive deciduous element of plant environments would have remained intact. The major difference between the sites of each period is the density of artifact deposits: Archaic sites tend to have light artifact scatters over a moderate to broad area, while Woodland sites exhibit moderate to dense artifact scatters over relatively smaller areas. This contrast hints at changes in the frequency with which certain environments may have been used and the size of the groups involved in their exploitation.

Woodland peoples, operating in relatively small groups, appear to have used uplands and low-order stream environments more frequently than did their Archaic predecessors. At the same time, major Woodland habitation sites located in the floodplains of rivers show a degree of permanence or sedentism not evinced in Archaic settlements. The more frequent use of peripheral habitats during Woodland times is probably a direct result of longer occupations at floodplain habitation sites, in effect, an intensification of traditional hunting and gathering subsistence activities. What led to the increased sedentism at habitation sites during the Woodland period is still a subject requiring much more archaeological research.

Early Woodland Period

The Early Woodland period is distinguished by the use of ceramic technology and evidence of cultivated plants. Ceramic technology made possible the production of highly portable and durable containers that could withstand the rigors of cooking with direct heat and provided waterproof storage. While cooked foods may have affected the nutrition and population dynamics of Woodland groups, the use of ceramic containers also enhanced the capability of these groups to store food. Food storage has implications for population dynamics since stored reserves can support sedentary, long-term settlements while partially offsetting the seasonal fluctuations in resource availability.

The economic base of Early Woodland cultures in the region is not well understood. It is apparent from evidence recovered from Meadowcroft Rockshelter near Pittsburgh that Early Woodland people had knowledge of domesticated plants such as corn (*Zea mays*) and small pumpkins or squash (*Cucurbita sp.*). It can be surmised that even minimal attention given to the propagation of domesticated plants requires a formal

scheduling of settlement movements, if not prolonged habitation at select sites during the summer. There is as yet no evidence of a major settlement or subsistence shift to farming or garden-oriented villages in arable floodplain locations during the Early Woodland. Such a shift is evident during the Late Woodland period when populations are concentrated in farming-oriented villages in floodplain or high stream terrace settings. Early Woodland peoples are best characterized as specialized hunters and gatherers.

The toolkit of the period is essentially that of Late Archaic times, excluding stylistic changes in projectile points and the addition of ceramics. Ornaments and stone or clay pipes are also relatively new additions to artifact assemblages.

The repeated occurrence of Late Archaic and Early Woodland artifacts on the same sites suggests that there are many common elements in the respective settlement patterns. Early Woodland sites are anticipated to co-occur with Late Archaic deposits.

Middle Woodland Period

Middle Woodland cultures in eastern Pennsylvania show a basic continuity of lifestyles with their Late Archaic and Early Woodland predecessors. This includes a general overlap of where sites are located and the types of activities that were performed in various locations. Ceramic studies suggest, however, that the exploitative territories of some groups were more restricted during the Middle Woodland than in earlier times. In the absence of significant environmental and technological change, the limiting of territorial boundaries is viewed as a result of growing populations and elaborations of social relationships and organization.

Late Woodland Period

During Late Woodland times, farming-related base camps or villages are added to the inventory of site types. Although hunting and gathering remained important subsistence pursuits, the cultivation of domesticated plants such as corn, beans, and squash was a significant activity. The size of the exploitative territories of groups seems to decline from its Middle Woodland level, and the appearance of fortifications at some sites indicates the occurrence of intergroup conflicts. More frequent social contacts necessitated by greater population densities and the need to maintain access to resources that might have been outside a group's territory do not seem to have resulted in the development of complex societies or political hierarchies beyond those in existence during the Middle Woodland period.

Base camps or villages are located somewhat farther from stream edges than the major sites of earlier times although there is overlap of site locations in many cases. Late Woodland base camps are also related to a series of procurement sites in nearby uplands and low-order stream environments. A greater number of procurement sites per area might be expected during Late Woodland times given the long-term residence expected to have occurred at base camps. It is also expected that some Late Woodland procurement sites might appear in peripheral environments never before exploited, depending on the degree of strain that base camp populations placed on local resources. Neither of these contentions has yet been tested.

2.2.5 The Protohistoric Period

The Protohistoric period includes the times during which there was no actual contact among Native American populations of the region and Europeans. Local people encountered European diseases, artifacts, rumors, and second-hand descriptions of Europeans from groups in direct contact.

New diseases, against which the Native Americans had no immunities, spread from Native American groups in direct contact with Europeans and must have had a substantial effect on population size and cultural integrity. Snow (1980) calculated mortality rates from imported diseases on New England's Native American populations at 55-98 percent. The young and old were disproportionately affected. The loss of young people had a devastating effect on the size and viability of subsequent generations. The loss of elders likely diminished the transmission of cultural traditions to younger generations and so diminished cultural integrity.

Awareness of Europeans and the availability of European artifacts and technologies certainly prompted profound changes in Native American cultures prior to actual substantial contacts with Europeans. Native American refugees from areas already invaded by Europeans not only brought European diseases and artifacts with them, but also introduced much-altered remnants of their own cultures. Native Americans in southeastern Pennsylvania probably had been so changed during the more than 100-year-long Protohistoric period that the people and cultures first actually encountered by the earliest Europeans must have been very different from their recent prehistoric ancestors.

2.2.6 Contact Period

This Contact Period is the historically documented period in which Native American populations and European colonists come into contact with each other. The native populations of southeastern Pennsylvania and western New Jersey commonly referred to themselves as the Lenape; a people who were often referred to as the Delaware by Europeans.

At the time of contact, the Lenape consisted of three loosely organized tribal/clan sub-groups: the Munsee (Upper Delaware), the Unami (Middle Delaware Valley), and the Unalachtigo (Lower Delaware Valley) (Becker 1985; Kraft 1986).

Beginning in the seventeenth century, Europeans gradually purchased most of the Lenape territory culminating in the "Walking Purchase of 1737" which represented the sale of the last major portion of Lenape land in eastern Pennsylvania (Becker 1985). As a result, the Lenape began their westward migration, first to the Susquehanna Valley and then ultimately Oklahoma in the late nineteenth century.

2.3 PREVIOUSLY DOCUMENTED PREHISTORIC ARCHAEOLOGICAL SITES

Research at the PHMC/BHP revealed that no prehistoric archaeological resources are known within the Project Area or within a 2–mile radius. Although many sources indicate that a Lenape fishing camp was located on the eastern bank of the Schuylkill River near its confluence with the Delaware River (approximately 3 miles to the west of the Project Area), no evidence of the site has ever been documented (Donehoo 1928; Weslager 1956; Cotter et al. 1992).

2.4 HISTORIC BACKGROUND

2.4.1 Historical Overview of the Vicinity of the Project Area

Historic occupation in the Delaware River Valley began with the discovery of the river by Henry Hudson in 1609. The Dutch established Fort Nassau on the eastern shore of the Delaware River in 1626 near Gloucester County, New Jersey and a whaling station at the mouth of the Delaware River (Garber 1917:129).

Swedish settlements along the Delaware River began in 1638 and consisted of scattered farmstead tracts that formed loosely connected communities (e.g. Kinssessing – located approximately 5 miles to the west of the Project Area). The Swedish colonies dominated the area until William Penn arrived to claim his proprietary colony in 1682 (Garber 1917:135). By 1712, the scattered communities of the Swedes were abandoned, a gridded land system was imposed on the territory, and the City of Philadelphia was divided into twelve townships (Meyers 1966:120).

The area to the west of the Project Area was strategically important during the American Revolution. Fort Mud (renamed Fort Mifflin) was originally constructed on Mud Island (4 miles to the west of the Project Area) by the British in 1771 and served as one of two forts used by the Continental Army to defend Philadelphia and the

Delaware River during the Revolution[1]. After an intensive bombardment, Fort Mifflin fell to British control in November 1777. Prior to and after the fall of Fort Mifflin, British batteries and forces were stationed at Girard's Point near the confluence of the Schuylkill and Delaware Rivers (Fadden 1779; Garber 1917).

Philadelphia was one of the busiest ports until 1812 when New York City surpassed Philadelphia as the nation's busiest port city. In response to the decline in the importation of goods from foreign markets, Philadelphia became an important center of domestic manufacture. Coal and iron mines, and the construction of new roads, canals, and railroads increased Philadelphia's manufacturing power and the city became the first major industrial city. Philadelphia was also the financial center of the country in the early nineteenth century (Bronner 1982).

Immigration, mostly from Germany and Ireland, increased the population of Philadelphia and its suburbs in the early-to-mid nineteenth century spurring the development of small row houses and boarding houses. Disease and crime was rampant in the poor crowded urban neighborhoods in the mid-nineteenth century (Miller 1982).

Philadelphia's population continued to increase from 565,529 in 1860 to 817,000 in 1876. The dense population areas were located along the Delaware River and westward across the Schuylkill River. Immigrants comprised a large portion of the population and by the 1880s, upper class suburbs were developed along the Pennsylvania Railroad Main Line west of the city (Beers 1982).

The history of the area surrounding the Project Area is also largely intertwined with the history of the League Island, which was officially transferred to the United States Government in 1868 as the site of a new navy yard to replace the original navy yard on Federal Street (created in 1801)[2]. The transfer included 447.25 acres of mostly low-lying marshland and 475.75 acres of water (Johnson 1955; Zubrow 1946). Construction of the new navy yard began in 1871 and included the dredging of the backchannel that separated the island from the mainland to create a mooring basin and to provide a portion of the 22 million cubic yards of fill material used to build up low-lying areas of the island, repairs to the existing dikes, and erection of temporary buildings (Zubrow 1946:28). At least two shipwrecks have been noted in the history of the navy yard including the USS New Ironsides, which burned and sank while docked at League Island in 1866 and the USS Chattanooga, which was struck by ice and sank while docked at League Island in 1871[3].

Permanent buildings were constructed on League Island beginning in 1872 and progressed slowly through 1875. By 1876, the transfer of all shipyard activities from the original Federal Street navy yard was complete. A severe storm in 1878, however, caused extensive damage to the League Island shipyard and halted development until 1888 when the Congress appropriated the funds necessary for the construction of dry docks on the island (U.S. Navy Department 1888:42). Additional construction on the island continued through the late 1890s (Coletta 1985:483). In 1908, the navy yard at League Island was renamed the Philadelphia Navy Yard (Coletta 1985:483).

The Naval Aircraft Factory (NAF), was established on the eastern end of the island in 1917 to construct seaplanes and "flying boats" for use in World War I (Coletta 1985:484). Between 1920 and 1930, the backchannel was filled with dredged material to create an additional 135 acres of land for use as an aircraft landing field (Mustin Field).

By 1921, the Philadelphia Navy Yard was "one of the world's largest naval installations" and contained "549 buildings, 21 miles of rail line, three dry docks, and three shipways" (John Milner Associates, Inc. 1994:20 21).

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[1] Fort Mercer, constructed in 1777 by the Continental Army along the eastern bank of the Delaware River Gloucester County, New Jersey, was the companion fortification to Fort Mifflin.

[2] John Milner Associates, Inc. conducted an extensive cultural resources survey of League Island in 1994 and provides an excellent summary of the history of the Navy Yard on League Island.

[3] Neither of these ships, or any other shipwreck, were located within the Project Area.

During World War II, a total of 53 vessels were constructed and 1,218 other vessels were overhauled or repaired at the Philadelphia Navy Yard. The facility also developed, tested, and produced materials for use on fleet and on-shore stations critical o the war effort (Zubrow 1946).

Following World War II, the facility was renamed the Philadelphia Naval Shipyard and its focus was shifted form ship construction to conversion and overhaul. Aircraft design and production was also phased out in favor of research and development of catapults, arresting gear, aircraft barriers and jet engine testing (Trimble 1990: 320). Although Mustin Field was officially closed in 1963 and the navy yard ceased as an aviation testing and development center, it continued to modernize war ships until 1996 when the shipyard was officially closed (Holcomb 1996).

2.4.2 Historical Overview of the Project Area

Analysis of historic cartographic sources and aerial photographs of the three discontiguous areas that comprise the Project Area was conducted to develop a detailed understanding of the development and land use history of the Project Area between 1843 and 2010. The historical development of each of the three areas is discussed below relative to the year in which each was mapped.

1843

The 1843 *Map of the County of Philadelphia* by Charles Ellet, Jr. indicates that the land forming the Project Area did not exist but was rather marshland and open water within the Delaware River (Figure 5).

1855

The 1855 *Map of the Consolidated City of Philadelphia* by R.L. Barnes indicates that the land forming the Project Area did not exist but was rather marshland and open water within the Delaware River (Figure 6). Streets, however, had been planned through the area ("paper streets").

1862

The 1862 *Atlas of the City of Philadelphia* by Samuel L. Smedley indicates that that the Project Area's land still did not exist but was rather marshland and open water within the Delaware River (Figure 7). "Paper streets", however, are depicted.

1876

The 1876 *Map of Philadelphia* by G.M. Hopkins indicates that that the Project Area remained located within the marshland and open water within the Delaware River (Figure 8). "Paper streets", however, are indicated within the marshlands extending southward from the mainland into the Delaware River.

1891

The 1891 USGS *Philadelphia, PA 15-minute series topographic quadrangle* also shows that the Project Area remained within the marshlands and near shore environment of the Delaware River (Figure 9). Due to the fact that the map was designed to illustrate topographic information, only major thoroughfares are shown and "paper streets" were not illustrated in the area.

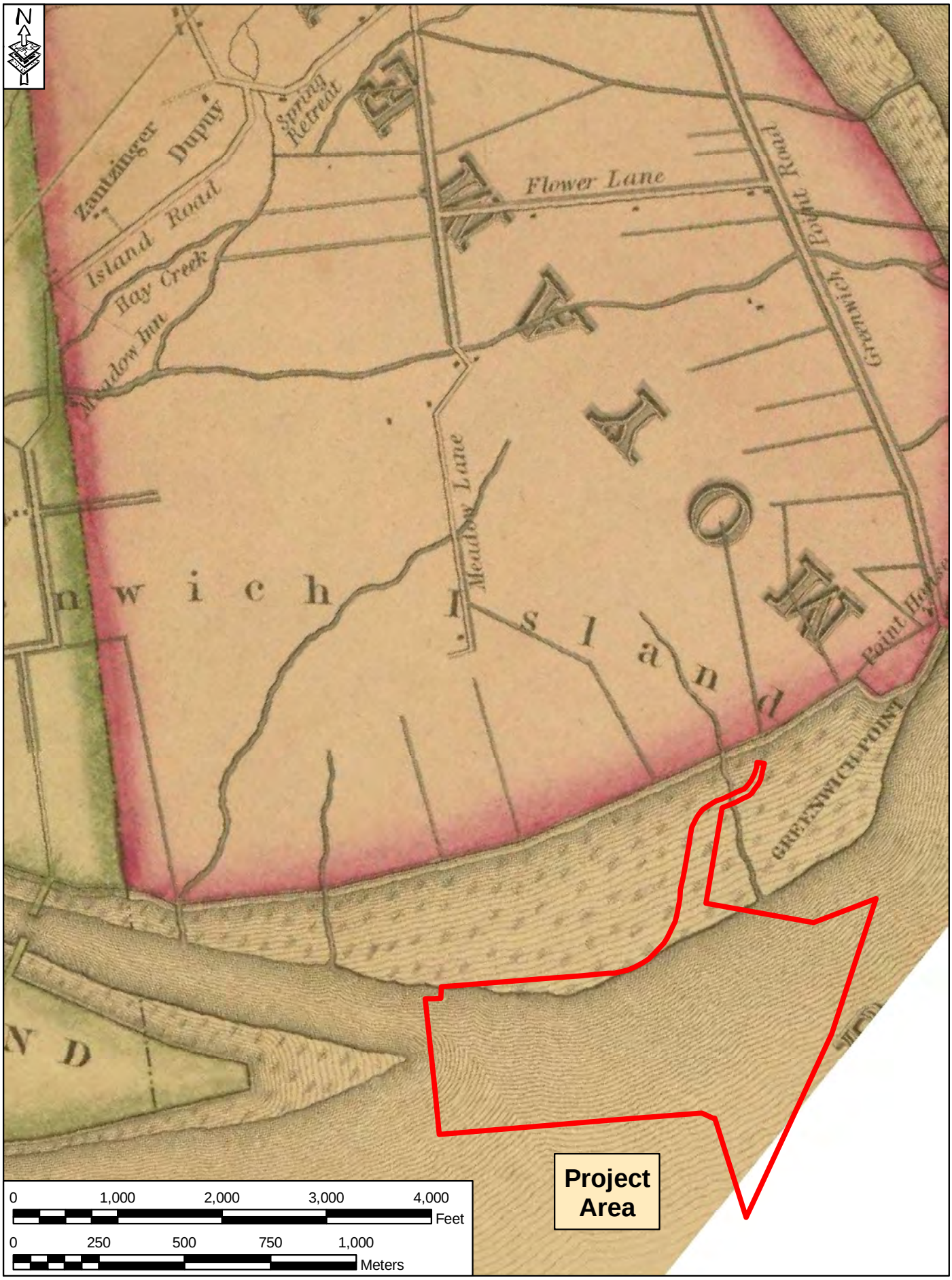

FIGURE 5: 1843 View of the Southport Development Project Area

SOURCE: Ellet 1843

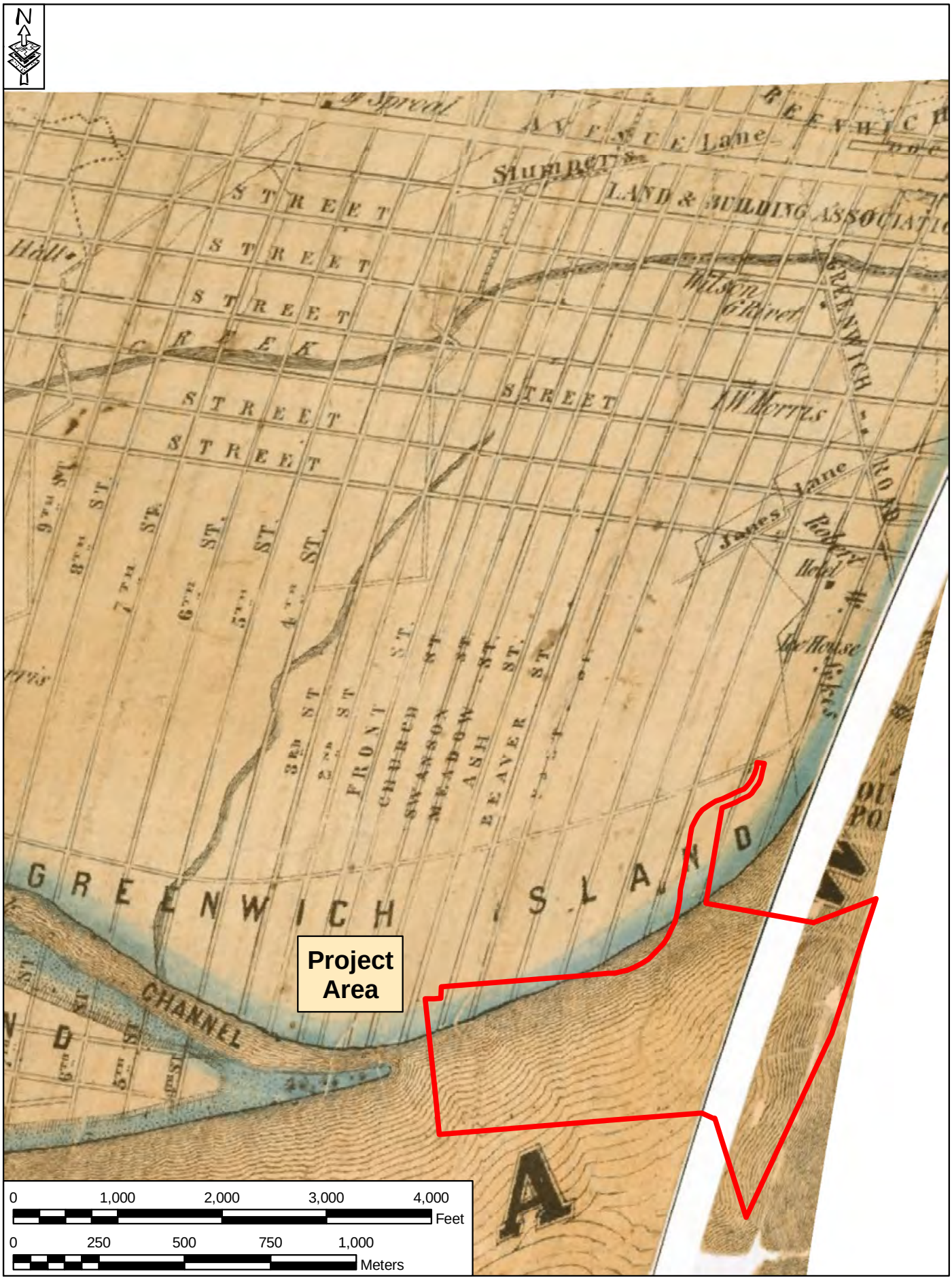

FIGURE 6: 1855 View of the Southport Development Project Area

SOURCE: Barnes 1855

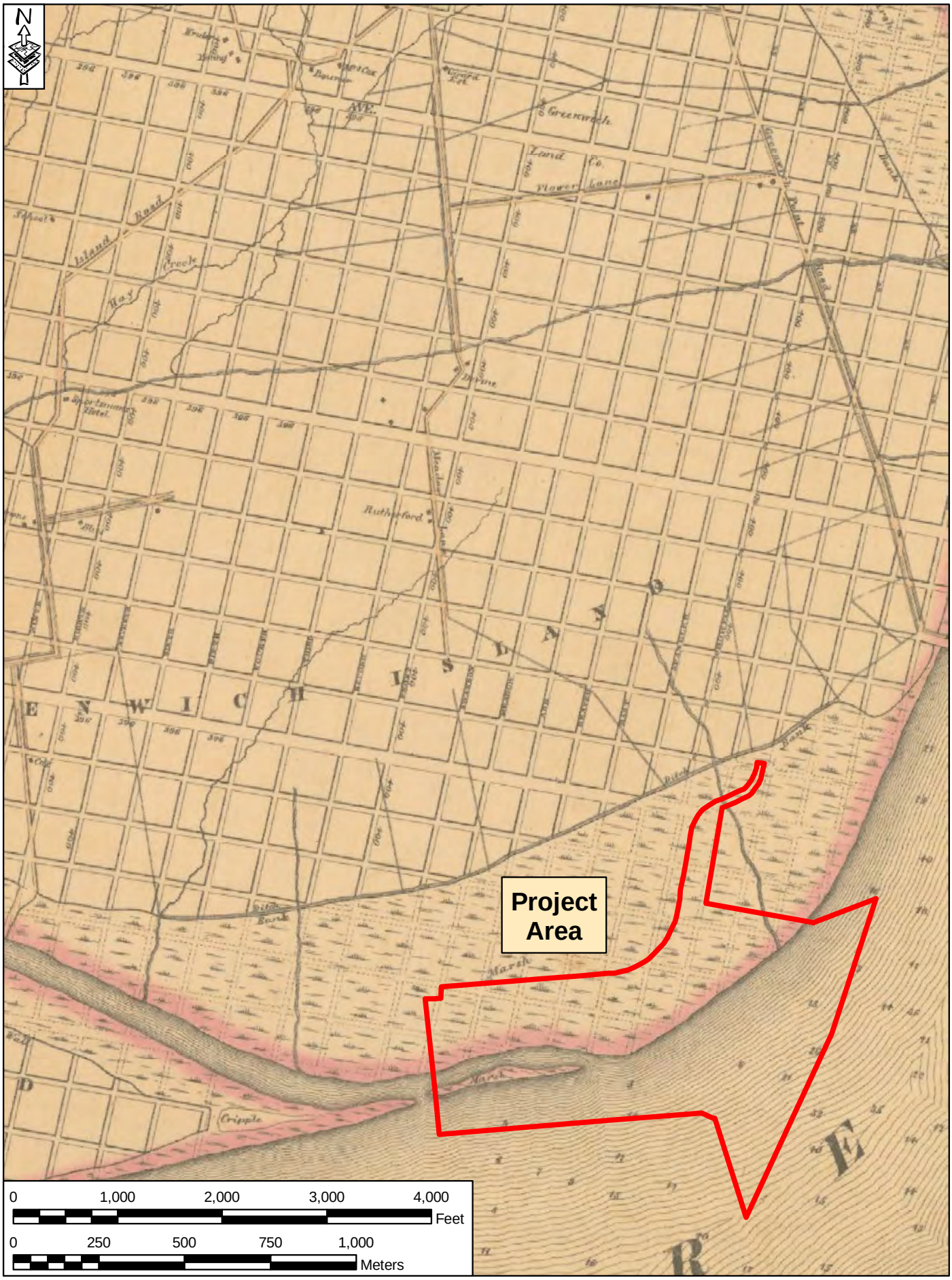

FIGURE 7: 1862 View of the Southport Development Project Area

SOURCE: Smedley 1862

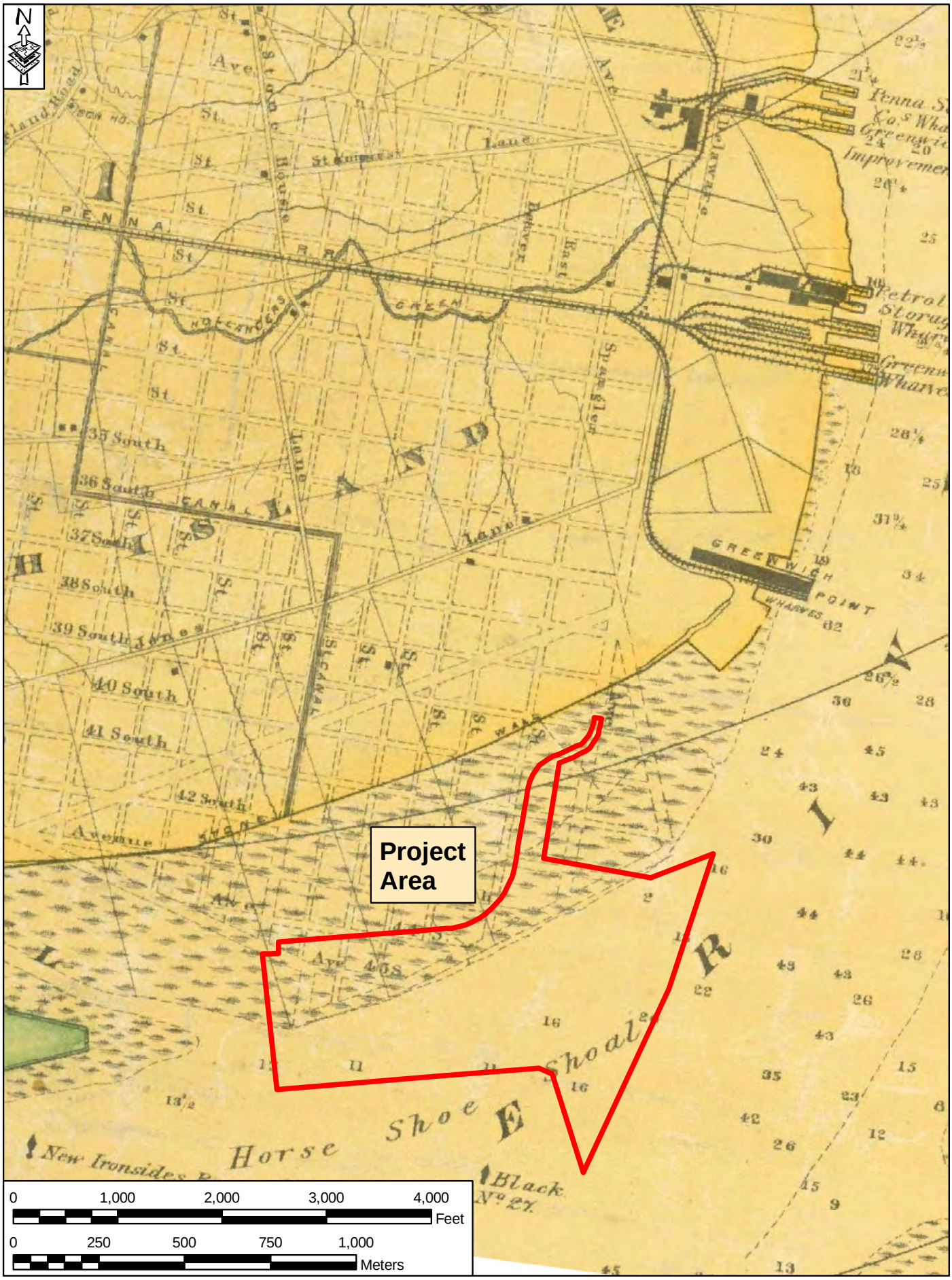

FIGURE 8: 1876 View of the Southport Development Project Area

SOURCE: Hopkins 1876

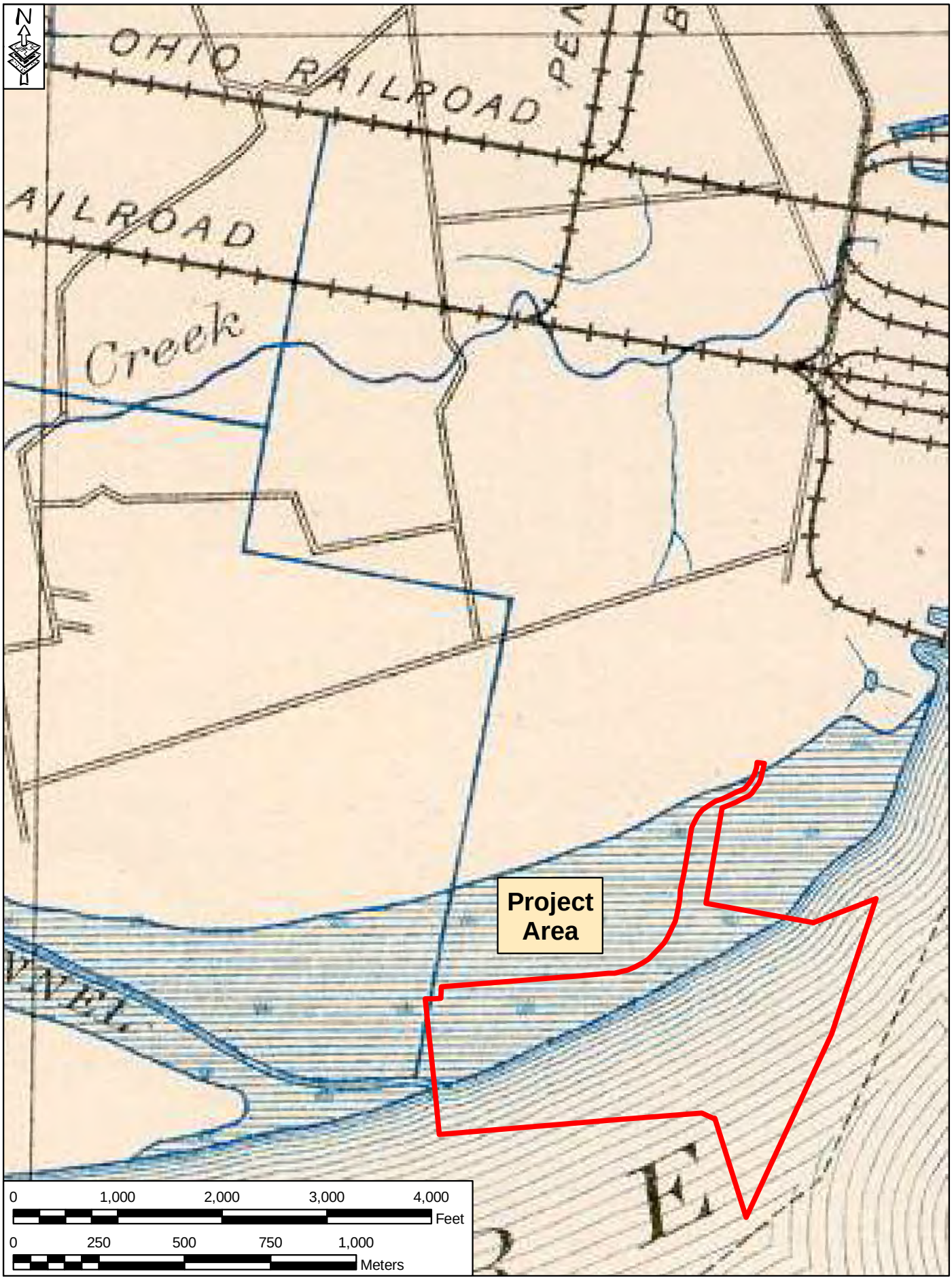

FIGURE 9: 1891 View of the Southport Development Project Area

SOURCE: USGS 1891

1895

The 1895 *City Atlas of Philadelphia* by G.W. Bromley also shows that the Project Area was located within the marshland and shore environment of the Delaware River (Figure 10). "Paper streets", however, had been planned through the area.

1901

The 1901 *Atlas of the City of Philadelphia* by G.W. Bromley indicates that that the Project Area continued to remain offshore and within the Delaware River (Figure 11). The same "paper streets" as shown in prior maps are also shown within the Project Area.

1903

Although not a detailed map of the Project Area, the 1903 *Philadelphia street map* by Dodd, Mead & Company, indicates that the Project Area's land remained within the marshland and near shore environment of the Delaware River known as the "Horse Shoe Shoals" (Figure 12). No "paper streets" are depicted within the Project Area.

1910

The 1910 *Atlas of the City of Philadelphia* by G.W. Bromley indicates that the Project Area did not exist and continued to be depicted as marshland and open water within the Delaware River (Figure 13). "Paper streets", however, had been planned through the Project Area.

1922

The 1922 Sanborn map of the Project Area indicates that the area encompassing the Project Area was not yet created. The Project Area was situated within marshland and open water within the Delaware River (Figure 14).

1930

The 1930 USGS *Philadelphia, PA 15-minute series topographic quadrangle* indicates that that the land which is now the Project area did not exist but was rather marshland and open water within the Delaware River (Figure 15)[4].

1942

The 1942 *Philadelphia Land Use Map* by the Works Progress Administration (WPA) indicates that a portion of the western quadrant of the Project Area had been filled between 1940 and 1942 and Government Avenue was extended across the newly created land mass. The northern portion of the Project Area was also filled by this time and came under the ownership of the Pennsylvania Railroad Company. Pier 124 was also depicted and was labeled as the "P. R.R. Coal Pier". The remainder of the Project Area continued to exist as marshland and open water within the Delaware River (Figure 16).

1951

Although the 1951 Sanborn map of the Project Area does not illustrate the entirety of the Project Area, based on the information shown from the 1942 map of the Project Area (see Figure 16), the western portion of the

[4] Although this topographic map was updated in 1930 it does not accurately reflect changes along the banks of the Delaware River that occurred between 1922 and 1930 as the 1951 Sanborn map of the area indicates that a thawing house associated with the Pennsylvania Railroad Company was built in this area in 1929.

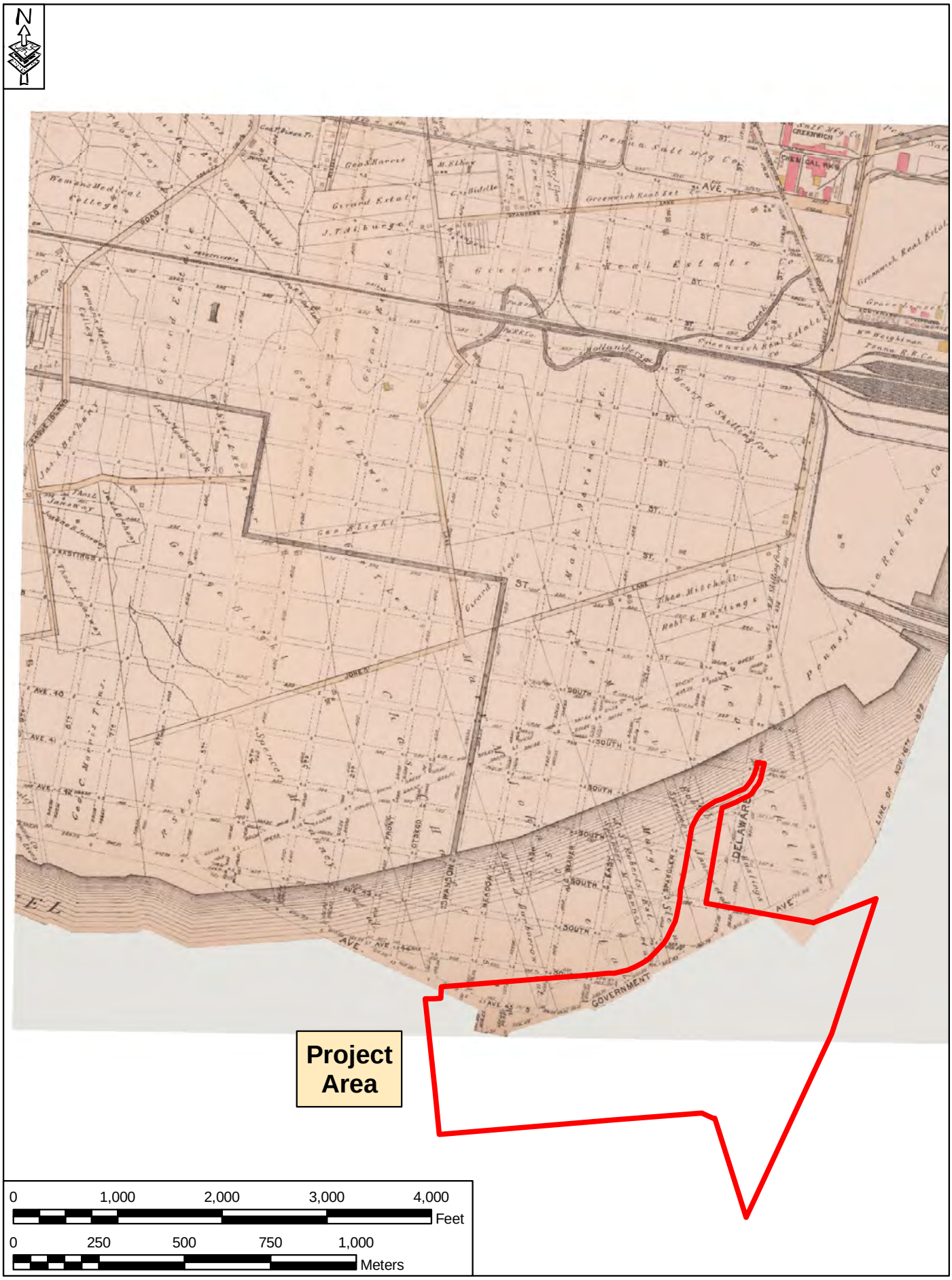

FIGURE 10: 1895 View of the Southport Development Project Area

SOURCE: Bromley 1895

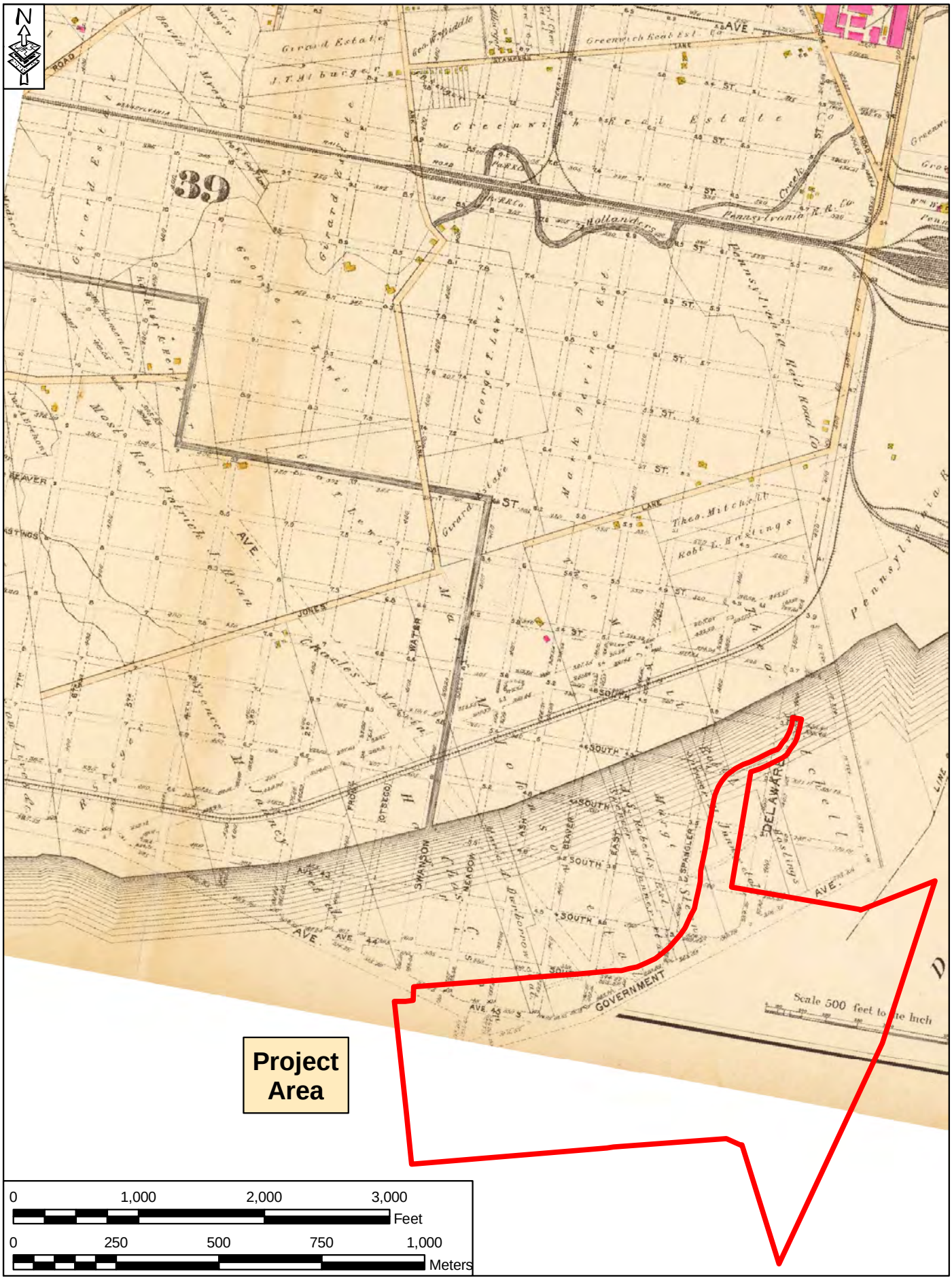

FIGURE 11: 1901 View of the Southport Development Project Area

SOURCE: Bromley 1901

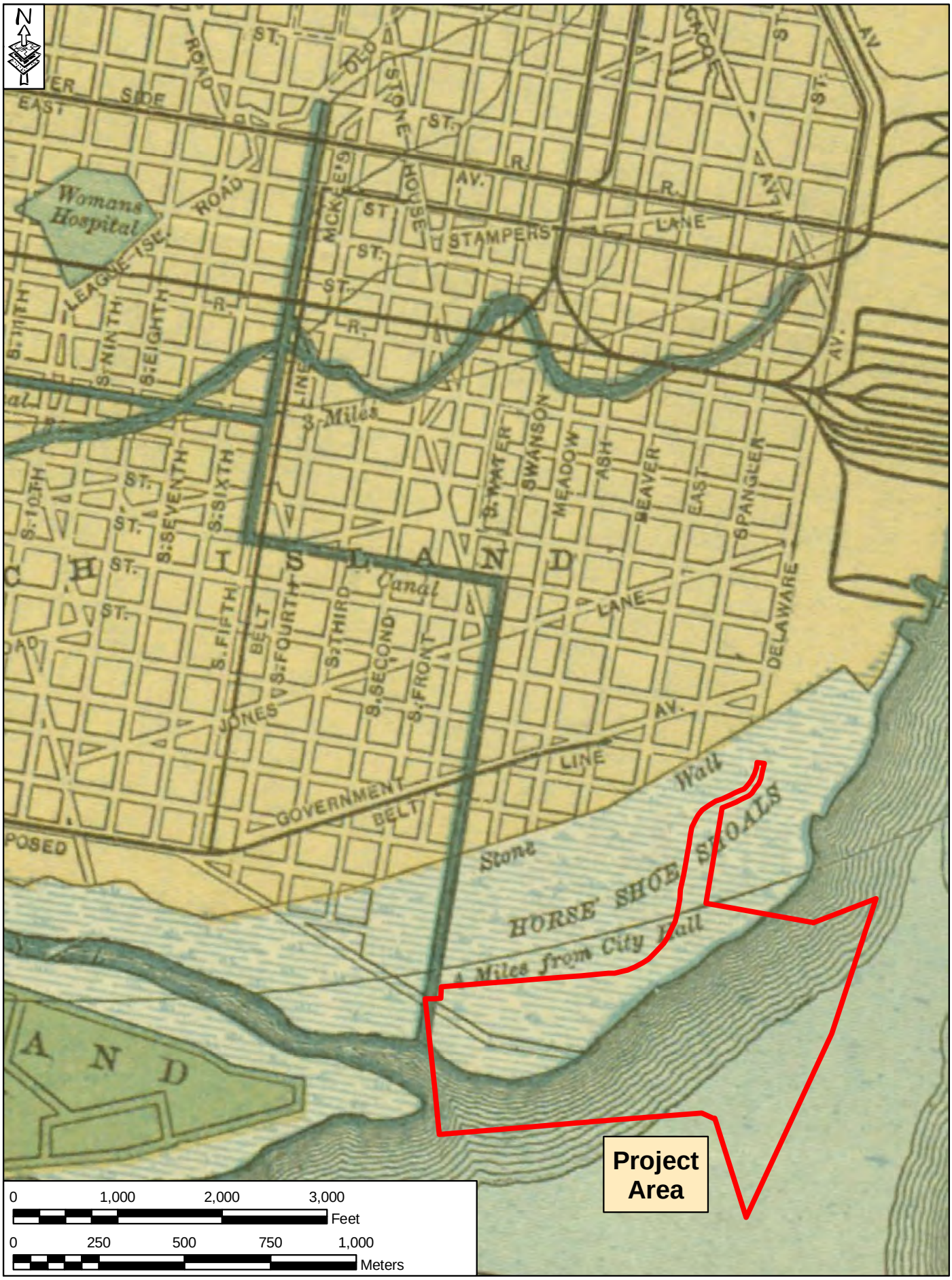

FIGURE 12: 1903 View of the Southport Development Project Area

SOURCE: Dodd, Mead & Co., 1903

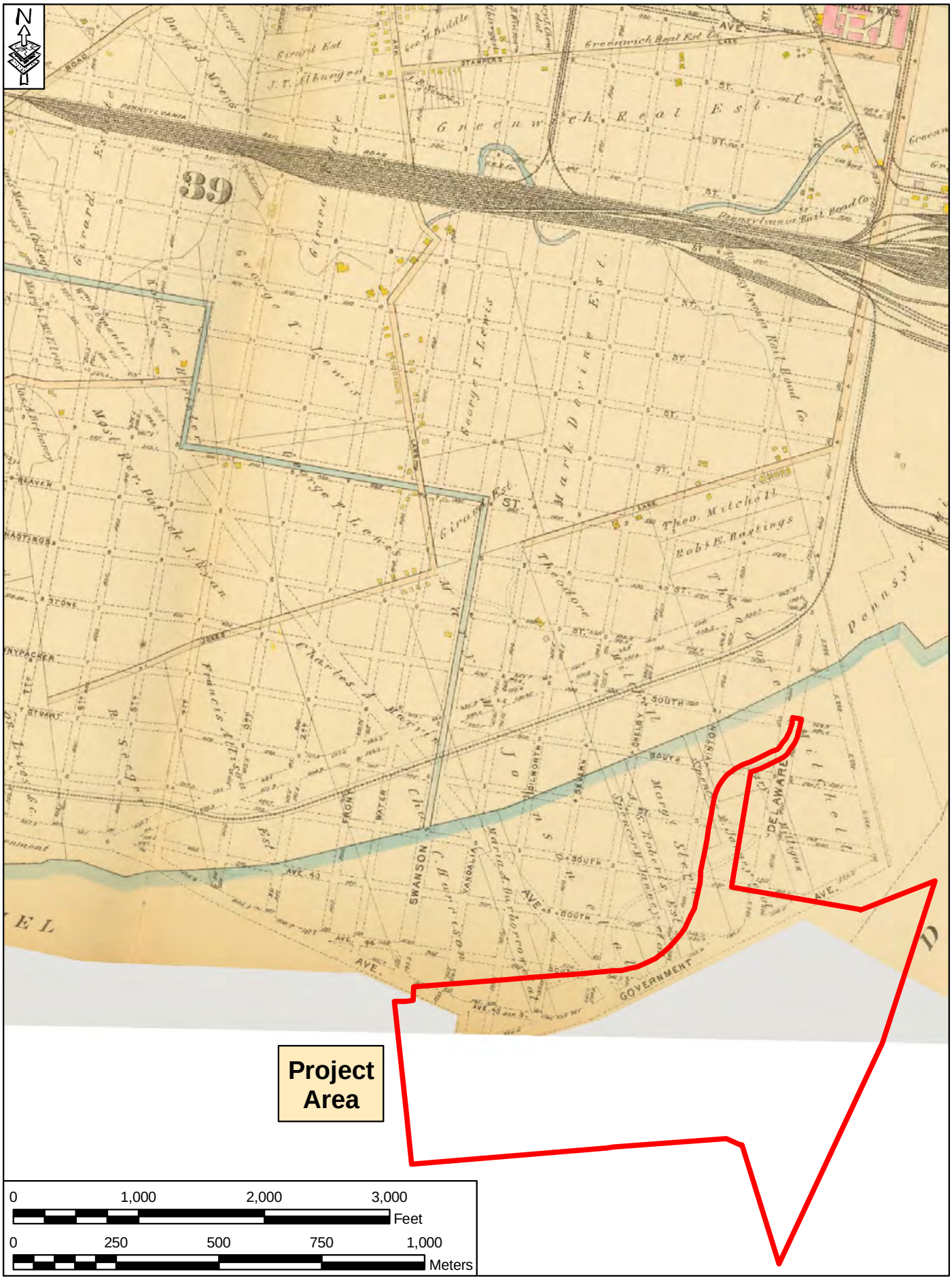

FIGURE 13: 1910 View of the Southport Development Project Area

SOURCE: Bromley 1910

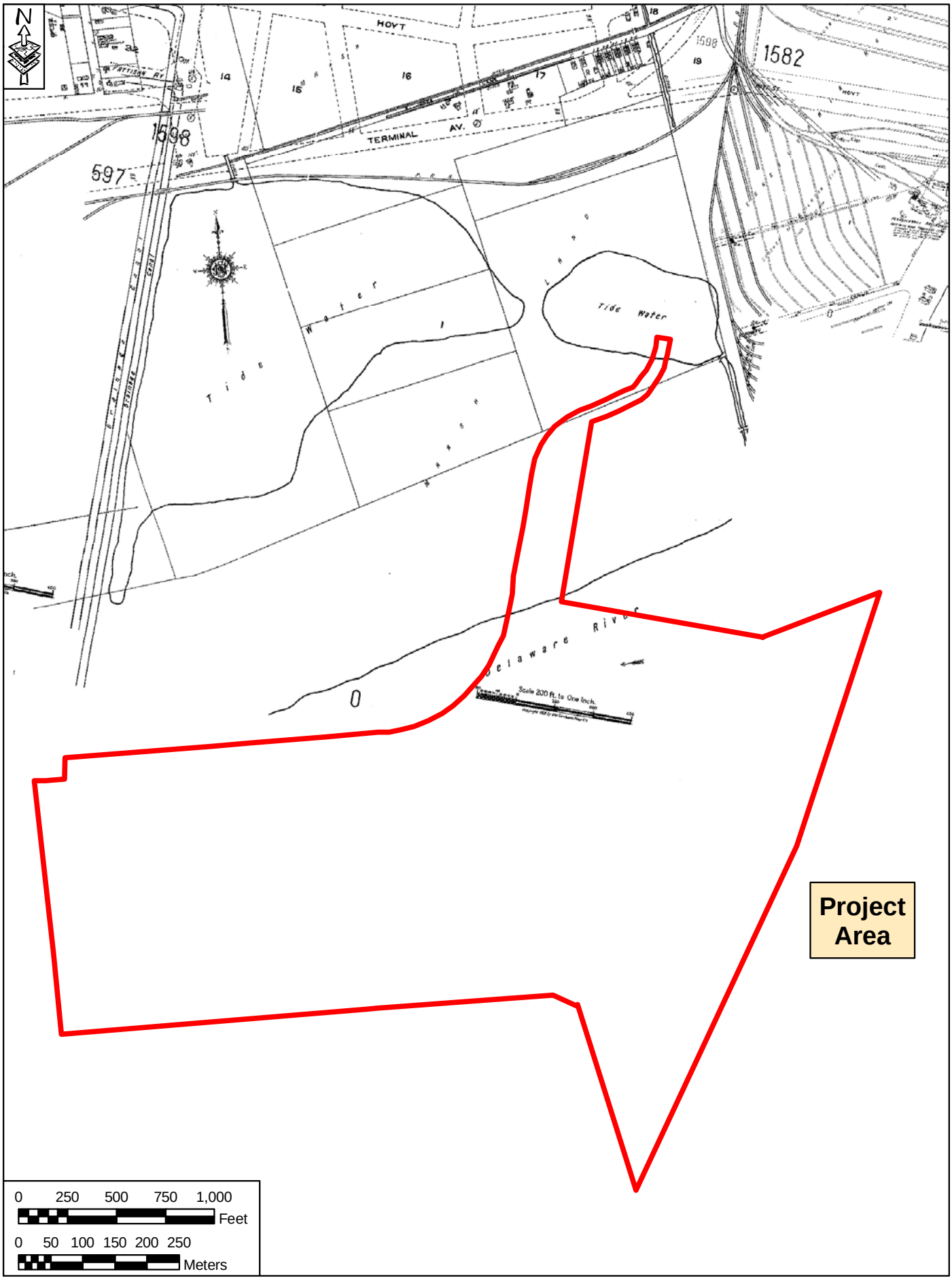

FIGURE 14: 1922 View of the Southport Development Project Area

SOURCE: Sanborn 1922

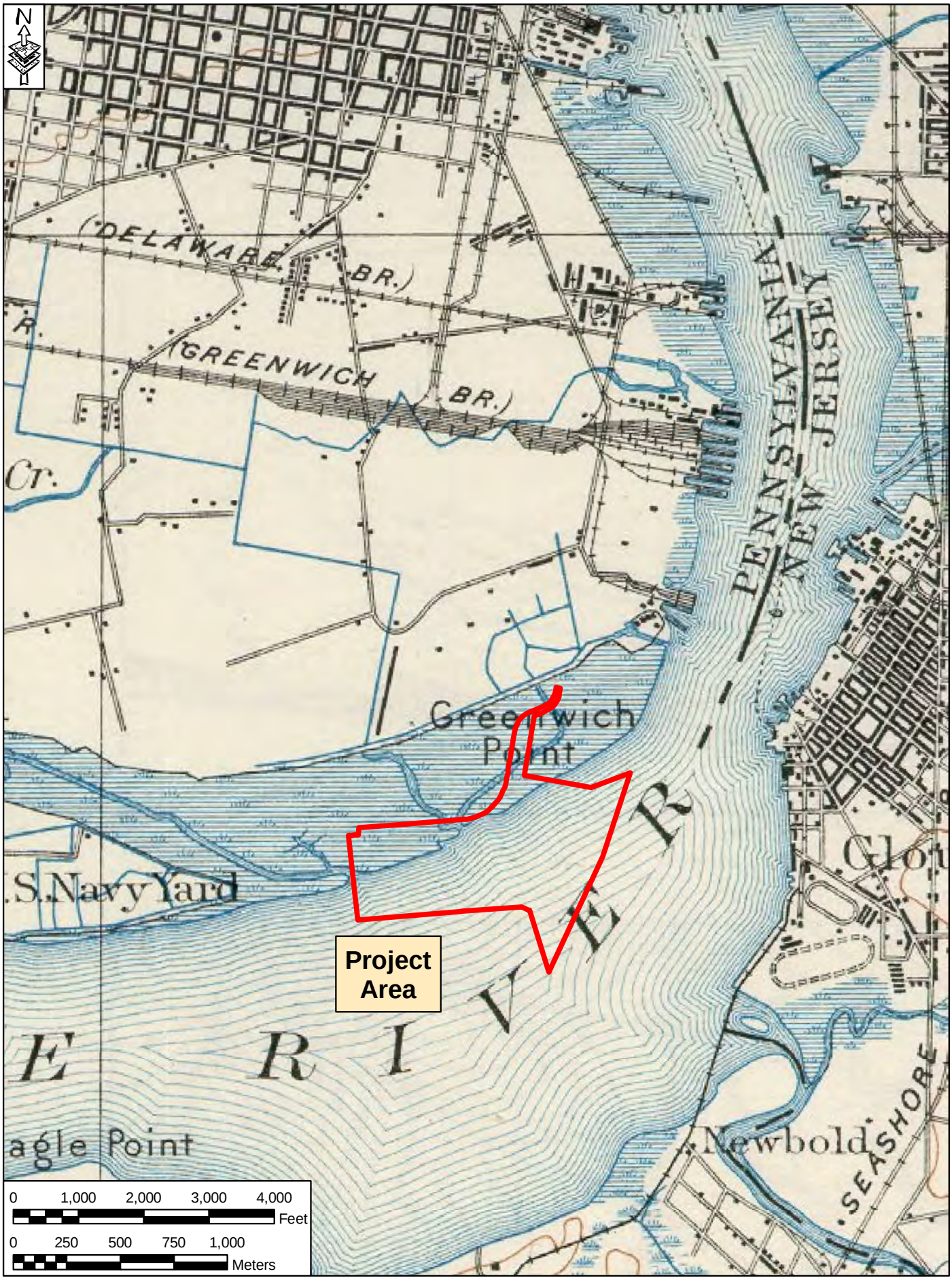

FIGURE 15: 1930 View of the Southport Development Project Area

SOURCE: USGS 1898, reprinted 1930

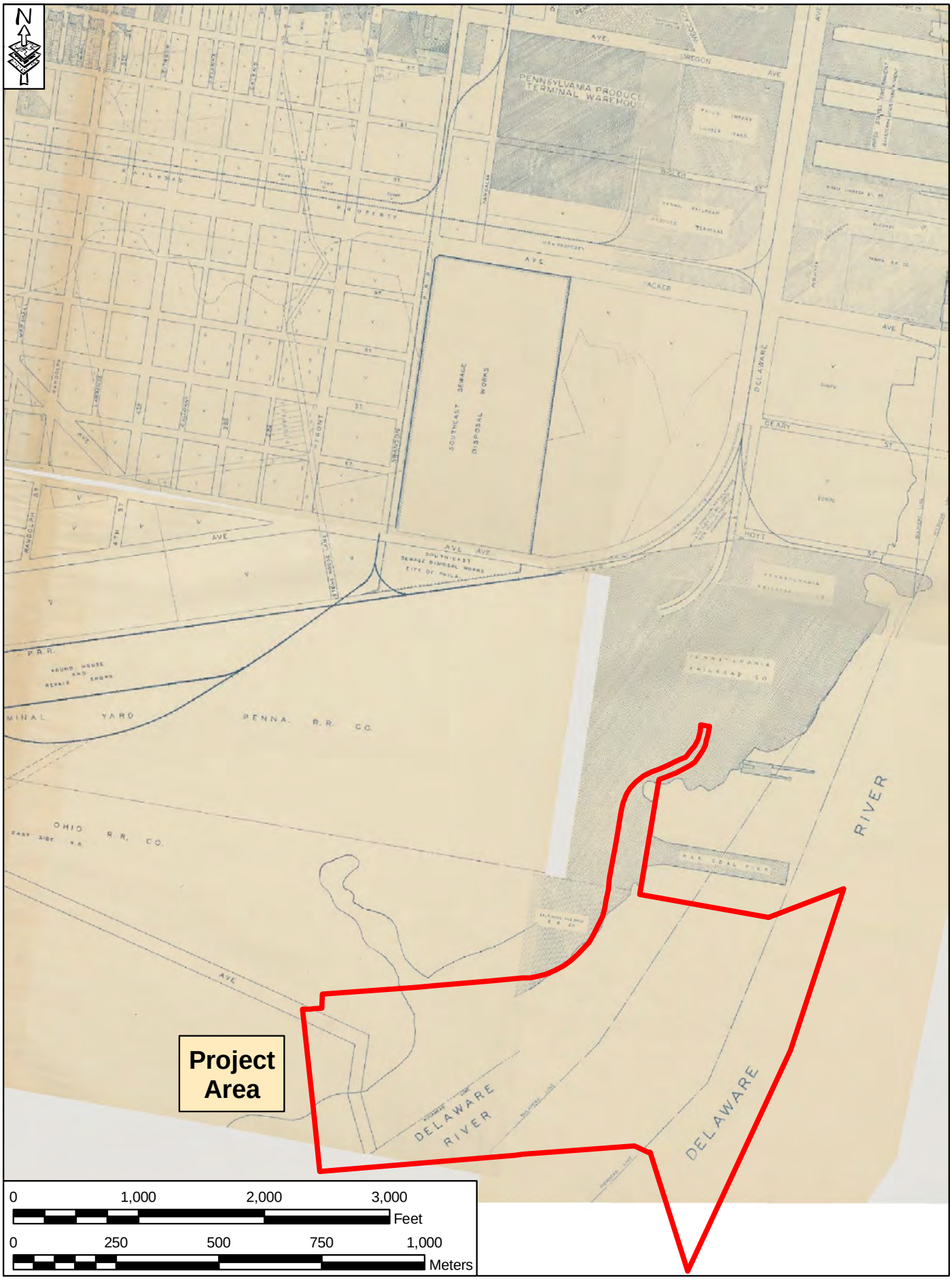

FIGURE 16: 1942 View of the Southport Development Project Area

SOURCE: WPA 1942

Project Area is known to be located on created land. The northern portion of the Project Area is shown as built land on marsh, containing the "Pennsylvania Railroad Company Thawing House" and rail spurs to Pier 122. The remainder of the Project Area was either marshland or open water (Figure 17).

1962

The 1962 *Philadelphia Land Use Map* by the Works Progress Administration (WPA) represents the Project Area in much the same manner as the 1942 Land Use Map, but now showing the Walt Whitman Bridge. The 1962 map indicates that a portion of the western quadrant of the Project Area had been filled (between 1940 and 1942) and Government Avenue was extended across the land mass. The northern portion of the Project Area remained under the ownership of the Pennsylvania Railroad Company. Pier 124 was also depicted and was labeled as the "P.R.R. Coal Pier". The remainder of the Project Area continued to exist as marshland and open water within the Delaware River (Figure 18).

1962-Present

Historic aerial images available from www.historicmaps.com and Google Earth were also consulted to obtain further details regarding the development or abandonment of the Project Area from 1963 to 2007. Although the historic images are not reproducible, due to copyright provisions, the aerials indicate that the Project Area was further filled between 1963 and 1970 when the land mass assumed a configuration similar to the current landform[5].

2.5 PREVIOUSLY DOCUMENTED HISTORIC ARCHAEOLOGICAL SITES

Six historic archaeological sites have been previously documented within a 2.0-mile radius of the Project Area. Four of these sites (36-PH-57, 36-PH-58, 36-PH-59, and 36-PH-60) are related to late nineteenth to early twentieth century parade grounds and military barracks that were identified within the Philadelphia Naval Shipyard on League Island. All four of these military sites are located between 0.6 and 1.5 miles to the west of Project Area. An industrial site, the Bonnin/Morris China Factory (36-PH-19) was previously documented 2 miles to north of the Project Area. A historic shipwreck site, the Albert Cummins (36-PH-27), was also previously identified 1.0 miles north and east of the Project Area. None of the above mentioned historic archaeological sites are listed on the NRHP and none have been issued opinions of eligibility by the PHMC. No historic archaeological sites were previously identified within the Project Area.

2.6 PREVIOUS CULTURAL RESOURCE SURVEYS

Background research in the files of the PHMC/BHP indicates that eight previous cultural resource surveys were conducted within a 2-mile (3.21-kilometer) radius of the present Project Area and one survey was previously conducted in the immediate vicinity of the present Project Area (associated ER#s: 1982-0230-101-D; 1193-0983-101-B90; 2007-8002-101-B).

Six of the eight prior surveys were conducted within the Philadelphia Naval Shipyard Historic District on League Island by John Milner and Associates and Kise Straw and Kolodner, Inc. (associated ER# 1993-0983-101-B90) to the west of the present Project Area, and reported evidence of landfill material overlying dredged soils and gley soils indicating that the eastern portions of League Island was historically marshland and/or the former river channel. This information, in combination with review of historic cartographic sources indicates that the Project Area likely contains similar fill and dredged deposits as the Project Area was also historically marshland.

[5] Due to copyright provisions, that aerial images from 1963 and 1970 cannot be reproduced here but are available for viewing at www.historicaerials.com

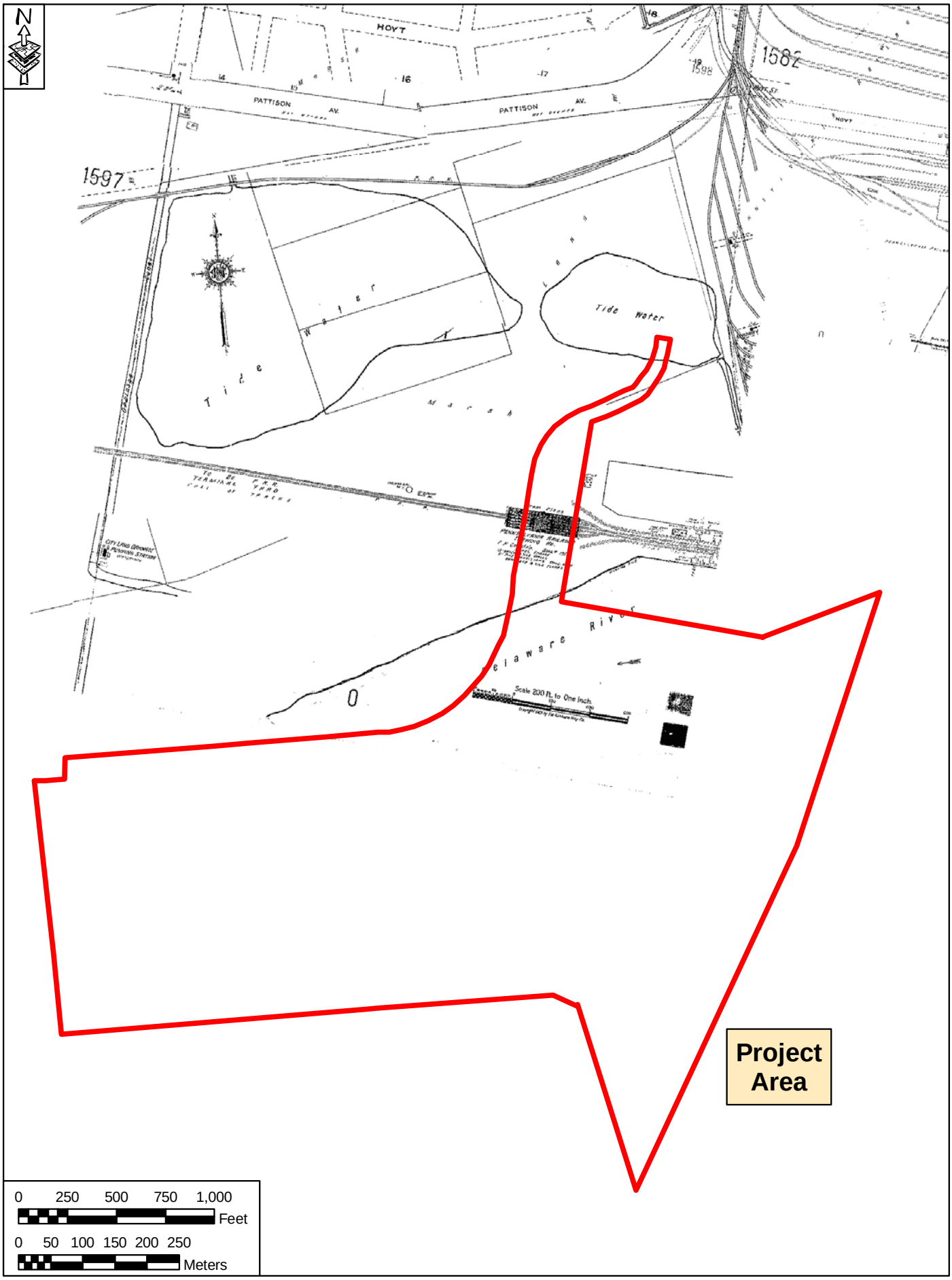

FIGURE 17: 1951 View of the Southport Development Project Area

SOURCE: Sanborn 1951

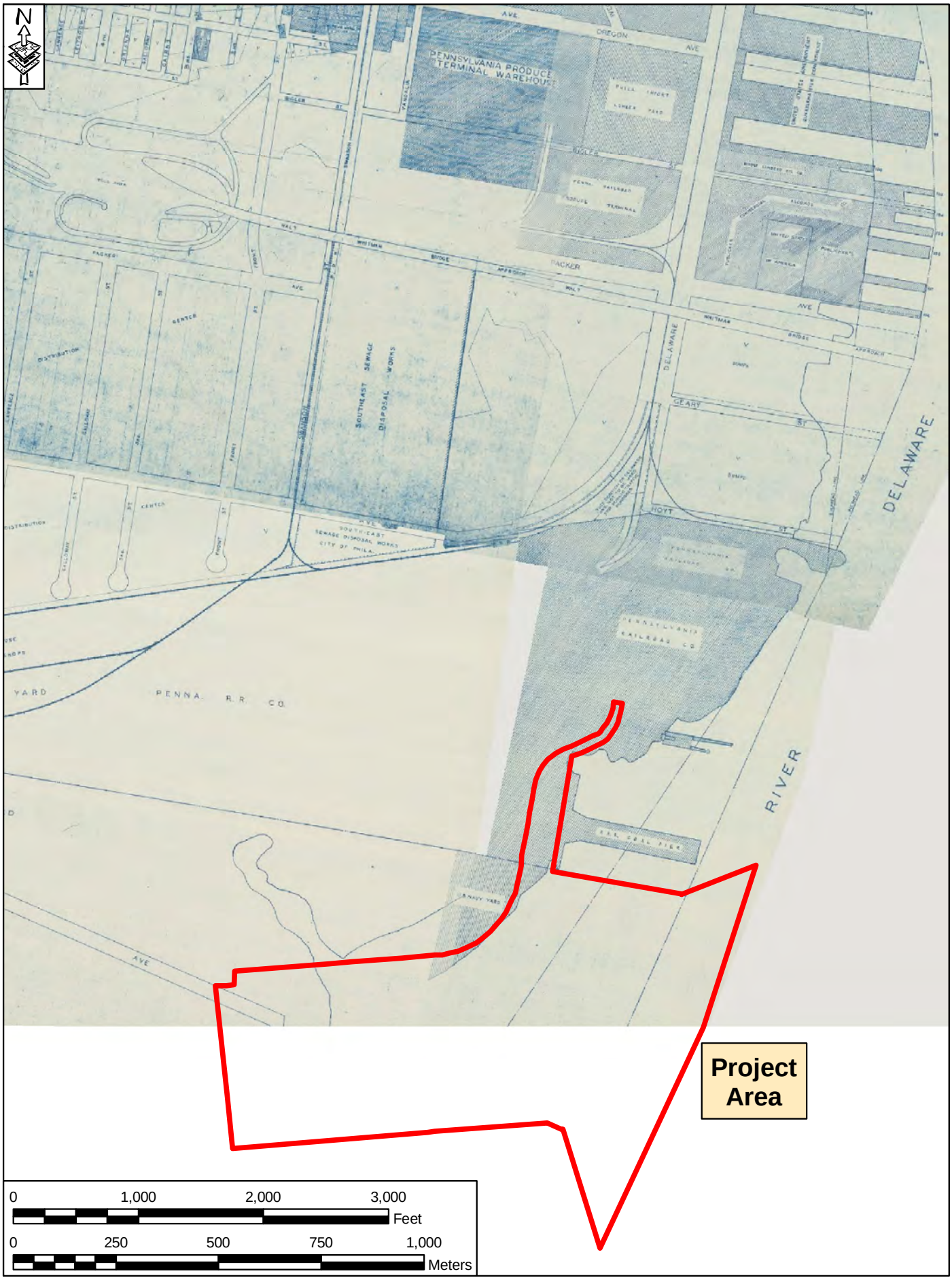

FIGURE 18: 1962 View of the Southport Development Project Area

SOURCE: WPA 1962

DMJM Harris conducted a Phase IA archaeological survey and archaeological monitoring of geotechnical borings of just north of the Project Area in 2006 (ER# 2007-8002-101-B). These investigations indicated that dwellings were present in the area north of the Project Area on late nineteenth century and early twentieth century maps. Monitoring of the geotechnical borings in the vicinity of the mapped buildings "indicated that mid-to-late twentieth century disturbance extended below the original natural ground surface" and therefore concluded that the investigations had "little potential for encountering any intact archaeological deposits.

3.0 HISTORIC ARCHITECTURAL PROPERTIES

3.1 PREVIOUSLY DOCUMENTED HISTORIC ARCHITECTURAL RESOURCES

Research at the PHMC/BHP revealed the presence of three previously recorded historic architectural resource in the immediate vicinity of the Project Area.

The Greenwich Coal and Ore Yard (CRGIS Key # 109635) is located north of the Project Area. This parcel was operated by the Pennsylvania Railroad and was the main freight yard that serviced the docks along Delaware Avenue in the early to mid twentieth century. The yard had a "storage capacity of about 1,500 loaded coal cars" and other freight for domestic sale and for export to foreign markets (Sproule 1914). Although remnants of former tracks are visible on the surface of the area, the location does not currently possess integrity of location, design, setting, materials, craftsmanship, feeling, and association. The Greenwich Coal and Ore Yard was previously determined ineligible for inclusion on the National Register of Historic Places by the PHMC.

The National Register listed Philadelphia Naval Shipyard Historic District (CRGIS Key# 86856) is located to the west of the Project Area. Although the central core of the district is located 1.5 miles to the west of the Project Area, the World War II era Seaplane Hangar (Building 653), which is a discontiguous portion of the historic district, is located immediately west of the Project Area. The Seaplane Hangar, constructed in 1943, is a contributing resource to the Philadelphia Naval Shipyard Historic District and has significance in the areas of architecture and history. The hangar is described as follows in the National Register of Historic Places Nomination Form:

> "This large, rectangular, steel-framed concrete arch hangar consists of the central arched block and flanking brick and concrete blocks, rectangular in plan. The south façade of the hangar is dominated by the original, corrugated, steel-sheathed, sliding hangar doors. The flanking brick and concrete blocks are fenestrated with ribbons of wood framed, double hung, four over four windows in the first story and six over six windows in the second story. Most of these windows have been boarded over. Three overhead loading doors are placed in the west elevation. The building measures 302 feet long, 273 feet wide and a maximum of 49 feet high. Resources associated with the hangar include a substation (Building 677) and a ramp (Structure 882)."

The Pier 122/Ore Conveyor and Support Building (CRGIS Key# 142774) is located immediately north and east of the Project Area. The pier was constructed by the Pennsylvania Railroad between 1951 through 1954. The pier was later owned by Conrail. Historically, four independently operated unloaders on the pier functioned to offload iron ore pellets from ships. The facility was closed by Conrail in the 1990s and became the property of CSX in 1997. The pier is currently owned by the Philadelphia Regional Port Authority and is being demolished. The PHMC has previously issued an opinion of eligibility for Pier 122.

3.2 HISTORIC ARCHITECTURAL SURVEY AND RECOMMENDATIONS

Berger has conducted a survey of historic architectural resources greater than 50 years of age within the Project Area and immediate vicinity. This survey was based on the pedestrian reconnaissance conducted within the Project Area on January 13, 2010, as well as the historic and background research conducted for the Project. Potential effects to historic architectural resources that have been previously listed on or opinioned eligible for inclusion on the National Register of Historic Places and recommendations for further documentation and intensive level survey are also in Table 1 and the narrative below. Figure 19 illustrates the locations of each of the surveyed properties listed in Table 1.

Table 1: Surveyed Historic Architectural Properties

Map Number	Resource Name	Previous Eligibility Status	Recommendation
1	Philadelphia Naval Shipyard Historic District	National Register listed	No Further Survey
2	Former Military Housing (1970-1985)	Not recommended eligible	No Further Survey
3	Mustin Airfield (Abandoned)	Not recommended eligible	No Further Survey
4	Greenwich Coal Pier (Pier 124)	Not recommended eligible	No Further Survey
5	Pier 122/Ore Conveyor and Support Building Historic District	Eligible	No longer meets the evaluation criteria for listing on the National Register
6	Greenwich Coal and Ore Yard	Ineligible	No Further Survey

The Project Area is currently dominated by former military housing that was constructed between 1970 and 1985 (see Plates 1 and 2). The housing, which consists of garden apartments and townhouses, is representative of clustered, attached housing typically contained at military installations. Previous survey of the housing as part of the Philadelphia Naval Complex survey and evaluation did not recommend eligibility (John Milner and Associates 1994). Although a separate remedial action project will result in the demolition of the former military housing, these buildings do not meet the 50-year criteria for listing on the National Register of Historic Places and do not appear to be of exceptional importance required to meet Criteria Consideration **g** for properties achieving significance within the past 50 years. Therefore, no further investigations are recommended for the former military housing within the Project Area.

The abandoned Mustin Airfield is also located in the northwestern portion of the Project Area (map number 3 on Figure 19). Previous survey of the airfield as part of the Philadelphia Naval Complex survey and evaluation did not recommend eligibility (John Milner and Associates 1994). Although the proposed Project will result in the demolition of a portion of the abandoned airfield, no further investigations are recommended for the airfield due to its previous designation as ineligible.

The National Register listed Philadelphia Naval Shipyard Historic District (CRGIS Key# 86856) is located west of the Project Area. Although the central core of the district is located 1.5 miles to the west of the Project Area, the World War II era Seaplane Hangar (Building 653), which is a discontiguous portion of the historic district, is located immediately west of the Project Area. The Seaplane Hangar, constructed in 1943, is a contributing resource to the Philadelphia Naval Shipyard Historic District and has significance in the areas of architecture and history (Plate 6). The proposed Project, however, will not physically alter the Seaplane Hangar or associated structures and will not have an adverse effect on this resource.

The northern portion of the Project Area is characterized by two piers and related buildings, structures, and trackage. The northern-most pier is Pier 122, a bulk export pier built in circa 1953 for iron ore (Society for Industrial Archeology 1990:3). The pier consisted of its four traveling unloaders, former rail line spurs extending to the pier, and support buildings related to the historic function of Pier 122.

Pier 122 was previously surveyed and determined eligible for listing on the National Register in 2006. Since the survey and evaluation of Pier 122 in 2006, demolition of Pier 122 and the adjacent Pier 124 have been underway. To date, the loaders/cranes, ore conveyor system, tracks to the Machine Shop, and Metal Distribution Structure associated with Pier 122 have been dismantled.

FIGURE 19: Surveyed Historic Architectural Properties

SOURCE: Berger Field Data 2010; City of Philadelphia, Division of Technology, 2008, http://www.pasda.psu.edu/

A portion of one of the ore loaders/cranes remains at the end of the pier (Plates 7 & 8). The former Machine Shop and noncontributing support buildings appear to be unaltered (Plate 9). The fertilizer domes are extant, however, but are less than 50 years old and are not within the National Register-eligible district (Figure 20). The pier, loaders, ore conveyor, and distribution structure are integral contributing features that characterized Pier 122 and its ore transportation network. The loss of these features has resulted in a loss of integrity of the district. It would appear that given these losses, the Pier 122 district no longer meets the evaluation criteria for listing on the National Register (see Appendix A for updated survey form and the 2006 survey form).

Plate 6: Seaplane Hangar (Building 653). View Northwest. *Photo by D. Van Steen January 13, 2010.*

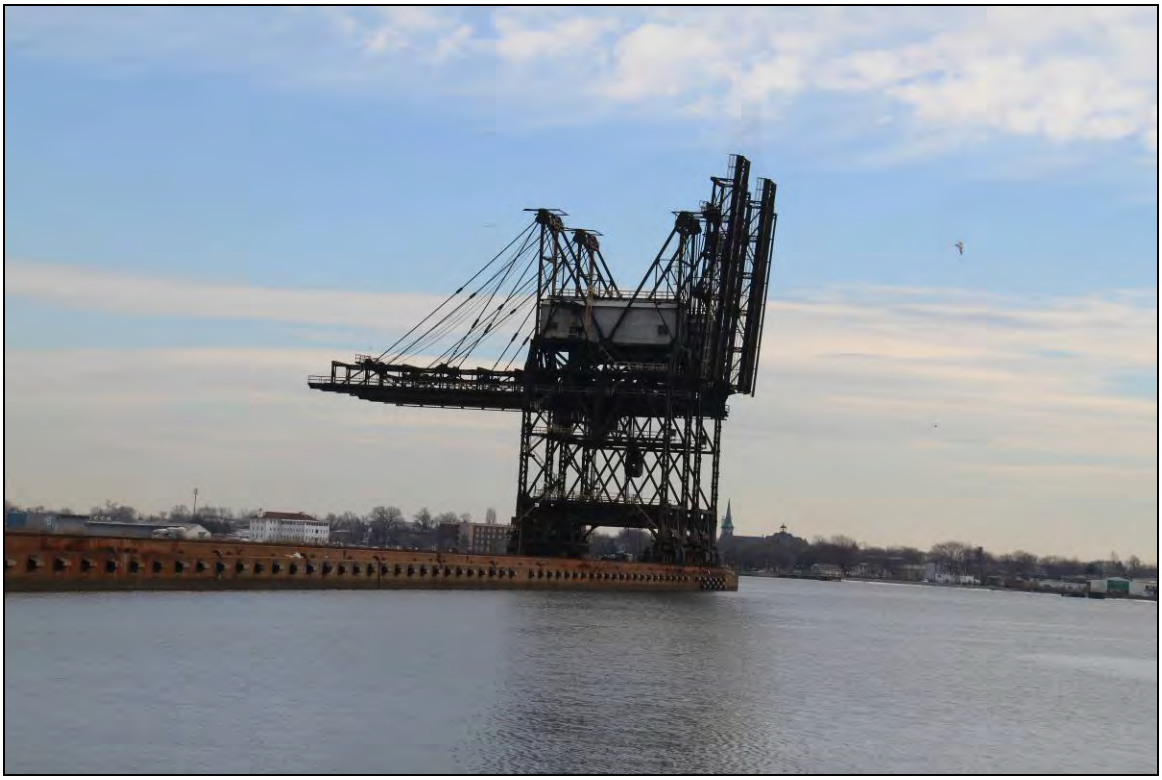

Plate 7: Last Remaining and Partially Dismantled Loader/Crane on Pier 122, View Northeast.
Photo by D. Van Steen January 13, 2010.

Plate 8: A Dismantled Loader on the ground near Pier 122, View West.
Photo by D. Van Steen January 13, 2010.

Plate 9: Machine Shop, View Northwest. *Photo by D. Van Steen January 13, 2010.*

Figure 20 - Fertilizer Domes west of Pier 122. View North. Source: www.bing.com/maps

The Greenwich Coal Pier (Pier 124) is a former coal export pier constructed by the Pennsylvania Railroad in the late 1920s and modernized in circa 1980 (Plates 10 & 11). The pier formerly consisted of two parallel rotary dumpers and a 5,000 ton/hour traveling shiploader, ramped rails set on arched concrete piers, and support structures extending the length of the pier (Society for Industrial Archaeology, 1990: 3; Pennsylvania Railroad, 1949: 10).

Beyond Pier 124 is a two-story brick office building constructed by the Pennsylvania Railroad and supporting structures of more recent construction (Plates 12 through 15). As with Pier 122, Pier 124 and many of the associated structures are in the process of being dismantled. Due to the resulting loss historic fabric and architectural integrity, no further historic architectural investigations are recommended for Pier 124.

Plate 10: Greenwich Coal Pier **(**Pier 124). View Southeast. *Photo by D. Van Steen January 13, 2010.*

Plate 11: Demolition at Greenwich Coal Pier **(**Pier 124). View Southeast.
Photo by D. Van Steen January 13, 2010.

Plate 12: Two Story Brick Office Building at Pier 124. View West. *Photo by D. Van Steen January 13, 2010.*

Plate 13: Pier 124 Cinderblock Supporting Structure of More Recent Construction. View Southeast.
Photo by D. Van Steen January 13, 2010.

Plate 14: Pier 124 Cinderblock Supporting Structure of More Recent Construction. View South.
Photo by D. Van Steen January 13, 2010.

Plate 15: Pier 124 Cinderblock Supporting Structure of More Recent Construction. View Southeast.
Photo by D. Van Steen January 13, 2010.

4.0 ARCHAEOLOGICAL RESOURCE POTENTIAL

4.1 PREHISTORIC ARCHAEOLOGICAL RESOURCE POTENTIAL

Berger developed a site location predictive model based on an archaeological potential/sensitivity assessment that categorized the prehistoric archaeological potential of the Project Area into areas of high, low, moderate, and no potential. High potential areas are defined herein as those where archaeological sites have been previously documented and/or areas containing landforms known to be associated with the occurrence of archaeological sites.

The assessment of archaeological potential within the Project Area was based primarily on cartographic evidence for steep slopes, naturally occurring sources of surface potable water, and historic architectural properties depicted on historical cartographic resources as well as modern USGS quadrangles and aerial photography. The cartographic data were supplemented by data gathered during the course of pedestrian surveys of the Project Area. Additionally, although no previously identified prehistoric sites are located within the Project Area, the locations of known prehistoric archaeological deposits elsewhere within a two mile radius of the Project Area provide information regarding site location patterns in this portion of Philadelphia County and suggest a preference for settlement near upland riverine environments demonstrated in the Archaic through Late Woodland cultural periods. Therefore, it was considered probable that prehistoric sites, most likely temporary campsites, would likely be present within the Project Area on uplands near naturally occurring sources of surface potable water. Based on the topography and the presence of known archaeological sites dating from the Late Archaic to the Woodland periods in similar settings elsewhere in Philadelphia County, the prehistoric archaeological resource potential for those undisturbed portions of the Project Area with less than 15-degree slopes and within 300-feet of naturally occurring sources of surface potable water was considered to be high. The archaeological potential of undisturbed areas with less than 15-degree slopes but beyond 300 feet of naturally occurring sources of surface potable water was considered to be moderate or low. Archaeological deposits are not likely to be present or intact in areas that have evidence of thorough mixing by mechanized construction activities (i.e., bulldozing/grading), naturally imported sediments (colluvium), and artificially imported sediments (fill) and/or which been artificially mined, trenched, stripped for topsoil, or graded for development. Additionally, areas from which sediments with the potential for containing archaeological deposits have been removed by natural agents such as erosion, stream scour, and channel meandering likewise lack archaeological integrity.

As discussed in Section 2.4.2 of this report, the Project Area was historically marshland and open water until between 1940 and 1957 when additional land was created from marshland and open water through the use of dredged materials and fill; the southwestern portion of the Project Area was created from marshland between 1940 and 1957 while the southeastern portion was not created until between 1963 and 1970. The Project Area assumed its current manufactured configurations as late as between 1963 and 1970. As a result, although the Project Area is in close proximity to the Delaware River, the area was historically marshland and open water and therefore there is no likelihood that intact significant prehistoric archaeological remains are located within the Project Area.

4.2 HISTORIC ARCHAEOLOGICAL RESOURCE POTENTIAL

A review of historic literature and cartographic resources pertaining to the Project Area were also consulted in conjunction with pedestrian surface surveys to examine the potential of the proposed Project to affect historic archaeological features related to historic archaeological resources within the Project Area.

Although the area of the Delaware River between Marcus Hook and Allegheny Avenue in Philadelphia has been characterized as having a “medium-high” potential for the presence of submerged cultural resources, dredging in the Delaware River in that area “has probably seriously disturbed or destroyed many of these resources” (Cotter et al. 1992:465). Areas of the Delaware River that are exceptions to this assumption include

the vicinity of Pier 78, the channel at Tinicum Island, and the back channel of Pettys Island –all of which are located beyond the boundaries of the Project Area. Therefore, the Project Area does not possess the potential to contain submerged archaeological resources.

As discussed in Section 2.4.2 of this report, the Project Area was historically marshland and open water until between 1940 and 1957 when additional land was created from marshland and open water through the use of dredged materials and fill. The area assumed its current manufactured configurations as late as between 1963 and 1970. Development within the northern portion of the Project Area began in 1929 with the construction of rail spurs and industrial buildings associated with the Pennsylvania Railroad and the mid-twentieth century Ore Pier 122. The southern portion of the Project Area was developed as military housing between 1970 and 1985. Additionally, no shipwrecks have been documented in the Delaware River within the Project Area. Pedestrian reconnaissance of the Project Area confirmed the presence of late twentieth century former military housing, paved areas, and wetlands. As a result, due to the mid-to-late twentieth century development/land use history, the Project Area is considered to have no potential for containing significant historic archaeological remains.

5.0 SUMMARY AND RECOMMENDATIONS

The Louis Berger Group, Inc. (Berger), of Morristown, New Jersey, conducted a Phase IA cultural resources survey for the proposed Southport Development Project in the City of Philadelphia, Pennsylvania (Project). The Project consists of a large area east of the former Philadelphia Naval Shipyard on League Island and south of the Walt Whitman Bridge.

The Phase I cultural resource assessment was conducted in January 2010 with the objective of investigating the potential for previously undocumented archaeological resources to exist within the Project Area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP) within the Project Area.

Archaeology

The Project Area was historically marshland and open water until between 1940 and 1957 when additional land was created from marshland and open water through the use of dredged materials and fill. The area assumed its current manufactured configurations as late as between 1963 and 1970. As a result, due to the mid-to-late twentieth century development/land use history, the Project Area is considered to have no potential for containing significant historic archaeological remains.

Dredging in the Delaware River between Marcus Hook and Allegheny Avenue has likely seriously disturbed or destroyed any submerged archaeological resources (shipwrecks) that may have existed in the River (Cotter et al. 1992:465). Therefore, the Project Area does not possess the potential to contain submerged archaeological resources.

As a result of the documentary review and pedestrian reconnaissance conducted by Berger, the Project Area does not possess the potential to contain intact significant archaeological resources.

Historic Architecture

Berger has also conducted a preliminary survey of historic architectural resources greater than 50 years of age within the Project Area and immediate vicinity.

Although a separate remedial action project will result in the demolition of the former military housing within the Project Area, these buildings do not meet the 50-year criteria for listing on the National Register of Historic Places and do not appear to be of exceptional importance required to meet Criteria Consideration g for properties achieving significance within the past 50 years. Therefore, no further investigations are recommended for the former military housing within the Project Area.

The abandoned Mustin Airfield is also located in the northwestern portion of the Project Area. Previous survey of the airfield as part of the Naval Complex Philadelphia survey and evaluation did not recommend eligibility (John Milner and Associates 1994). Although the proposed Project will result in the demolition of a portion of the abandoned airfield, no further investigations are recommended for the airfield due to its previous designation as ineligible.

The National Register listed Philadelphia Naval Shipyard Historic District (CRGIS Key# 86856) is located to the west of the Project Area. Although the central core of the district is located 1.5 miles west of the Project Area, the World War II era Seaplane Hangar (Building 653), which is a discontiguous portion of the historic district, is located immediately west of the Project Area. The Seaplane Hangar, constructed in 1943, is a contributing resource to the Philadelphia Naval Shipyard Historic District and has significance in the areas of architecture and history. The proposed Project, however, will not physically alter the Seaplane Hangar and will not have an adverse effect on this resource.

As a result of ongoing demolition of the structures on Pier 122, notably the unloaders, the National Register-eligible Pier 122 and associated buildings no longer possess sufficient integrity of design, setting, materials, and association. Berger has reevaluated Pier 122 and its associated buildings and determined that this resource no longer meets the significance criteria for listing on the National Register. Since Pier 122 no longer meets National Register eligibility criteria, the proposed Project will have no effect to this historic resource.

As with Pier 122, the Greenwich Coal Pier (Pier 124) and many of the associated structures are in the process of being dismantled within and east of the Project Area. Due to the resulting loss historic fabric and architectural integrity, no additional work is recommended for Pier 124.

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APPENDIX A:
PHMC Historic Resource Survey Form - Pier 122/Ore Conveyor and Support Building

Historic Resource Survey Form

PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION
Bureau for Historic Preservation

Key #_____

ER#_____

Name, Location and Ownership *(Items 1-6; see Instructions, page 4)*

HISTORIC NAME PRR Ore Pier/Conveyor and Support Building

CURRENT/COMMON NAME Pier 122/Ore Conveyor and Support Building

STREET ADDRESS South end of Delaware Avenue (S. Christopher Columbus Blvd) League Island **ZIP** n/a

LOCATION South end of Delaware Avenue (S. Christopher Columbus Blvd) eastern terminus of League Island

MUNICIPALITY City of Philadelphia **COUNTY** Philadelphia

TAX PARCEL #/YEAR Various **USGS QUAD** Philadelphia

OWNERSHIP ☐ **Private**
☒ **Public/Local** ☐ **Public/County** ☐ **Public/State** ☐ **Public/Federal**

OWNER NAME/ADDRESS Philadelphia Regional Port Authority, 3460 N. Delaware Avenue, Philadelphia, PA 19134

CATEGORY OF PROPERTY ☐ **Building** ☐ **Site** ☐ **Structure** ☐ **Object** ☒ **District**

TOTAL NUMBER OF RESOURCES n/a

Function *(Items 7-8; see Instructions, pages 4-6)*

Historic Function	Subcategory	Particular Type
Transportation	Rail Related	Pier and Ore Loading Facility
Machine Shop	Rail Related	Related Railroad Support Bldgs

Current Function	Subcategory	Particular Type
Vacant	Not in Use	

Architectural/Property Information *(Items 9-14; see Instructions, pages 6-7)*

ARCHITECTURAL CLASSIFICATION

Conveyor and Pier	No Style
Industrial Buildings	No Style

EXTERIOR MATERIALS and STRUCTURAL SYSTEM

Foundation	Concrete	
Walls	Steel Framework	
Roof		
Other		
Structural System	other	

WIDTH n/a (feet) or _____ (# bays) **DEPTH** n/a (feet) or _____ (# rooms) **STORIES/HEIGHT** n/a

Key #_____

ER#_____

Property Features *(Items 15-17; see Instructions, pages 7-8)*

Setting Industrial Waterfront

Ancillary Features

Pier	Support Buildings	Distr. Structure (demo)
Rail Track	conveyor (demolished)	_____
Narrow Gauge Track	Loaders/Cranes (demo)	_____

Acreage n/a (round to nearest tenth)

Historical Information *(Items 18-21; see Instructions, page 8)*

Year Construction Began 1952 ☐ Circa **Year Completed** 1954 ☐ Circa

Date of Major Additions, Alterations 2010 ☐ Circa 1970s ☒ Circa _____ ☐ Circa

Basis for Dating ☒ Documentary ☒ Physical

Explain demolition of pier in progress at time of field survey (2010); previous survey (2006)

Cultural/Ethnic Affiliation(s) _____

Associated Individual(s) _____

Associated Event(s) Steel Industry, Pennsylvania and Nation-wide

Architect(s) _____

Builder(s) Pennsylvania Railroad

Submission Information *(Items 22-23; see Instructions, page 8)*

Previous Survey/Determinations NR Eligible, Key # 142774, ER 2006-8034-101

Threats ☐ None ☐ Neglect ☐ Public Development ☒ Private Development ☒ Other

Explain Demolition of Pier and rails and redevelopment

This submission is related to a ☐ non-profit grant application ☐ business tax incentive ☒ NHPA/PA History Code Project Review ☒ other

Preparer Information *(Items 24-30; see Instructions, page 9)*

Name & Title Deborah Van Steen, Architectural Historian

Date Prepared March 18, 2010 **Project Name** Southport Development Project

Organization/Company The Louis Berger Group

Mailing Address 412 Mount Kemble Avenue, PO Box 1946, Morristown, New Jersey 07962

Phone 973.407.1260 **Email** dvansteen@louisberger.com

Key #_____

ER#_____

National Register Evaluation *(Item 31; see Instructions, page 9)*

(To be completed by Survey Director, Agency Consultant, or for Project Reviews ONLY.)

☒ Not Eligible (due to ☐ lack of significance and/or ☒ lack of integrity)

☐ Eligible Area(s) of Significance _____

Criteria Considerations _____ Period of Significance _____

☐ Contributes to Potential or Eligible District District Name _____

Bibliography *(Item 32; cite major references consulted. Attach additional page if needed. See Instructions, page 9.)*

Cook, Lauren J., DMJM Harris. Evolution of the Greenwich Rail Yard, Navy Yard Temporary Access Project, Philadelphia, Pennsylvania. Prepared for PennDOT Engineering District 6-0. 28 April 2006.

PHMC CRGIS Online. Pier 122/Ore Conveyor and Support Building. Key 142774; ER 2006-8034-101.

Tabachnick, Alan, DMJM Harris. Pier 122/Ore Conveyor and Support Building, Pennsylvania Historic Resource Survey Form. 8 March 2006. (attached)

Additional Information

The following must be submitted with form. Check the appropriate box as each piece is completed and attach to form with paperclip.

☐ Narrative Sheets—Description/Integrity and History/Significance (See Instructions, pages 13-14)

☒ Current Photos (See Instructions, page 10)

☒ Photo List (See Instructions, page 11)

☒ Site Map (sketch site map on 8.5x11 page; include North arrow, approximate scale; label all resources, street names, and geographic features; show exterior photo locations; See Instructions, page 11)

☐ Floor Plan (sketch main building plans on 8.5x11 page; include North arrow, scale bar or length/width dimensions; label rooms; show interior photo locations; See Instructions, page 11)

☒ USGS Map (submit original, photocopy, or download from TopoZone.com; See Instructions, page 12)

Send Completed Form and Additional Information to:

National Register Program
Bureau for Historic Preservation/PHMC
Keystone Bldg., 2nd Floor
400 North St.
Harrisburg, PA 17120-0093

Key #_____

ER#_____

Photo List (Item 33)

See pages 10-11 of the Instructions for more information regarding photos and the photo list. In addition to this photo list, create a photo key for the site plan and floor plans by placing the photo number in the location the photographer was standing on the appropriate plan. Place a small arrow next to the photo number indicating the direction the camera was pointed. Label individual photos on the reverse side or provide a caption underneath digital photos.

Photographer name Deborah Van Steen

Date 13 January 2010

Location Negatives/Electronic Images Stored The Louis Berger Group, Morristown, NJ

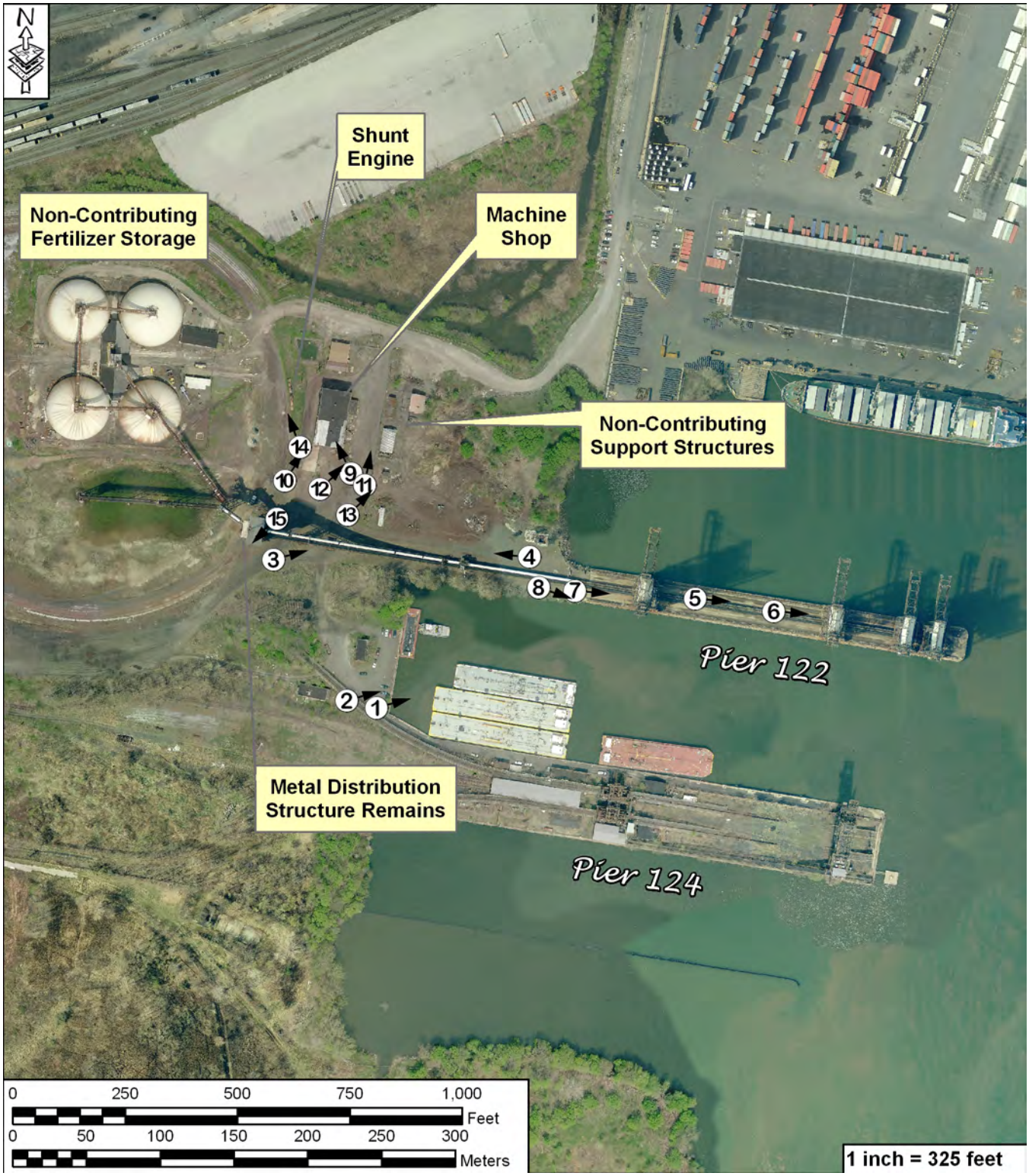
Photo #	Photo Subject/Description	Camera Facing
1	Pier 122	ne
2	Last Remaining and Partially Dismatled Loader/Crane on Pier 122	ne
3	Rail Tracks Remains	e
4	Dismatled Loader on the ground near Pier 122	w
5	Pier 122	e
6	Partially Dismantled Loader/Crane at Pier 122	e
7	Tracks on Pier 122	e
8	Pier 122 Bulkhead	se
9	Machine Shop	nw
10	Machine Shop	ne
11	Non-contributing Support Buildings	ne
12	Non-contributing Support Building	ne
13	Non-contributing Support Building	ne
14	Railroad Track and Narrow Gauge Shunt Engine	nw
15	Railroad Track and Foundation Remains of Metal Distribution Structure	sw

Key #_____

ER#_____

Site Plan and Photo Key (Item 34)

See page 11 of the Instructions for more information regarding the site plan. Create a sketch of the property, showing the footprint of all buildings, structures, landscape features, streets, etc. Label all resources and streets. Include a North arrow and a scale bar (note if scale is approximate). This sheet may be used to sketch a plan or another map/plan may be substituted.

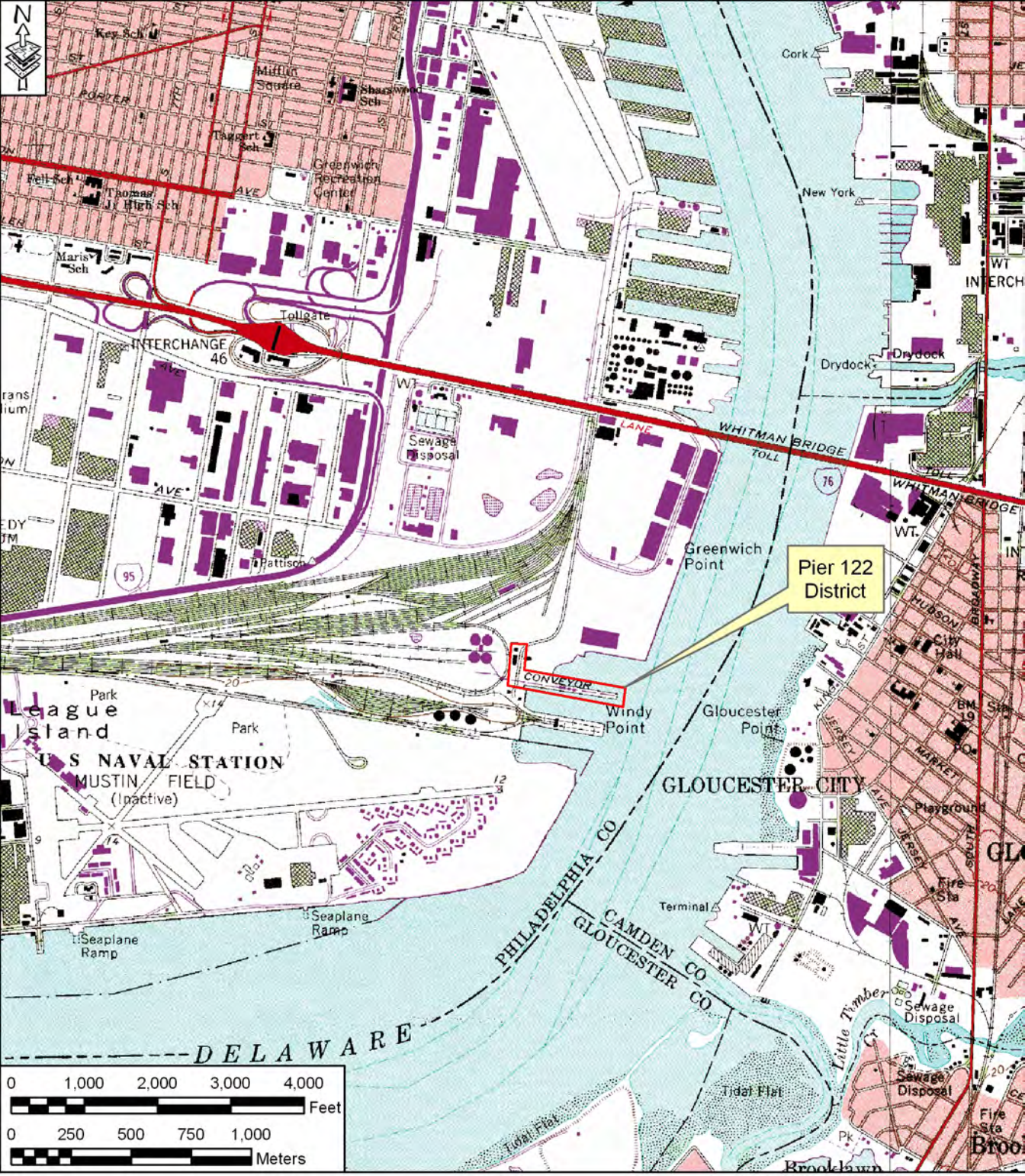


USGS Map

Key #_____

ER#_____

SOURCE: USGS 7.5' Series Quads, Philadelphia, PA-NJ, Camden, NJ-PA, Woodbury, NJ & Runnemede, NJ, 1979



SOURCE: USGS 7.5' Series Quads, Philadelphia, PA-NJ, Camden, NJ-PA, Woodbury, NJ & Runnemede, NJ, 1979

Key #_____

ER#_____

Physical Description and Integrity (Item 38)

Provide a current description of the overall setting, landscape, and resources of the property. See page 13 of the Instructions for detailed directions. Continue on additional sheets as needed. Suggested outline for organizing this section:

- Introduction [summarize the property, stating type(s) of resource(s) and function(s)]
- Setting [describe geographic location, streetscapes, natural/man-made landscape features, signage, etc.]
- Exterior materials, style, and features [describe the exterior of main buildings/resources]
- Interior materials, style, and features [describe the interior of main buildings/resources]
- Outbuildings/Landscape [describe briefly additional outbuildings/landscape features found on property, substitute Building Complex Form if preferred; See Instructions, page 18]
- Boundaries [explain how/why boundaries chosen, such as historic legal parcel, visual natural features such as tree lines, alley separating modern construction, etc.]
- Integrity [summarize changes to the property and assess how the changes impact its ability to convey significance

---

(Text entered directly into form fields will not permit formatting adjustments, such as spell checking or italicizing. Instead, you may wish to cut-and-paste text from another document into the field below; "unprotect" the document for this section, or prepare the "Physical Description and Integrity" narrative as a separate document.)

The purpose of this survey is to photo document the current condition of Pier 122. The pier was surveyed and determined eligible for listing on the National Register in 2006. Since the survey and evaluation of Pier 122 in 2006, demolition of Pier 122 and the adjacent Pier 124 have been underway. Todate, the loaders/cranes, ore conveyor system, tracks to the Machine Shop, and Metal Distribution Structure associated with Pier 122 have been dismantled. A portion of one of the ore loaders/cranes remains at the end of the pier. The former Machine Shop and non-contributing support buildings appear to be unaltered. The fertilizer domes are extant, however, are less that 50 years old and are not within the National Register-eligible district.

The pier, loaders, ore conveyor, and distribution structure are integral contributing features that characterized Pier 122 and its ore transportation network. The loss of these features has resulted in a loss of integrity of the district. It would appear that given these losses, the Pier 122 district no longer meets the evaluation criteria for listing on the National Register.

Key #_____

ER#_____

History and Significance (Item 39)

Provide an overview of the history of the property and its various resources. Do not substitute deeds, chapters from local history books, or newspaper articles. See page 14 of the Instructions for detailed directions. Continue on additional sheets as needed. Suggested outline for organizing this section:

- History [Summarize the evolution of the property from origin to present]
- Significance [Explain why the property is important]
- Context and Comparisons [Describe briefly similar properties in the area, and explain how this property compares]

(Text entered directly into form fields will not permit formatting adjustments, such as spell checking or italicizing. Instead, you may wish to cut-and-paste text from another document into the field below; "unprotect" the document for this section, or prepare the "History and Significance" narrative as a separate document.)

See Pennsylvania Historic Resource Survey Form, 2006 (attached)

Photo 1: Pier 122, View Northeast. (D. Van Steen January 2010)

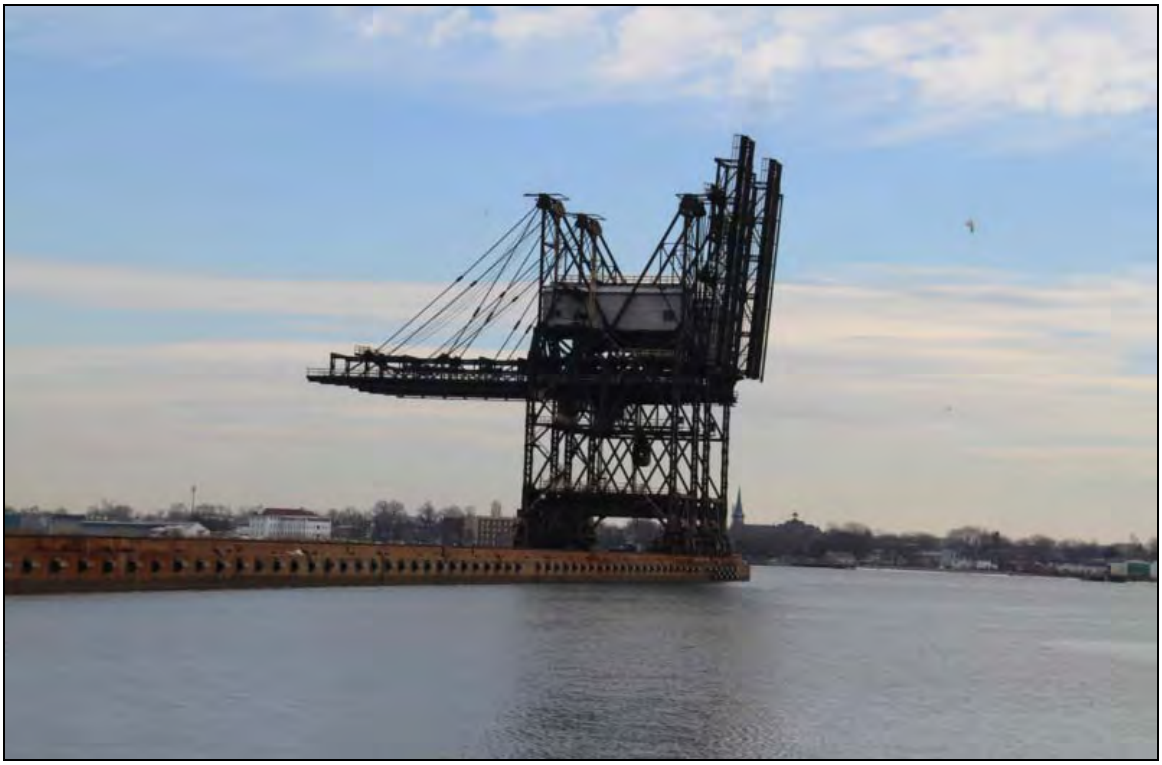


Photo 2: Last Remaining and Partially Dismantled Loader/Crane on Pier 122, View Northeast. (D. Van Steen January 2010)

Photo 3: Rail Tracks Remains, View East. (D. Van Steen January 2010)

Photo 4: A Dismantled Loader on the ground near Pier 122, View West.
(D. Van Steen January 2010)

Photo 5: Pier 122, View East. (D. Van Steen January 2010)

Photo 6: Partially Dismantled Loader/Crane at Pier 122, View East. (D. Van Steen January 2010)

Photo 7: Tracks on Pier 122, View East. (D. Van Steen January 2010)

Photo 8: Pier 122 Bulkhead, View Southeast. (D. Van Steen January 2010)

Photo 9: Machine Shop, View Northwest. (D. Van Steen January 2010)

Photo 10: Machine Shop, View Northeast. (D. Van Steen January 2010)

Photo 11: Non-contributing Support Buildings, View Northeast. (D. Van Steen January 2010)

Photo 12: Non-contributing Support Building, View Northeast. (D. Van Steen January 2010)

Photo 13: Non-contributing Support Building, View Northeast. (D. Van Steen January 2010)

Photo 14: Railroad Track and Narrow Gauge Shunt Engine, View Northwest.
(D. Van Steen January 2010)

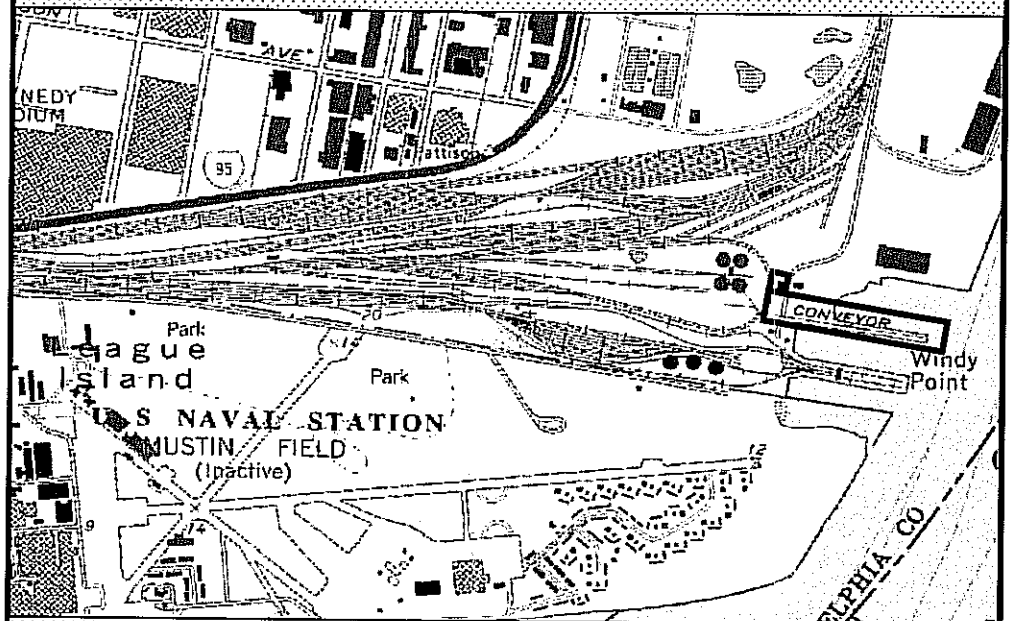
Photo 15: Railroad Track and Foundation Remains of Metal Distribution Structure, View Southwest. (D. Van Steen January 2010)

PENNSYLVANIA HISTORIC RESOURCE SURVEY FORM-PHOTO/SITE PLAN SHEET

Pennsylvania Historical and Museum Commission
Bureau of Historic Preservation
Box 1026, Harrisburg, PA 17108-1026

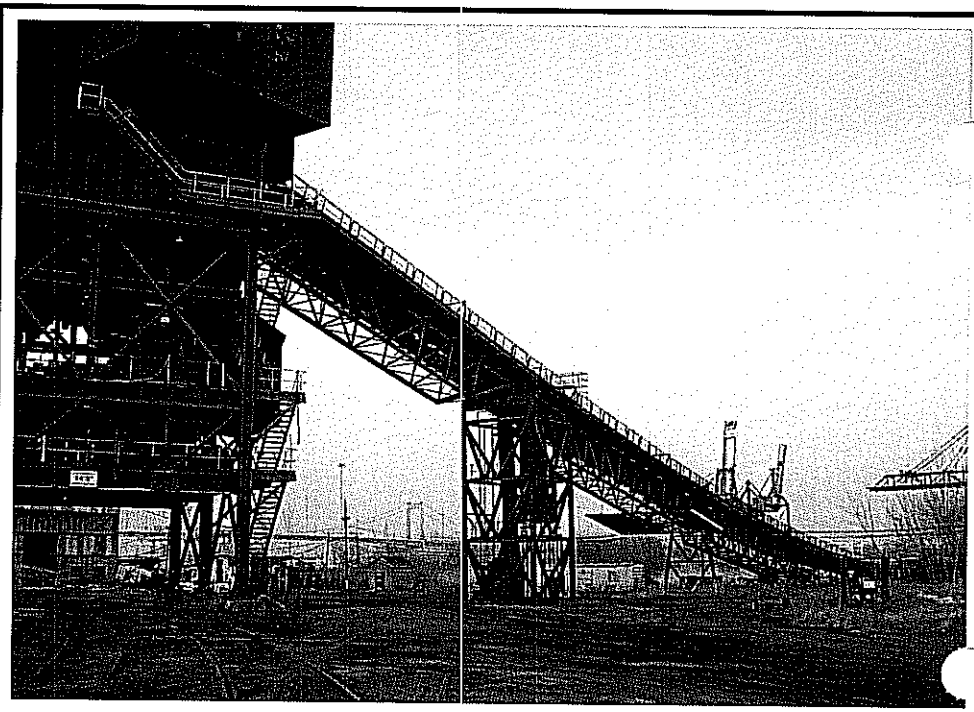
Survey Code/Tax Parcel/Other Various Tax Parcels **County:** Philadelphia
Municipality: City of Philadelphia **Address:** South end of Delaware Avenue, eastern end of League Island
Historic Name/Other Name: Pier 122/Ore Conveyor and Support Building

SITE PLAN



PIER 122/ORE CONVEYOR AND SUPPORT BUILDING - LOCATION MAP
USGS-PHILADELPHIA, PA QUADRANGLE, 1984
Scale: Approx. 1" = 1800'

PHOTO INFORMATION



Number	Description of View	Direction of Camera
	View of Ore Conveyor System	NE

Photographer Name: Alan Tabachnick **Date:** 3/8/2006
Negative Location: DMJM Harris, Phila. PA.

PENNSYLVANIA HISTORIC RESOURCE FORM - DATA SHEET 89B

Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation

IDENTIFICATION AND LOCATION

Survey Code: _____ Tax Parcel/Other No.: Various

County: 1. Philadelphia 1 0 1 2. _____

Municipality: 1. Philadelphia 1 0 1 2. _____

Address: Foot of Delaware Avenue, eastern terminus of League Island

Historic Name: _____

Other Name: PRR Ore Pier/Conveyor and Support Buildings

Owner Name/Address: CONRAIL Shared Assets, 405 Division Street, Elizabeth, NJ 07201

Owner Category: ____ Private xx Public-local ____ Public-state ____ Public-federal

Resource Category: ____ Building xxx District ____ Site ____ Structure ____ Object

Number/Approximate Number of Resources Covered by This Form: 1

USGS Quad: 1. Philadelphia, PA 2. _____

UTM References: A. zone 18 48618E 44 15724N C. _____

B. _____ D. _____

HISTORIC AND CURRENT FUNCTIONS

Historic Function Category:	Subcategory:	Code:	
A. Transportation	Rail Related	16	A
B.			
C.			
D.			

Particular Type:
A. Pier and Ore Loading facility
B. Railroad support buildings tied to ore operations
C.
D.

Current Function Category:	Subcategory:	Code:	
A. Transportation	Rail Related	16	A
B. Vacant	Not in Use	98	
C.			
D.			

PHYSICAL DESCRIPTION

Architectural Classification: A: Conveyor and Pier No Style 01

B. Industrial Buildings – Mixed 90 C. _____

D. _____ Other: _____

Exterior Materials: Foundation Concrete 65 Roof N/A

Walls Steel Framework 56 Walls N/A

Other _____ Other _____

Structural System: 1. N/A 2. _____

Width: N/A Depth: N/A Stories/Height: N/A

HISTORICAL INFORMATION

Year Built: ____ C. 1954 to ____ C. ____ Additions/Alterations Dates: ____ C. 1970s ; ____ C. ____
Basis for Dating: x Documentary x Physical
Explain: Based upon background research into the history of the pier complex, conveyor system, and associated buildings as well as a site visit.

Cultural/Ethnic Affiliation:	1.	N/A	2.	
Associated Individuals:	1.	N/A	2.	
Associated Events:	1.	Mid 20th Century Industry/Transportation	2.	
Architects/Engineers:	1.	Unknown	2.	
Builders:	1.	PRR	2.	

MAJOR BIBLIOGRAPHICAL REFERENCES

See Attached

PREVIOUS SURVEY, DETERMINATIONS

The buildings and the conveyor system were previously noted in a PHRS form for the nearby Greenwich Yard, which was determined eligible. These buildings and features were noted as being not significant in the PHRS form submitted for the rail yard. ER 97-0776-042-Q. Also noted in Workshop of the World, 1990.

EVALUATION (Survey Director/Consultants Only)

Individual NR Potential: X Yes ____ No Context(s): ____
Contributes to Potential District ____ Yes X No District Name/Status: ____
Explain: The ore pier, conveyor system, and machine shop building, are significant mid 20th century industrial and transportation related resources tied to the last period of industrial and railroad growth in the country.

THREATS

Threats: 2 1. None 2. Public Development 3. Private Development 4. Neglect 5. Other
Explain: The resource is located within the APE for the Philadelphia Navy Yard Access Project. The project crosses beneath the conveyor system and adjacent to the buildings that are part of the complex.

SURVEYOR INFORMATION

Surveyor Name/Title: Alan Tabachnick, Architectural Historian Date: 3/7/06
Project Name: Navy Yard Access Study
Organization: DMJM Harris, Inc. Telephone: 215-735-0832
Street and No.: 260 S. Broad Street, Suite 1500
City State: Philadelphia, PA Zip Code: 19102
Additional Survey Documentation: ____
Associated Survey Codes: ____

Survey Code: _____ Tax Parcel/Other No.: Various
County: Philadelphia Municipality: Philadelphia
Address: South of Delaware Avenue, on eastern end of League Island
Historic/Other Name: PRR Ore Pier/Conveyor and Support Buildings

PHYSICAL DESCRIPTION:

This complex of resources consists of a number of 20th century structures, as well as one building, all related to the transfer of raw materials from river going vessels once moored at Pier 122, to a transfer facility to the immediate west on League Island. Iron ore from the ships was transferred to the distribution structures to the west, where the ore could be loaded onto railcars for shipment.

Pier 122 was built by the Pennsylvania Railroad in 1954. According to specifications noted by the National Ocean Service (2005), the pier is 850 long with a deck height of 12 feet. It has four cranes with an unloading rate of 1,200 tons per hour. The pier is currently owned by CONRAIL and operated by the Pennsylvania Tidewater Dock Company.

The large ore conveyor system, also built from 1952 to 1954, extends from the end of Pier 122 on the Delaware River westward to a distribution facility. It is constructed of steel, with a variety of struts welded to metal piers that support the overhead trestle system. The entire operation is run by a series of electric generators located in a brick building near the conveyor system. The ore conveyor was built by the Pennsylvania Railroad in order to provide a more efficient way of transferring the rough iron ore materials that were offloaded on Pier 122, to waiting rail cars in the adjacent rail yard. In the mid 1950s, the conveyor system ran from the pier to the island for a distance of approximately 1250', and then tied in to a metal distribution structure that was located over the railroad track. It appears that freight cars were pulled beneath the hopper, and then the ore was poured into the cars, or the ore was deposited in a central pile and then cars were loaded from those piles. The cars full of ore were then transported to industrial sites across the region. According to one source, the iron ore pellets were shipped to steel mills in Bethlehem and Johnstown, Pennsylvania, and Weirton, West Virginia (Workshop of the World 1990:1-10). At some time in the 1970s, the conveyor system was altered to adapt to a new process, and the orientation of the conveyor was shifted from running roughly east to west, to running on a northwest angle and tying into modern storage domes. The four domed fertilizer holders, built by Growmark, were added in 1988 (Workshop of the World 1990:1-10). New sections of the conveyor system were built at that time to access this facility. This newer section is recommended as Not Contributing.

There is one 20th century contributing building in this complex. The large 3 story concrete block and metal Machine Shop building is rectangular in plan with a small, one story, rear (east) addition. The first story is concrete block, with a series of symmetrically placed six pane windows. There second and third stories are clad in standing seam metal plates. There is a course of vertical transparent heavy plastic/fiberglass sheeting around the building, half way up the elevation, which allows light into the interior of the space. The roof is has a very shallow pitch. There are two exterior brick chimney stacks rising on the east and west elevations. This building was identified as a machine shop in a 1952 Pennsylvania Railroad Company map (Pennsylvania Railroad 1952), with a rail spur running into the south facing façade. It was likely used for the repair and upkeep of the rolling stock that once served the ore pier. It is likely that this building stopped being used in the late 1990s when the operations ceased.

There are a number of non-contributing buildings surrounding the complex: metal shed structures that appear to date to the 1970s, as well as a number of small concrete block structures.

HISTORICAL NARRATIVE:

The Pennsylvania Railroad Company's Ore Pier and support structures were built between 1952 and 1954. An historical article published by the company specifically focused on the history and significance of the pier and conveyor complex, and that article forms the basis for this narrative (Pennsylvania Railroad 1954).

"Located at Greenwich Point ... the new pier, which juts 850 feet into the busy waterway, is expected to make Philadelphia the nation's leading port for ore shipments from South America, Africa, Labrador and other foreign sources of supply. The railroad's huge investment (ten million dollars) in the pier is a vital factor in the over-all program of improvements in the Port of Philadelphia geared to the industrial expansion in the entire Delaware Valley.

In addition to the ores to be transported to Central and Western Pennsylvania and the steel producing areas of the mid-west it is anticipated that a considerable volume of the ore required at the Fairless plant of United States Steel at Morrisville will be handled over the Pennsylvania's new facility...

The pier, under construction for more than two years, can carry 3,600 tons of ore an hour on its two 54-inch wide steel cord belts to loading hoppers that will transfer the ore to railroad cars for transportation to steel centers. Looking to possible increased needs in future years the railroad's engineers designed the pier for an ultimate length of 1,250 feet with docking capacity for four ships and six unloading machines, providing a capacity of 10,800 tons per hour over the unloading belts.

With a gradual lessening of the ore supply from the Mesabi Range in Minnesota, steel manufacturers in the past several years have made plans for sharply increasing ore imports from foreign sources. Quick to recognize the change in the basic pattern of steel manufacture, Walter S. Franklin, president of the Pennsylvania late in 1951, announced that the railroad would build a modern ore pier on the Delaware River at Philadelphia... Thousands of hopper cars carrying coal eastward for fueling Philadelphia industries or for export trade return to the mines of Western Pennsylvania and West Virginia empty. By locating the ore pier in an adjacent area these cars will carry the imported ores back to steel centers which are in the same general territory. Thus the cars that now transport coal in one direction will haul ore in the other.

Construction of the pier was a gigantic project. The Delaware was dredged to a depth of 39 feet in that area... 1,210 reinforced concrete piles ranging up to 89 feet long were poured on a production line basis... railroad tracks were laid to the edge of the river and a temporary pier was built to carry on the task of floating the piles into position for driving.... Hundreds of workmen have been employed on the vast project which was started in early 1952.

While the pier was being constructed other workmen were laying miles of track and erecting various maintenance buildings necessary to tie in the new operation with the present extensive classification and service yards in South Philadelphia. Meanwhile, the Industrial Brown Hoist Company was building the two huge unloading machines at its Bay City, Michigan, plant and Heyl and Patterson, Inc. of Pittsburgh was assembling the conveyor belt system required for the operation.

Unloading the ore ships, buckets from each of the machines will lift 17 tons at a bite and the cranes to which they will be attached will have a reach of 72 feet on each side of the pier. The two 54-inch wide belts will then convey the ore to a loading house from which it will be dumped into freight cars through 40-ton weighing hoppers. These cars will move to the new classification yard where they will be made up into trains for direct movement to steel-making centers.

The new pier is one of the largest tidewater ore unloading facilities in the country and it utilizes the most modern electrical equipment to remove import ore from ship holds to railroad

cars in one swift, smooth operation. Its supporting facilities include a complete machine shop, receiving and departing tracks capable of accommodating trains of 125 cars, classification tracks for empty cars, rip and cleaning tracks, a yard office, an electric sub station, a bunkhouse for railroaders, welfare facilities and parking space" (Pennsylvania Railroad 1954: 2-5).

Key senior employees at the Pennsylvania Railroad were responsible for the design, construction, and supervision of this project, including J.L Gressitt (chief engineer of the PRR), S.R. Hursh, L.P. Struble, C.J. Henry, J.E. South, and others. The pier was operated at that time on a contract basis by the Pennsylvania Tidewater Dock Company, with Pennsylvania Railroad employees handling all of the work in the supporting yards.

The Machine Shop building, ore pier, and conveyor system described in this form were all built during the 20th century and were tied to the transfer and shipment of raw materials (i.e. iron ore) from ships that docked at Pier 122 to the rail yard and transfer center operated by the Pennsylvania Railroad to the west. According to one source, the ore cars were transported by Shunt Engines that were built in 1951 and 1956 by the Atlas Car & Manufacturing of Cleveland, Ohio. The cars operated on a triple track horseshoe curve, which was narrow gauge (42"). The cars used pneumatically operated arms to push cars on parallel standard gauge tracks as they were being loaded with imported iron ore, unloaded from ships at the pier. Conventional locomotives then moved the assembled ore trains to Bethlehem Steel and other steel mills throughout Pennsylvania and the Midwest (www.rypn.org). There are three of these cars remaining within or adjacent to the complex. They are in extremely poor condition and are not considered contributing to this resource. One other Shunt Engine was moved to the National Museum of Industrial History in Bethlehem, and has been restored.

The "Machine Shop" building was built by the PRR during the early 1950s. In the 1980s, it appears that the conveyor system was altered to connect to a new distribution facility in the middle of the rail yard. It is likely at this time that the system was shifted so that materials could be directly offloaded from the ships at Pier 122 and then the materials conveyed and the stored in the domes. Materials could then be loaded from the dome complex into awaiting trucks or trains for transport. Currently the domes are owned by Growmark Inc., and store fertilizer. One source stated that the domes were built in 1988 (Workshop of the World 1990).

Since the 1970s, the yard's use dwindled as the demand for iron ore fell during this period. As the pier and associated yard complex was predominantly dependent upon ore for the steel industry, when this went into a steep decline starting in the1970s, the complex declined. When iron making at Bethlehem Steel's Bethlehem plant closed in 1995, Pier 122 and its associated shunt engines and support buildings continued to operate until 1999 when the operation largely closed down. Currently it appears that only the fertilizer storage operation is still ongoing. One of the Shunt locomotives was donated by Conrail Shared Assets to the National Museum of Industrial History in Bethlehem, and the unit was transported there in 2005. Currently the City of Philadelphia is attempting to market the pier and associated acreage including the buildings and conveyor system.

SIGNIFICANCE STATEMENT

Pier 122 and associated ore conveyor system and Machine Shop building are significant and recommended eligible for listing in the National Register of Historic Places, specifically meeting Criteria A and C. The pier complex and its associated conveyor system and support building were intimately tied to the mid 20th century growth of the steel industry in Pennsylvania and the nation. As the industry grew, plants demanded additional iron ore for the furnaces. The Pennsylvania Railroad anticipated this great demand and constructed this complex to meet that need. Two of the key plants that were tied to this facility were Bethlehem Steel and the U.S. Steel Fairless works in Bucks County, PA. The complex was built to efficiently take huge amounts of iron ore from the ships, convey it to awaiting trains, and then transport the raw materials to awaiting steel mills and other plants. On return trips, coal from mines in the

Northeast and western Pennsylvania and West Virginia were transported east, to be loaded onto ships for transport to other ports. The coal was off-loaded from the adjacent Pier 124 and loaded onto ships for transport to markets. This created a strong economic loop that formed much of the industrial backbone of the region during the mid 20th century. As an integral part of the industrial steel process from the last period of substantial growth and health, the pier complex and associated conveyor system and the Machine Shop are significant for the important role they played in those operations, meeting Criterion A.

The complex also meets Criterion C, for its engineering merit. The construction of the pier and the associated conveyor system was a huge and complex undertaking, and was one of the largest facilities of its kind when built by 1954. The construction of the pier involved the dredging of the Delaware River to a depth of 39 feet, driving 1,210 reinforced concrete piles up to 89 feet long, and building numerous temporary and permanent railroad lines and spurs during the construction process and for the functioning of the system. Maintenance buildings were also built, including the Machine Shop, which remain on site and currently used for storage. Other buildings that were present on the site and were built in the 1952-54 period included the AC Building (Power) and the Welfare Building (both have been demolished).

The technology incorporated into the design of the conveyor system was significant, allowing for the transport of 3,600 tons of ore per hour on the two 54-inch wide steel cord belts to the loading hoppers. The conveyor belts traverse a distance of 1,550 feet and operated at a speed of 500 feet per minute, constructed of rubberized fabric reinforced with steel (Pennsylvania Railroad 1954). The conveyor system also had a large "headhouse" which was equipped with electronic scales that automatically weighed out the ore for each carload. The loading hopper with integrated weighing systems eliminated the need for scales on the tracks (Workshop of the World 1990: 1-10). Because of the complex engineering elements associated with the construction of the pier complex and the ore conveyor system, this resource meets National Register Criterion C.

NATIONAL REGISTER BOUNDARY DESCRIPTION AND JUSTIFICATION

The proposed National Register boundary for this resource includes the pier itself, the conveyor system and support piers, and the support buildings that date to the period of significance: 1952-1954. The only building included as part of the resource is the Machine Shop Building. There are a number of metal shed buildings on the site but these post-date the period of significance (1970s era) and have been excluded. The proposed boundary is irregular, and can be seen on the accompanying figure. It follows the north, east, and southern limits of the pier complex, the footprint of each of the piers supporting the conveyor system, the land directly beneath the conveyor system that contains railroad tracks, and also extends northward to include the footprint of the Machine Shop Building. The proposed boundary includes all of the elements that contribute to the significance of the resource, and excludes areas that have lost integrity. Tracks that run directly beneath any portions of the conveyor system that are intact are included within the boundary. Tracks that also lead from the conveyor area into the Machine Shop Building are also included in the boundary. Areas that have been excluded include the rail yard west of the conveyor system that has been recently modified and many tracks have been removed. In addition, the overgrown brushy land to the east of the Machine Shop Building has been excluded as no activities or buildings relating to the function of the pier or the ore transfer occurred in this location.

A large area to the south of Pier 122 has also been excluded from the boundary. This area includes Pier 124 as well as former rail lines that accessed that pier. Pier 124 was used from the 1920s through the 1980s to transport coal from the railroad lines onto the container ships for transport. Pier 124 and its associated yards, were renovated in the 1970s by CONRAIL (Workshop of the World 1990) which included changes to the pier itself and the replacement of the loading equipment, as well as changes to the adjacent rail lines. Pier 124 is outside the APE for this project, and the railroad lines that once accessed it from the west have been largely removed and the area is overgrown. The pier and the formerly associated rail lines in that location have lost integrity and are not related to the ore shipments and process

that link Pier 122 with the conveyor system and its support building. Thus the area to the south of the Pier 122 complex has been excluded from the boundary and is not significant. The contributing elements to the Pier 122 Historic District include Pier 122, the conveyor system, the Machine Shop Building, and the associated railroad tracks beneath the conveyor and leading to the Machine Shop.

REFERENCES CITED

National Ocean Service

2005 *United States Coast Pilot 3, Atlantic Coast: Sandy Hook, NJ to Cape Henry, VA.* 38th edition. National Oceanic and Atmospheric Administration, Washington, DC.

National Park Service

1997 National Register Bulletin: How to Apply the National Register Criteria for Evaluation. U.S. Department of the Interior, Washington, D.C.

Oliver Evans Press

1990 Workshop of the World: A Selective Guide to the Industrial Archaeology of Philadelphia. The Oliver Evans Press, Wallingford, PA.

The Pennsylvania Railroad

1952 The Pennsylvania Railroad, Eastern Region, Philadelphia Terminal Division, Proposed Ore Handling Facilities. Plan No. 39633A, drawn in 1951, revised April 17, 1952.

1954 "Pennsylvania Railroad's New Ore Pier Goes Into Operation at Philadelphia." Published in a Pennsylvania Railroad's The Mutual Magazine, April, 1954. Provided by the Museum of Industrial History, Bethlehem, PA.

USGS Map

1984 Philadelphia Quadrangle, 7.5 Minute Series. U.S. Government Printing Office, Washington, DC.

Websites Consulted

www.rypn.org

http://prr.railfan.net/

http://www.railsandtrails.com/Maps/default.htm

ADDITIONAL PHOTOGRAPHS

Figure 1 – View of Pier 122, looking east from landside of pier. Note conveyor system on the right side of the photograph, the tracks running down the center of the photograph (potentially for the direct loading of ore, and the small narrow tracks on the left side for the movement of the loading derricks.

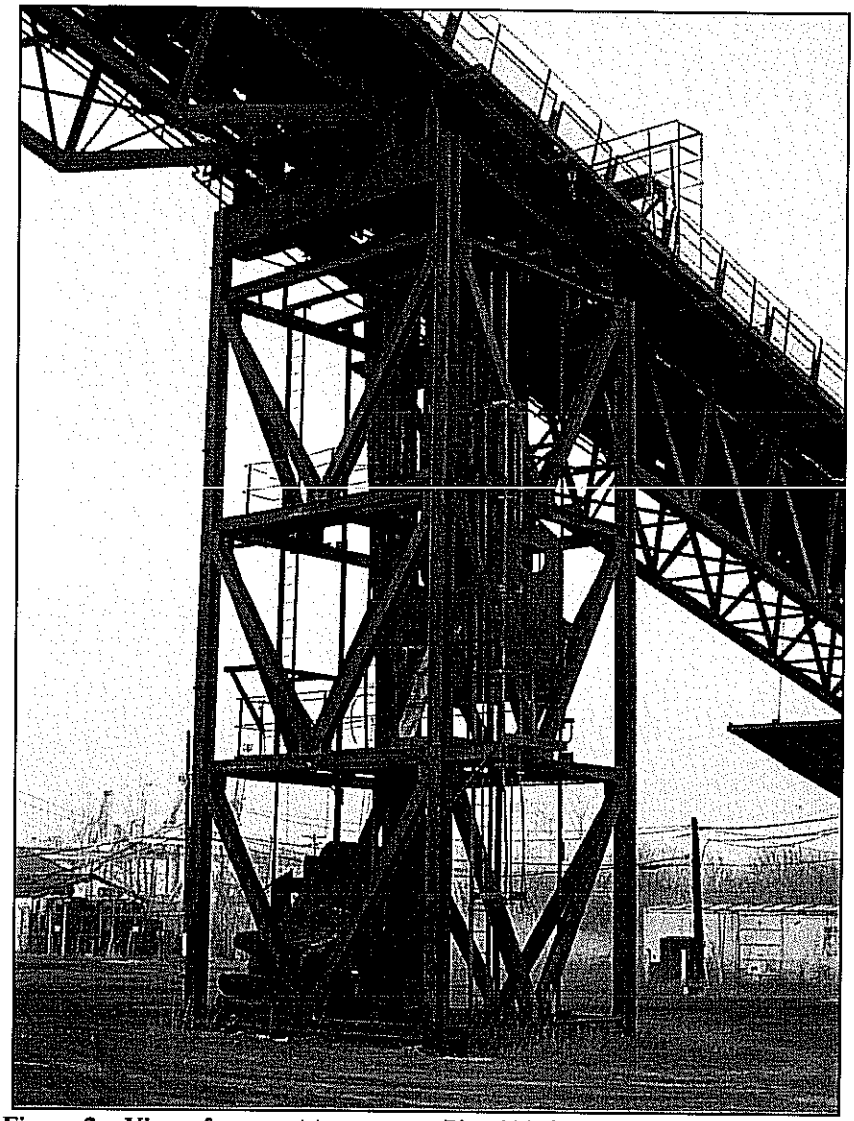


Figure 2 – View of support tower near Pier 122, looking northeast.

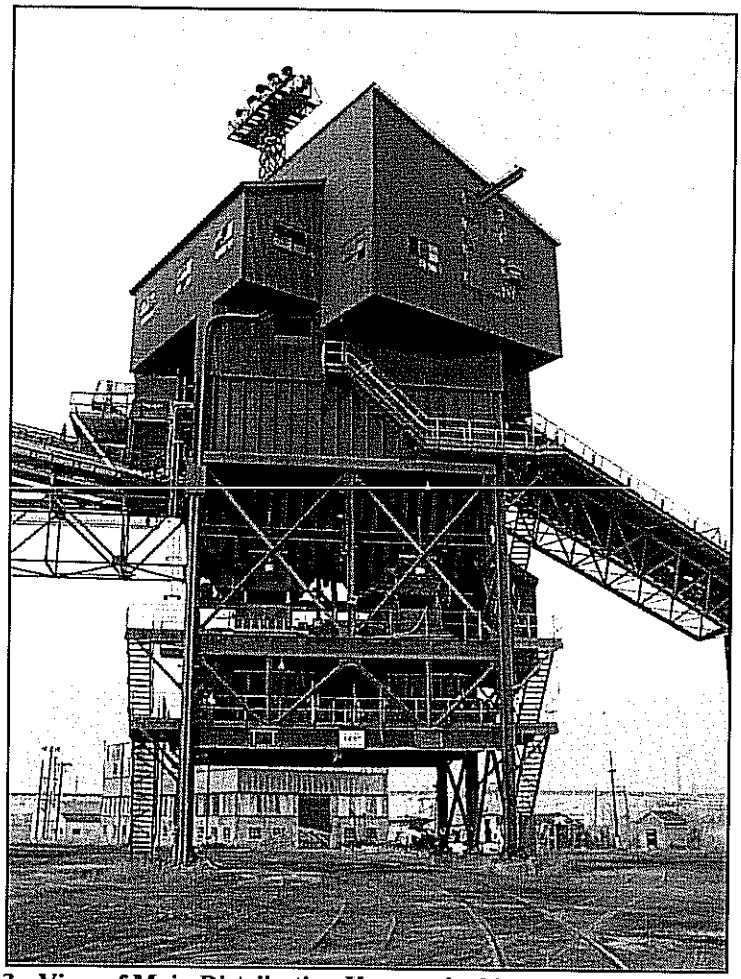


Figure 3 - View of Main Distribution Hopper, looking north. Note the remains of tracks running beneath the hopper, within the proposed boundary.

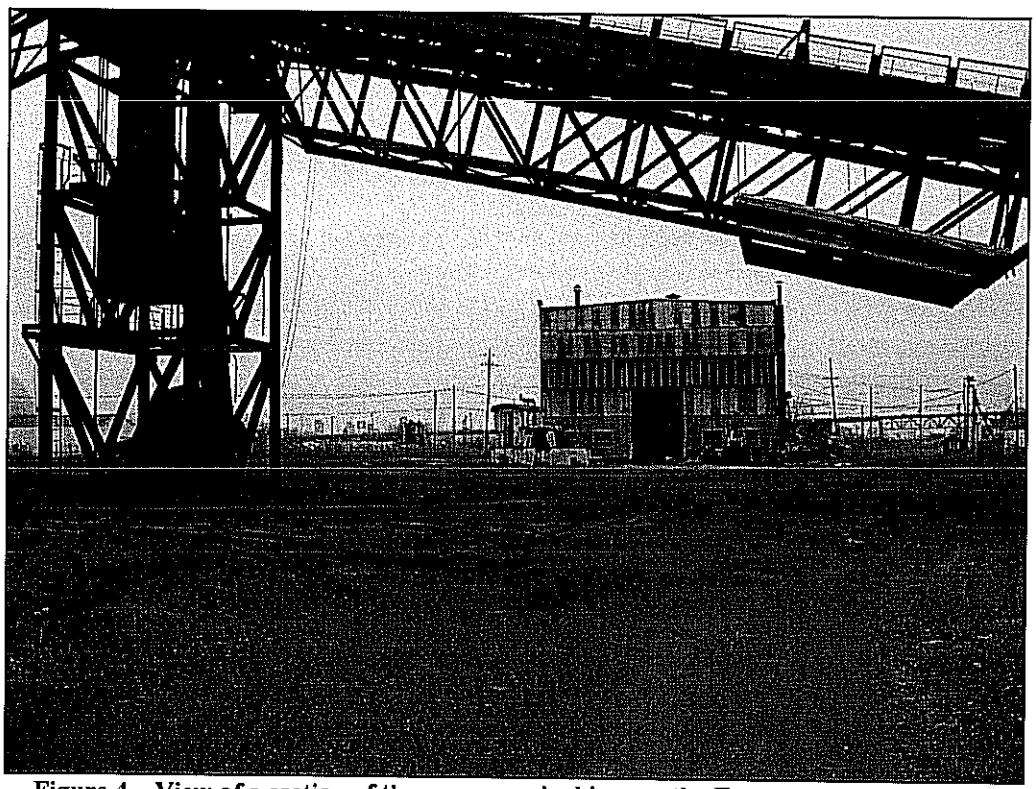


Figure 4 – View of a section of the conveyor, looking north. Former Machine Shop is at the rear of the view.

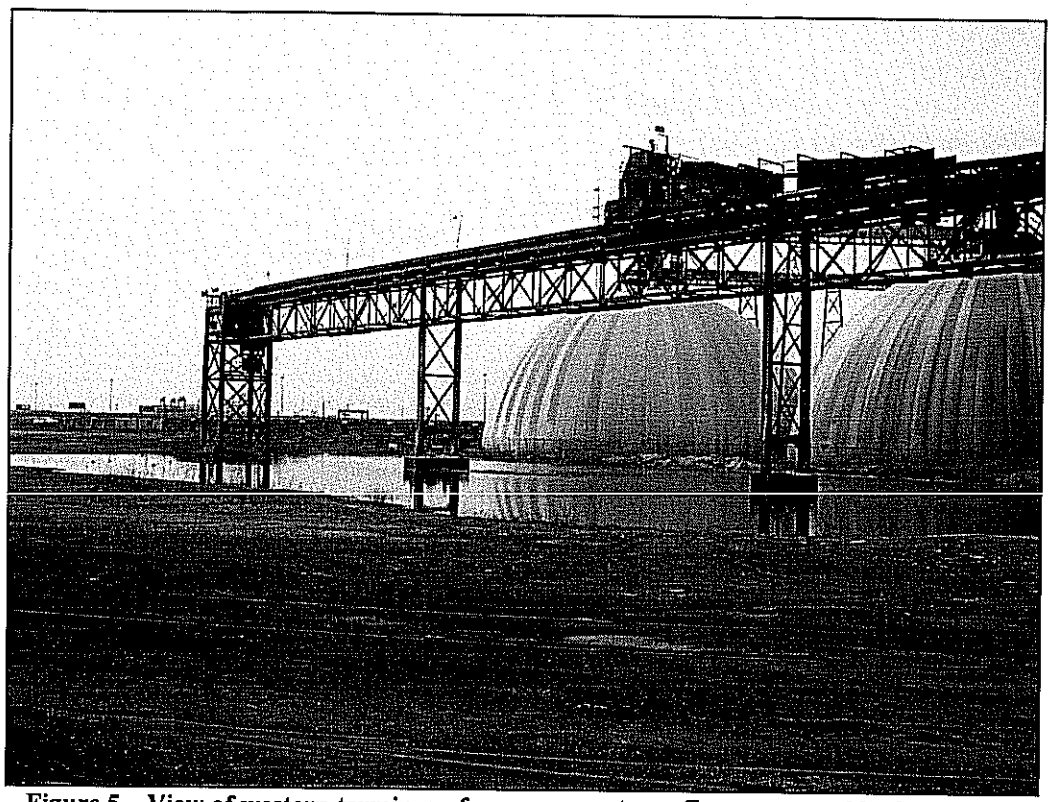


Figure 5 – View of western terminus of conveyor system. Conveyor would take the iron pellets and deposit them in large storage piles at the end of the line. Modern fertilizer domes are in the background of the photograph. Looking northwest. Vacant disturbed land outside of conveyor system footprint is outside of proposed boundary, as are the fertilizer domes in the background.

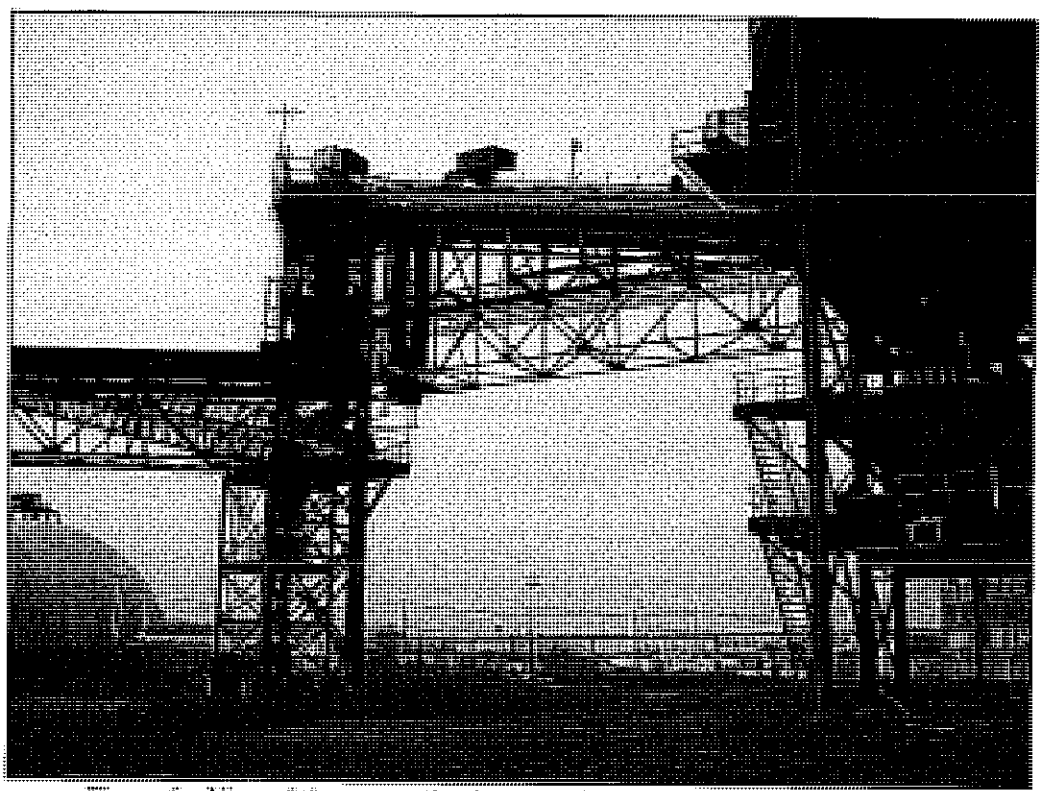


Figure 6 – View of the connection between the main hopper building and the modern conveyor to take the fertilizer to the storage domes. Looking northeast.

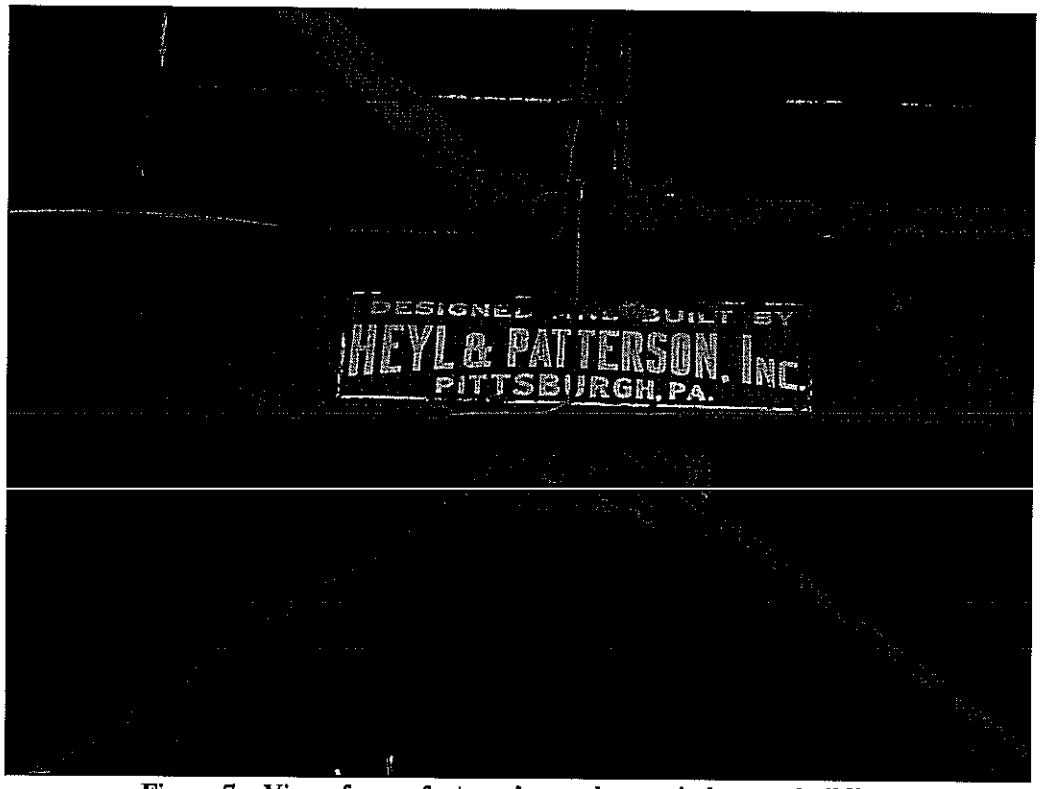


Figure 7 – View of manufacturer's panel on main hopper building.

Figure 8 – View of the conveyor system looking east with loading derricks on the pier in the background.

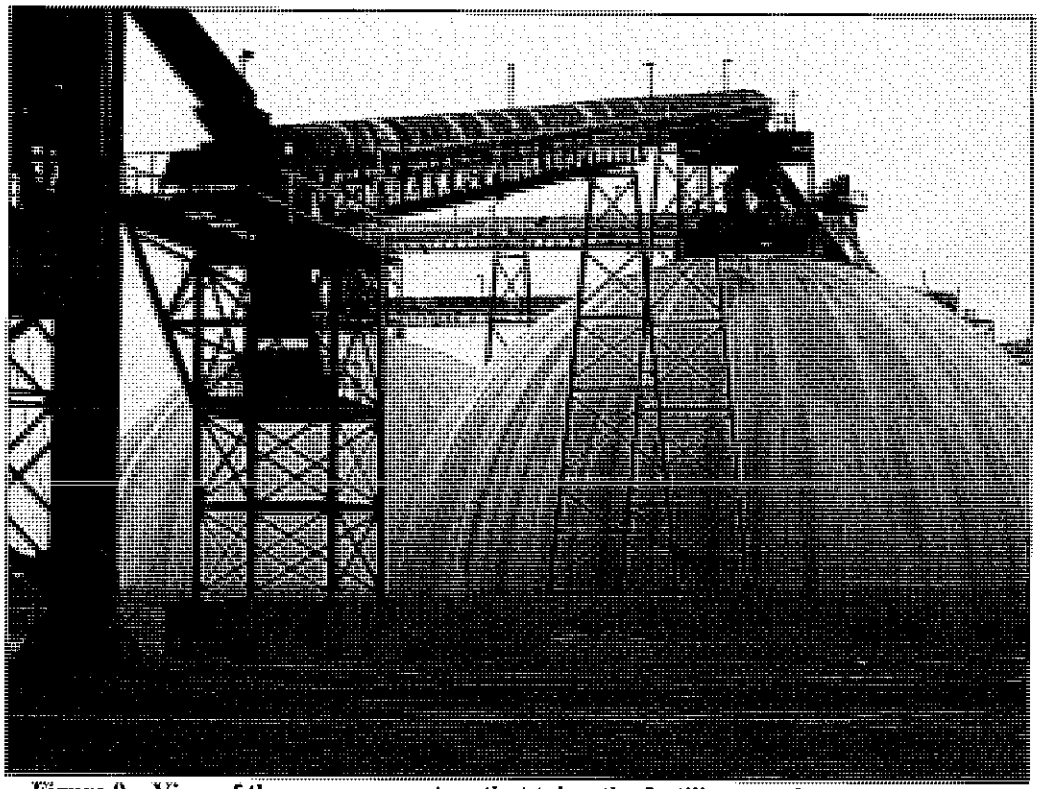


Figure 9 – View of the conveyor system that takes the fertilizer product from Pier 122 to the modern storage domes (1988). Non-contributing section. Looking west.

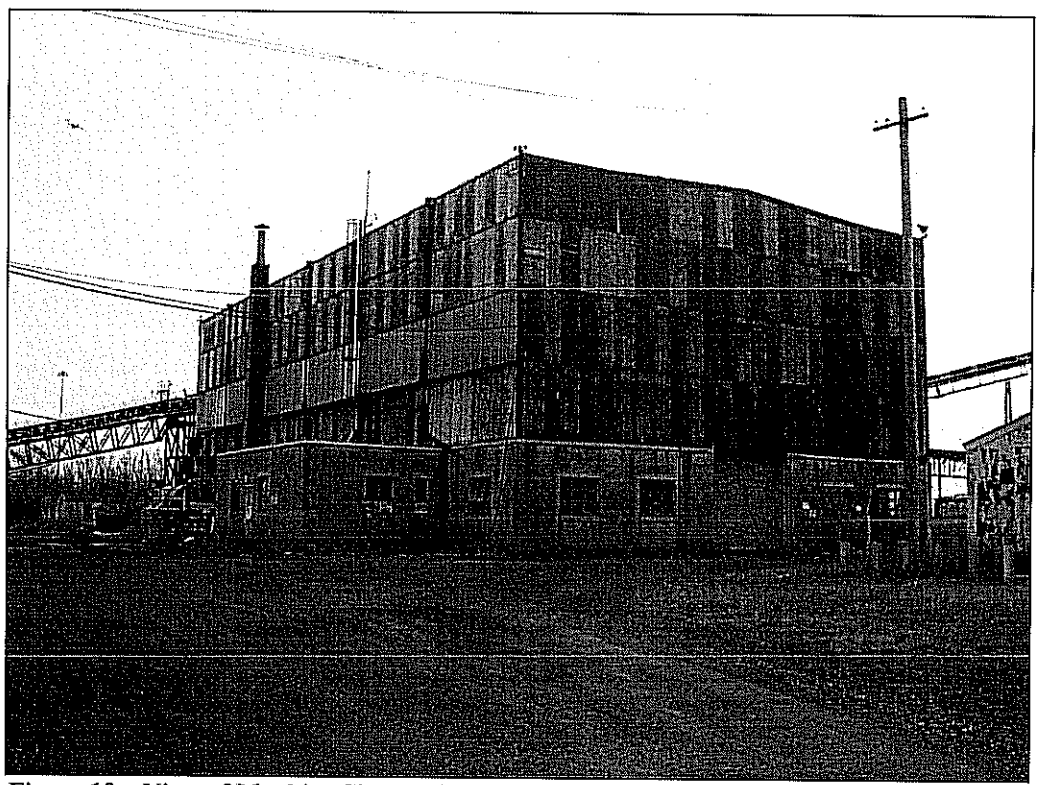


Figure 10 – View of Machine Shop Building looking south with the conveyor system in the background. Building was used to repair and maintain the Shunt Engines used in the movement of loaded and empty ore cars. Building has concrete block first story, and metal and fiberglass sheeting at the upper levels. Note the band of fiberglass sheeting along the mid-elevation to allow light to the iuterior

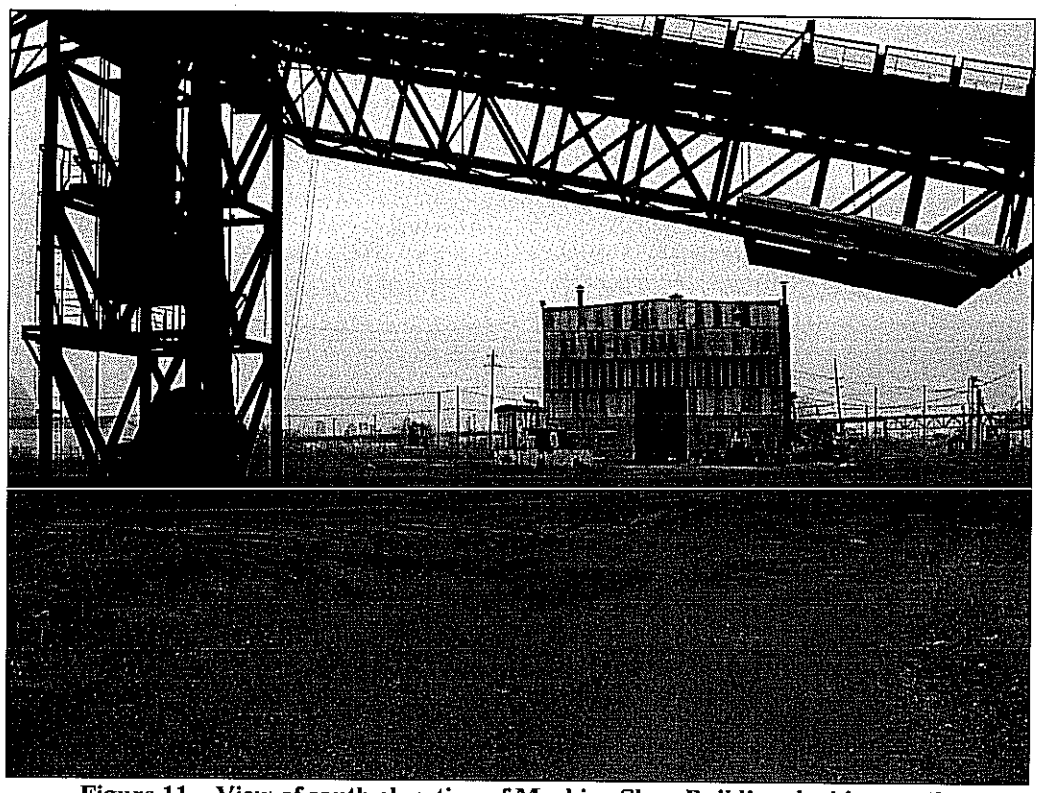


Figure 11 – View of south elevation of Machine Shop Building, looking north. Conveyor system is in the foreground. Abandoned Shunt Engine 3 is visible in front of Machine Shop Building.

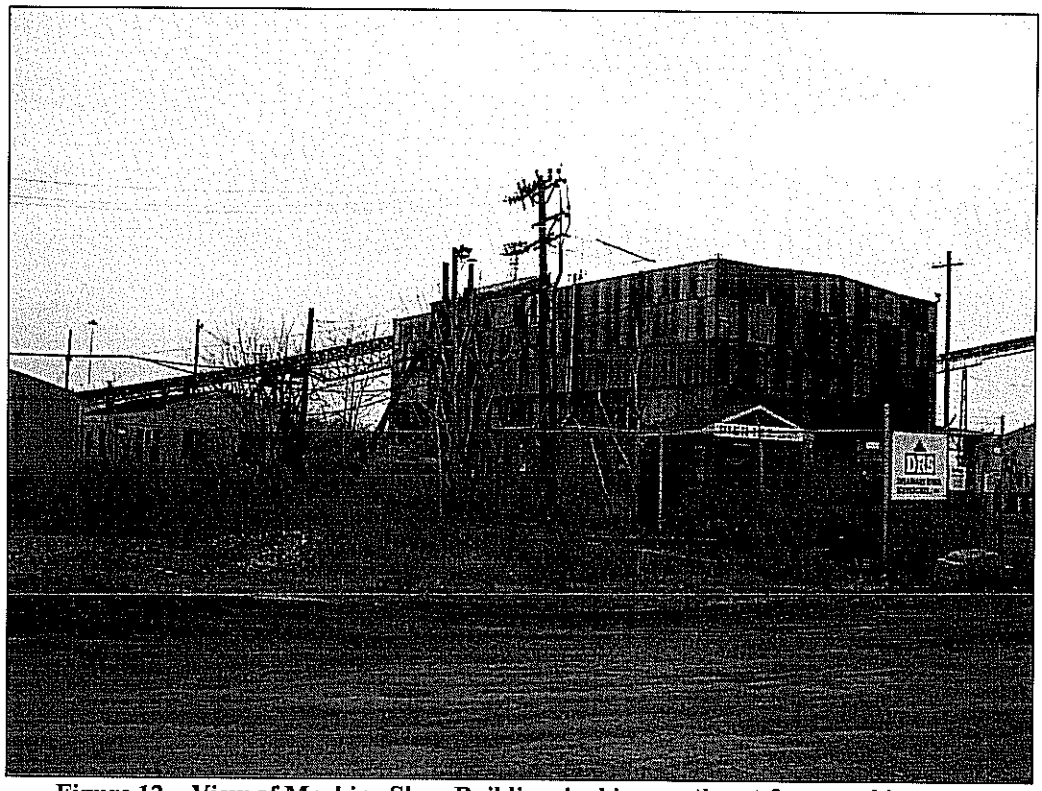


Figure 12 – View of Machine Shop Building, looking southeast from parking area.

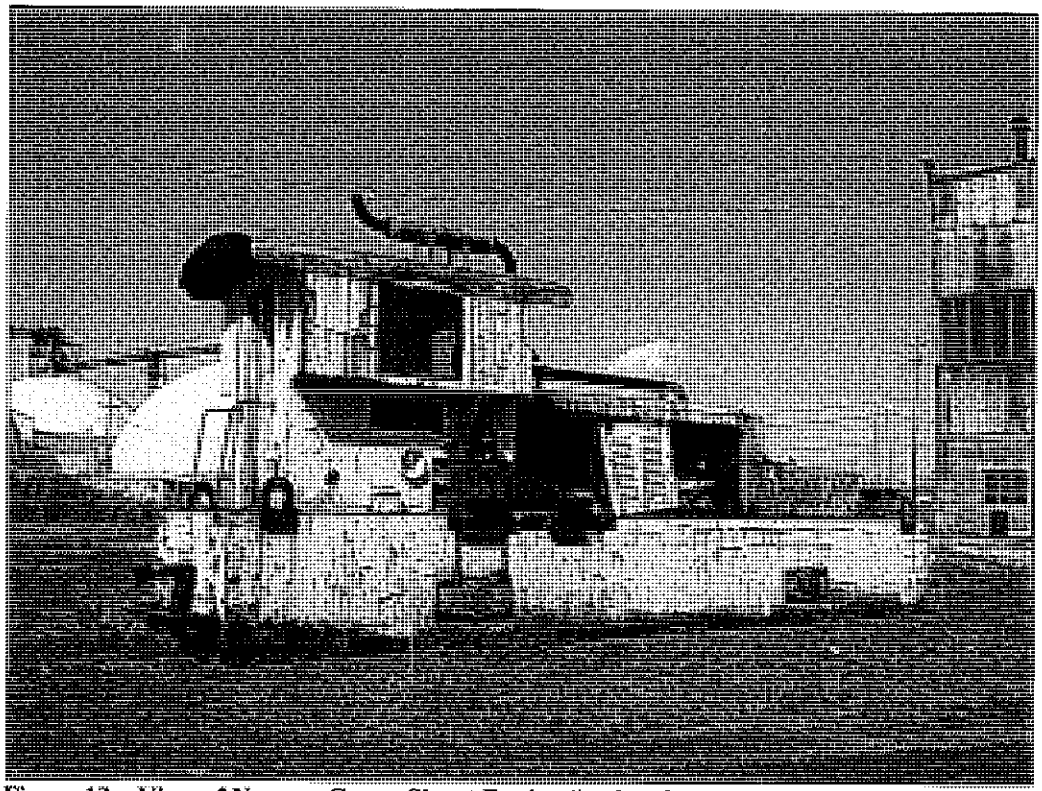


Figure 13 – View of Narrow Gauge Shunt Engine #3 abandoned on former tracks adjacent to the Machine Shop Building. Four of these engines were built by the Atlas Car and Manufacturing Company of Cleveland, Ohio. They operated on a triple track horseshoe curve and had pneumatically operated arms to push cars on parallel standard gauge tracks as they were being loaded with imported iron ore from the pier.

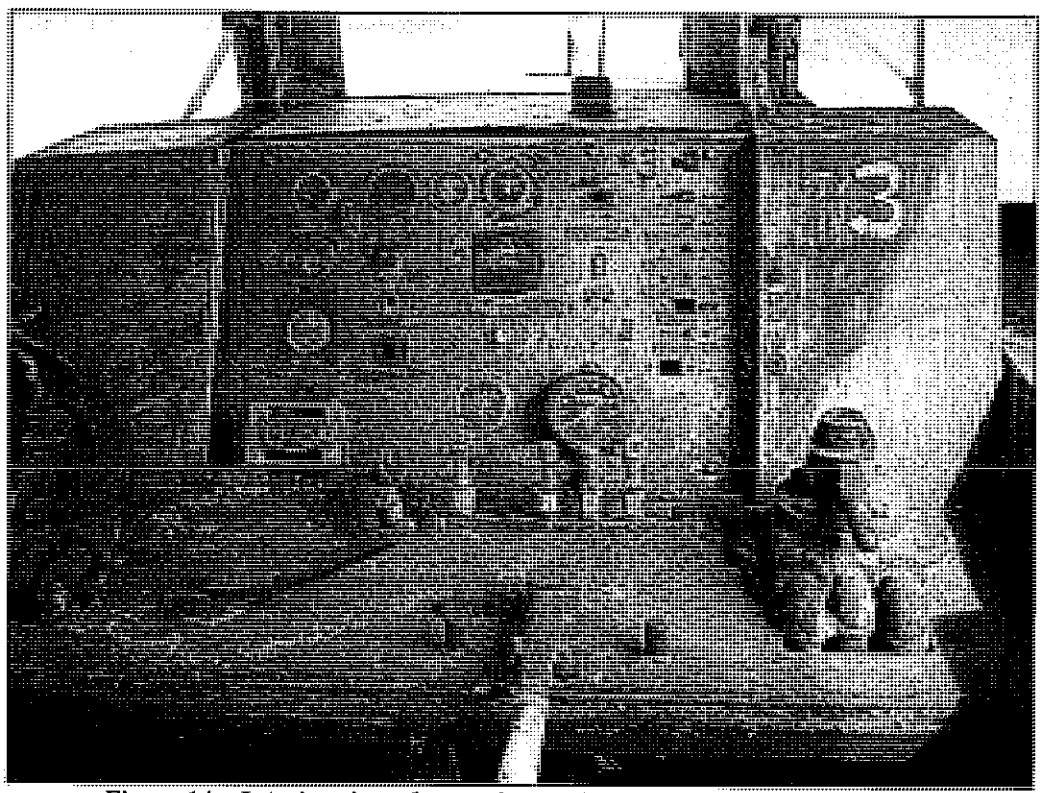


Figure 14 – Interior view of control panel inside Shunt Engine Number 3.

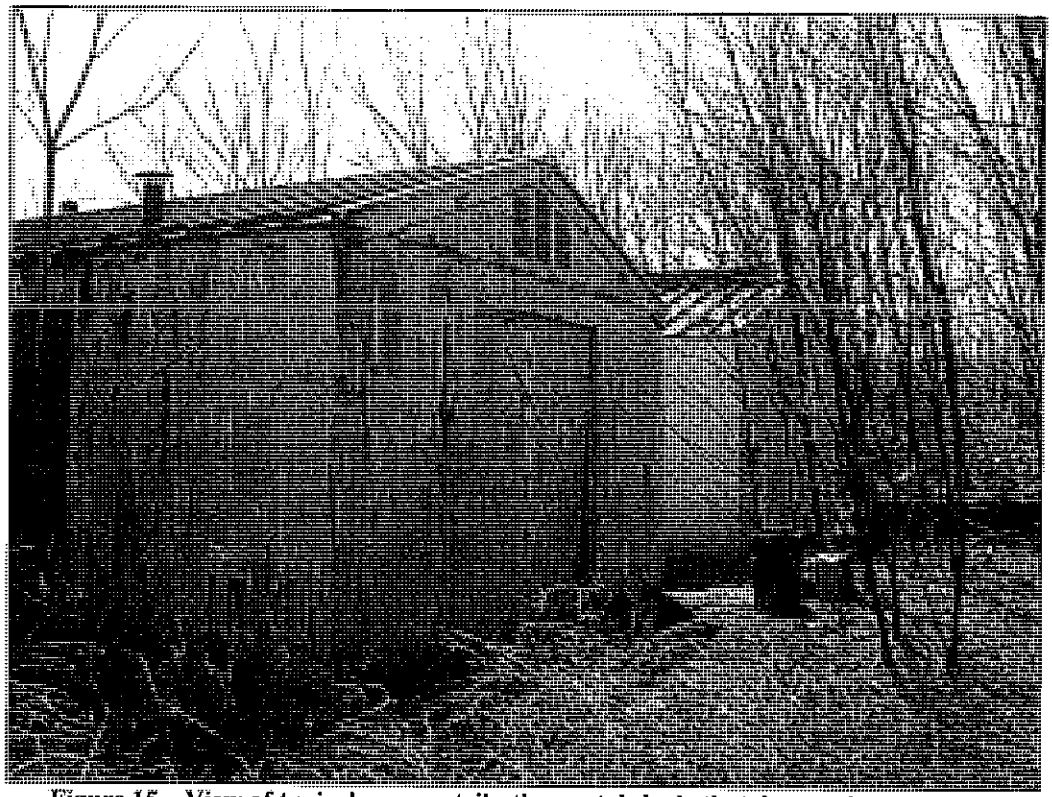


Figure 15 – View of typical non-contributing metal sheds that date to the mid-1970s on the site. These are outside of the proposed boundary.

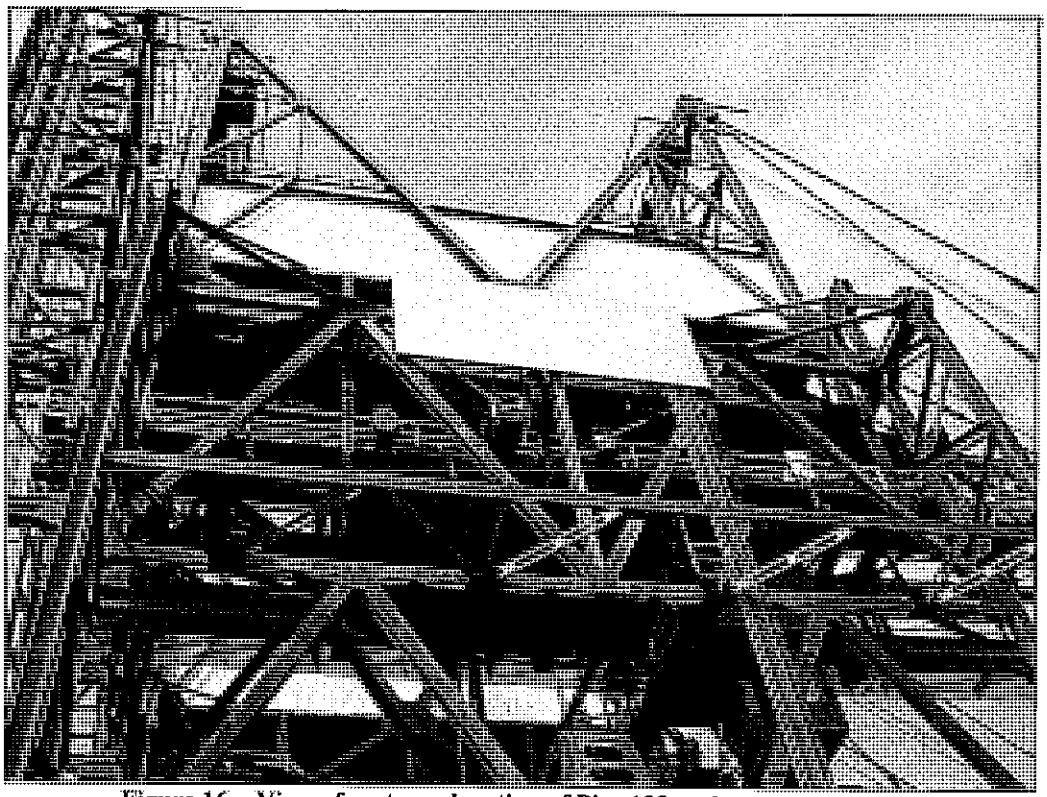


Figure 16 – View of eastern elevation of Pier 122 and conveyor system.

Figure 17 – View of tracks running beneath main hopper. Central tracks are narrow gauge to accommodate the Shunt Engines.

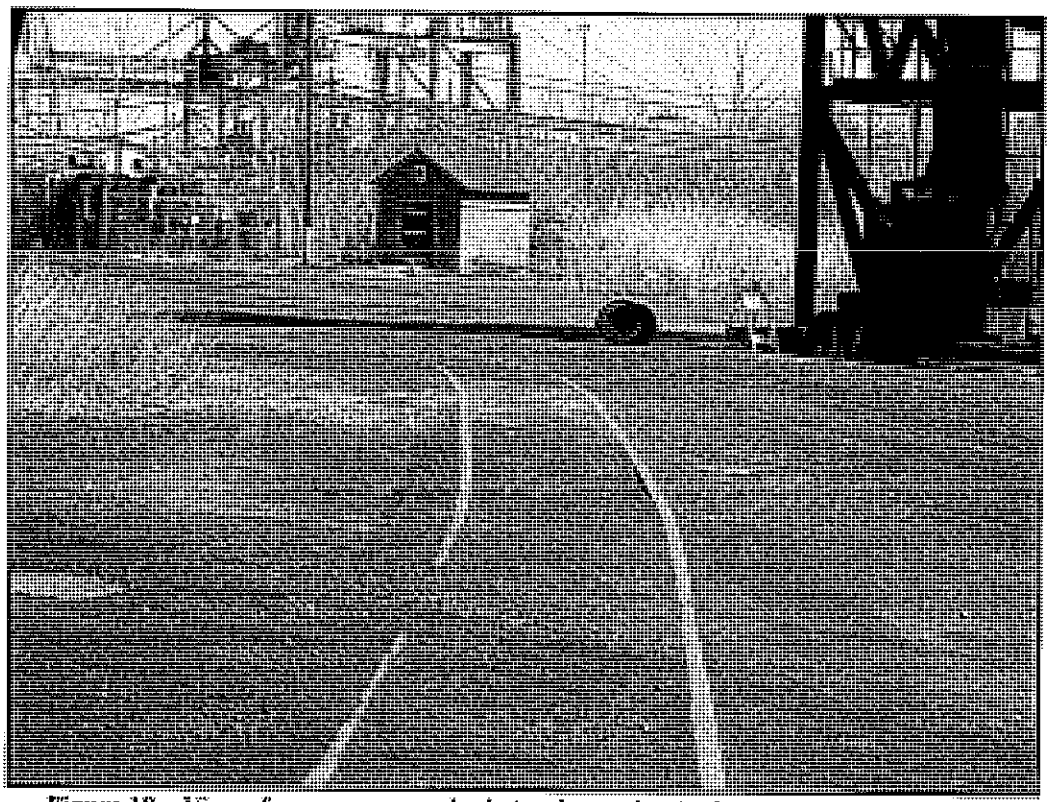


Figure 18 – View of narrow gauge single track running to the northeast, beneath the conveyor, to access the Machine Shop Building.

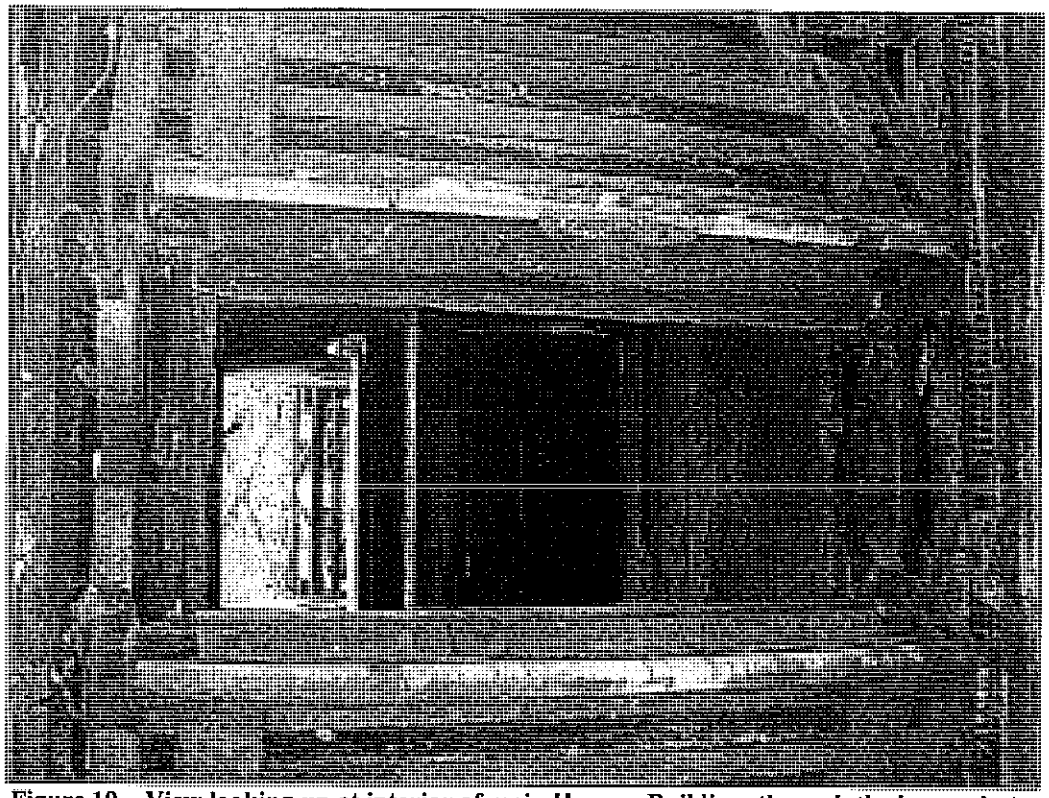
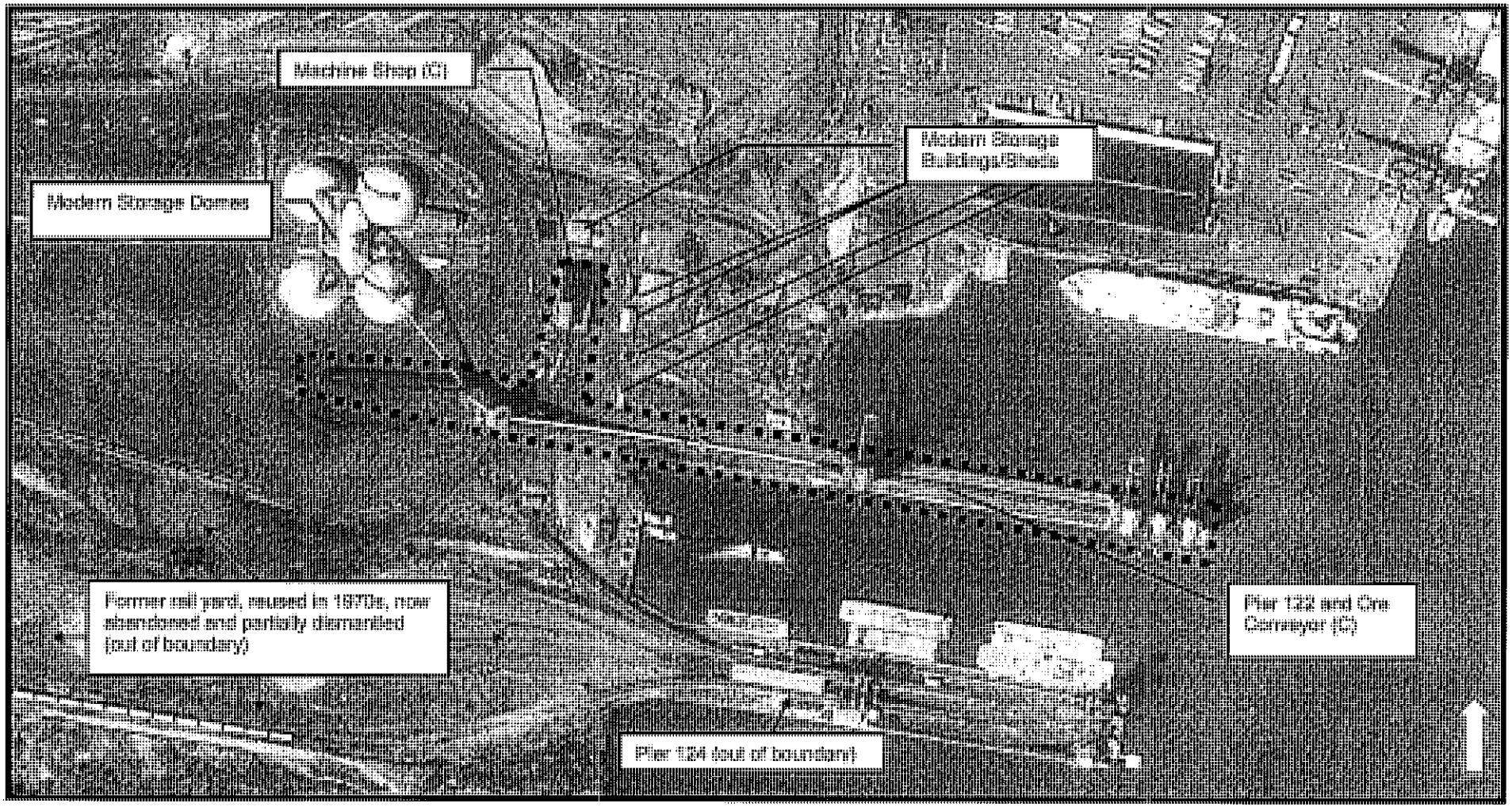


Figure 19 – View looking up at interior of main Hopper Building, through the lower chute. Ore would be dropped through this chute into the awaiting



Pennsylvania Railroad Pier 122/Ore Conveyor and Machine Shop
Proposed National Register Boundary

National Register Boundary ▪▪▪▪▪▪▪▪

Scale: 1" = Approx. 300'

Source: Terra Server Aerial Photography 1999

APPENDIX B:
Resumes of Key Personnel

KRISTOFER M. BEADENKOPF
The Louis Berger Group, Inc.
Senior Archaeologist

EDUCATION

- M.A.A. (Master of Applied Anthropology), Historical Archaeology, University of Maryland, 2002.
- B.A., Anthropology, Monmouth University, 1998.

PROFESSIONAL REGISTRATION

- Register of Professional Archaeologists (RPA)
- Eastern States Archaeological Federation
- Archaeological Society of New Jersey
- Society for Pennsylvania Archaeology

TECHNICAL TRAINING

- C.R.M. Essentials, New Jersey Historic Preservation Office, Trenton. October 26, 2007.
- Cultural Resources Best Workshop, New Jersey Historic Preservation Office, Trenton. October 27, 2006.
- Section 106 Essentials, Advisory Council for Historic Preservation, Washington, D.C. Don Klima (Instructor), August 11-12, 2004.
- Trenching and Excavation Safety—OSHA Construction Industry Standards, Subpart P (29 CFR 1926.650-652). Emilcott Associates, Inc., June 2, 2004.

PROFESSIONAL EXPERIENCE

Mr. Beadenkopf's background includes archaeological investigations at prehistoric sites dating to the Archaic through the Late Woodland periods and historic sites dating to the eighteenth through the early twentieth centuries throughout the Northeast, Middle Atlantic, and Southeast. As Principal Investigator he is responsible for the design and execution of archaeological research projects involving historic and prehistoric resources in the Northeast. His responsibilities include implementing surveys and excavations, performing background and site-specific research, analysis and interpretation of archaeological data and artifacts, preparation of technical reports, and consultation with regulatory agencies. His specialties include urban and historical archaeology and public archaeology. His experience includes public interpretation at several archaeological sites, education, presentations, and creation of displays of archaeological collections and information. Projects in Stavelot, Belgium; Idalion, Cyprus; and Rio Bravo, Belize, illustrate his international experience. Since joining The Louis Berger Group, Inc., Mr. Beadenkopf's major projects have included the following.

- **Documentary Analysis, Preliminary Field Investigations, and Grave Marker Inventory, Saint Vincent's Cemetery, Philadelphia, Pennsylvania**. Principal Investigator, documentary review of burial ledgers, permits, and historic cartographic resources, subsurface probing and excavation of buried grave markers, survey/mapping of the cemetery, and photo-recordation, transcription, and German-English translation of more than 90 grave markers in cemetery established in 1855. For St. Vincent's Homes. 2009.

- **Phase I/II Cultural Resource Investigations, Susquehanna to Roseland 500kV Transmission Project, Warren, Sussex, Morris, and Essex Counties, New Jersey**. In support of federal, state, and local permitting processes, Project Manager and Principal Investigator, cultural resource survey of 47.5-mile transmission corridor and more than 140 miles of temporary access

roads across northern New Jersey. Identified and evaluated 28 prehistoric archaeological sites and more than 1,000 historic architectural resources. For Public Service, Electric and Gas.

- **Phase I/II Cultural Resource Investigations, Susquehanna to Roseland 500kV Transmission Project, Luzerne, Lackawanna, Wayne, Pike, and Monroe Counties, Pennsylvania**. In support of federal, state, and local permitting processes, Project Manager and Principal Investigator, cultural resource survey of 100-mile transmission corridor and more than 100 miles of temporary access roads. Identified and evaluated 17 prehistoric archaeological sites and more than 1,000 historic architectural resources. For Pennsylvania Power and Light.

- **Phase I/II Cultural Resource Investigations, Susquehanna to Roseland 500kV Transmission Project, Delaware Water Gap National Recreation Area (DEWA), Monroe County, Pennsylvania, and Warren County, New Jersey**. As part of the Section 106 process, Project Manager and Principal Investigator, cultural resource survey of the portions of the transmission project extending through the Delaware Water Gap National Recreation Area (DEWA). Identified and evaluated 27 prehistoric and/or historic archaeological sites and historic architectural resources (including the Appalachian Trail) within DEWA. For Pennsylvania Power and Light and Public Service, Electric and Gas.

- **Phase I/II Cultural Resource Investigations at Four Proposed Wetland Mitigation Areas as Part of the New Jersey Turnpike Interchanges 6 to 9 Program, Burlington, Middlesex, and Mercer Counties, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, cultural resource survey of four wetland mitigation areas. Identified and evaluated 10 prehistoric and/or nineteenth-century archaeological sites. For the New Jersey Turnpike Authority.

- **Phase I/II Cultural Resource Investigations of Detention Basin and Pipeline Relocation Areas as Part of the New Jersey Turnpike Interchanges 6 to 9 Program, Burlington, Middlesex, and Mercer Counties, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, cultural resource survey of more than 70 detention basins locations and more than 20 miles of pipeline relocations associated with the New Jersey Turnpike Interchanges 6 to 9 Program. For the New Jersey Turnpike Authority.

- **Phase I Cultural Resource Survey, New Jersey Turnpike Widening, Interchanges 6 to 9, Gervasoni Farm Property, Robbinsville Township, Mercer County, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, Phase I/II subsurface archaeological investigation and building material analysis for former farm. Identified one historic archaeological site, the Robbins Gervasoni Farm Site (28-Me-374), but no significant associated deposits were encountered in the project area. For the New Jersey Turnpike Authority.

- **Phase I Cultural Resource Survey, New Jersey Turnpike Widening, Interchanges 6 to 9, Appleby House Investigation, Chesterfield, Burlington County, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, Phase IB subsurface archaeological survey and building material analysis for former toll house for the Bordentown and Crosswicks Turnpike between 1857 and 1901. For the New Jersey Turnpike Authority.

- **Phase I Archaeological Survey, Fretz Road (SR1008) Bridge Replacement, Lower Salford Township, Montgomery County, Pennsylvania**. Principal Investigator, archaeological survey in advance of the replacement of the 1923 Fretz Road (SR1008) Bridge over Skippack Creek. For the Pennsylvania Department of Transportation, Engineering District 6-0, King of Prussia.

- **Phase IA Cultural Resource Survey, Trenton-Robbinsville Airport Improvements**. Principal Investigator, cultural resource survey in advance of the construction of new hangars and access improvements at the Trenton-Robbinsville Airport. For DY Consultants, Roslyn Heights, New York.

- **Phase I Cultural Resource Survey, Burlington Sod Farm, Springfield Township, Burlington County, New Jersey**. Principal Investigator, cultural resource survey as part of the E.O. 215 process in advance of rezoning and construction of proposed county fairgrounds. Identified and evaluated several early nineteenth-century farmstead locations and identified five loci with historic and/or prehistoric archaeological potential. For the Freeholders of Burlington County.

- **Phase II Archaeological Investigation for Proposed Improvements to the Woodloch Intersection of SR590 and SR0408, Lackawanna Township, Pike County, Pennsylvania**. Principal Investigator/Field Director, implementation of the scope of services for historic architectural and archaeological resources, assessment of impacts, client coordination, and Section 106 compliance. Managed the excavation of more than 40 1x1-meter test units to delineate the boundaries and evaluate the National Register eligibility of multi-component (Middle Archaic to Late Woodland) prehistoric site and ruins of historical mill with associated raceways and residence located in/adjacent to the project right-of-way. For the Pennsylvania Department of Transportation, Engineering District 4-0, Dunmore.

- **Phase I Archaeological Assessment, Alcan Aluminum Corporation Focused Remedial Investigation Project, Oswego County, New York**. Principal Investigator, Phase I archaeological assessment under SEQRA for the Alcan Facility prior to the execution of a project designed to mitigate contaminated soils. Involved historical and cartographic research, including the identification and analysis of past disturbances and/or prior settlement and land use, the assessment of the property for its potential to contain archaeological resources, and archaeological subsurface survey. For Blasland, Bouck and Lee, Inc.

- **Archeological Overview and Assessment for the Edison National Historic Site (EDIS), West Orange, Essex County, New Jersey**. Principal Investigator, management and completion of archeological overview and assessment (AOA) of the three units that form the EDIS: the Laboratory Unit (the experimental facility of Thomas A. Edison from 1887 to 1931); the Glenmont Unit (the residence of Edison from 1886 to 1931); and the Maintenance Area (not historically related to Edison). The AOA provided information on known and potential historic-period archaeological resources, areas within the EDIS boundaries that have potential for pre-contact Native American sites, the relationship between Edison period and non-Edison-related activities that have been documented in vicinity of extant and former structures in each unit, and recommendations for additional research to locate and evaluate known and potential archaeological resources. For this AOA, the EDIS was stratified into areas of high, low, and no archaeological potential to facilitate future investigations and interpretation. Developed detailed matrix for the Laboratory Unit to dovetail with traditional archaeological sensitivity models to contribute to development of the unit's historic archaeological predictive model, including information on the major experiments conducted at the West Orange Laboratory, archaeological features and remains that may be associated with each experiment, and suggested methods for the identification of those chemicals/materials/features associated with experiments. The AOA presented general and specific recommendations for the management and protection of archaeological resources to be considered in the development of a formal Cultural Resources Management Plan for the EDIS. For the National Park Service, Northeast Region.

- **Phase I Archaeological Investigation, Stream Restoration and Related Work in the Sweet Brook Bluebelt, Annadale, Staten Island, New York**. Principal Investigator, archaeological investigations in advance of restoration and alteration of two sites along the Sweet Brook Bluebelt and associated wetlands owned by the New York City Department of Environment Protection and regulated by the New York State Department of Environmental Conservation. Involved assessment of past ground disturbance and potential for historic archaeological resources in the project area, and archaeological subsurface survey. For the JRC Construction Corporation.

- **Phase IA Archaeological Assessment, Restoration of the Rutherford/East Rutherford Drainage Ditch System in the Boroughs of Rutherford and East Rutherford, Bergen County, New Jersey**. Principal Investigator, archaeological resource assessment to support a United States Army Corps of Engineers Section 404/Section 10 permit application in advance of restoration of 35 acres of exiting drainage ditch system in the New Jersey Meadowlands. For the New Jersey Meadowlands Commission.

- **Phase I Cultural Resource Survey for Proposed Sentinel Williams/TRANSCO Pipeline Expansion Project: Mountain View and Turnpike Loops and five Meter Station Modification Locations, Bergen, Burlington, Mercer, Middlesex, Somerset, and Union Counties, New Jersey**. As part of the FERC permitting process and Section 106 compliance, Principal Investigator/Field Director, cultural resource survey of 3.78-mile proposed Mountain View Loop corridor, 1.3-mile proposed Turnpike Loop, and five Meter Station Modification Locations. Identified one Middle to Late Archaic period prehistoric site. For Williams/Transco, Houston, Texas.

- **Phase IB Archaeological Survey, Jamaica Avenue School, Block 4102, Lots 19, 27, 33, 35 & 36**, **Cypress Hills, Brooklyn, Kings County, New York**. Principal Investigator/Field Director, archaeological trenching at proposed New York City school location. Excavations identified, evaluated, and mitigated extensive backyard deposits dating to the late nineteenth through early twentieth centuries. For the New York City School Construction Authority.

- **Archaeological Investigation of the Frazee House, Scotch Plains, Union County, New Jersey**. As part of a holistic approach to the preservation of the eighteenth-century Frazee House, Principal Investigator/Field Director, removal of 0.5 to 2.0 feet of sediment in the house's basement. The investigations revealed cobblestone and brick paved sections of the basement and a drainage trough that may indicate that the basement was used for food storage. Archaeological survey of the grounds indicated that although much of the rear yard had been disturbed, the front yard remained intact and contained a buried ground surface with eighteenth- and early nineteenth-century artifacts. For the Fanwood/Scotch Plains Rotary/the Aunt Betty Frazee Project.

- **Phase IB Archaeological Survey for the Proposed Eagle Academy for Young Men, Bronx, New York**. Principal Investigator, Phase IB archaeological survey of mid-nineteenth- to early twentieth-century domestic lot in the Bronx. Excavations identified and evaluated six archaeological features, including a buried historic ground surface and a circa 1930 bottle dump, in the lot that represent the late nineteenth- through twentieth-century occupation, although extensive disturbance had severely impacted the integrity of these archaeological deposits. For the New York City School Construction Authority.

- **Phase IA Archaeological Assessment, Crab Island Wetland Mitigation Bank, Sayreville, Middlesex County, New Jersey**. Principal Investigator for an archaeological resource assessment to support a United States Army Corps of Engineers Section 404/Section 10 permit

application in advance of the restoration of 41 acres of wetland on the south bank of the Raritan River and on Crab Island in Sayreville, New Jersey. For EarthMarkNJMitigation LLC., Concord, North Carolina.

- **Phase IB Archaeological Survey, World Trade Center PATH Terminal, New York City**. Principal Investigator, archaeological investigations in advance of construction of the new WTC PATH Terminal. Coordinated excavation of 170-foot trench to 15 feet below the surface and within OSHA safety regulations. Identified, evaluated for National Register eligibility, and mitigated late eighteenth- and early nineteenth-century backyard residential archaeological features. For the Port Authority of New York and New Jersey.

- **Phase I Archaeological Survey for Proposed Improvements to the New Jersey Turnpike Interchanges 6 to 8A, Burlington, Middlesex, and Mercer Counties, New Jersey**. As part of the E.O. 215 process, Principal Investigator/Field Director, cultural resource survey of 25 miles of the turnpike. For the New Jersey Turnpike Authority.

- **Phase IA Archaeological Assessment, Rockaway Boulevard Site, Rockaway Boulevard & Nassau Expressway, Block 14260, Lot 1, Jamaica, Queens County, New York**. Principal Investigator/Field Director, archaeological resource assessment of proposed New York City Transit bus parking facility next to JFK International Airport. For New York City Transit.

- **Phase I/II Archaeological Survey/ for Proposed Improvements to SR 706, Susquehanna County, Pennsylvania**. Principal Investigator/Field Director, geomorphological assessment and archaeological survey of five locations along the SR0706 corridor. Identified two prehistoric archaeological sites and one nineteenth-century domestic archaeological site. For Pennsylvania Department of Transportation, Engineering District 4-0.

- **Phase I Archaeological Screening for Proposed Mulhockaway Creek Restoration, Hoffman Park, Union Township, Hunterdon County, New Jersey**. Principal Investigator/Field Director, cultural resource survey as part of the Hoffman Park Stream Restoration Project. The project was the first to be conducted under the New Jersey Highlands Water Protection and Planning Act and received the American Council of Engineering Companies of New Jersey (ACEC) Distinguished Award in March 2007. For Stony Brook-Millstone Watershed Association and the New Jersey Water Supply Authority.

- **Phase I Archaeological Survey for Proposed Bridge Replacement, Forkston, Wyoming County, Pennsylvania**. Principal Investigator/Field Director, overseeing the geomorphological investigation and archaeological survey of the Mehoopany Creek floodplain surrounding the proposed bridge replacement on SR0087. For Pennsylvania Department of Transportation, Engineering District 4-0, PennDOT District 4, Dunmore, Pennsylvania.

- **Phase I Cultural Resource Assessment, Trenton-Morrisville Toll Bridge Rehabilitation and One Auxiliary Northbound Lane, Morrisville, Pennsylvania, and Trenton, New Jersey**. Principal Investigator/Field Director, cultural resource assessment of improvements to interchanges and the Trenton-Morrisville Toll Bridge over the Delaware River. Involved archaeological assessment of proposed ground disturbance and historic architectural assessment of proposed interchange improvements to local structures, including the National Historic Landmark Delaware Division of the Pennsylvania Canal. For the Delaware River Joint Toll Bridge Commission.

- **First Presbyterian Church of Newark, Essex County, New Jersey Disinterment**. Principal Investigator/Field Director. Assisted with the disinterment of human remains from the

nineteenth-century First Presbyterian Church Cemetery in downtown Newark. Berger's archaeological investigations involved the careful use of heavy machinery and conscientious hand excavation of individual grave shafts. Photo-documentation and standardized burial forms were completed for each shaft/burial. After 21 days of intensive field efforts, Berger's team of approximately 30 archaeologists and field technicians identified 581 grave shafts, one crypt, and exhumed the remains of 510 individuals. For Langan Engineering and Environmental Services, Elmwood Park, New Jersey.

- **Phase I Archaeological Survey for Proposed Improvements to the Woodloch Intersection of SR590 and SR0408, Lackawanna Township, Pike County, Pennsylvania**. Principal Investigator/Field Director, implementation of the scope of services for historic architectural and archaeological resources, assessment of impacts, client coordination, and Section 106 compliance. Preliminary survey results indicated that both ruins of a historic mill and prehistoric deposits were located in or immediately adjacent to the project right-of-way. For the Pennsylvania Department of Transportation, Engineering District 4-0, Dunmore, Pennsylvania.

- **Phase IA Cultural Resource Assessment for the Proposed Belmar 2 Verizon Wireless Communication Facility, Borough of Belmar, Monmouth County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey

- **Phase I Archaeological Survey for the Proposed Albany Verizon Wireless Communications Facility, City of Albany, Albany County, New York**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Costich Engineering.

- **Phase IA Archaeological Assessment, Remedial Options Pilot Study, Grasse River Study Area, Alcoa-Massena, Massena, New York**. Principal Investigator, Phase IA archaeological assessment of early twentieth-century Alcoa fabricating, ingot, and extrusion and smelting plant under the jurisdiction of the U.S. EPA as a Superfund Site. Involved research and analysis of past disturbances and potential for historic archaeological resources associated with the industrial use of the project area. For Blasland, Bouck and Lee, Inc.

- **Phase IA Archaeological and Historical Survey for the Proposed Kearny 6 Verizon Wireless Communication Facility, Town of Harrison, Hudson County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey

- **Phase IA Archaeological and Historical Survey for the Proposed Old Bridge 3 Verizon Wireless Communication Facility, Old Bridge Township, Middlesex County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase IA Cultural Resource Assessment, East Orange Demonstration Project, Pre-K to 12th Grade School for the Performing Arts, City of East Orange, Essex County, New Jersey**. Principal Investigator, cultural resource assessment of a proposed new school to be constructed at the present location of the circa 1910 East Orange High School. Determined the project's potential to affect potential archaeological resources and coordinated the determination of the East Orange High School's National Register eligibility and the recordation of the school prior to demolition. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment for the Proposed Harlem Hospital Rehabilitation, New York, New York**. Principal Investigator. For the Dormitory Authority of the State of New York and the Harlem Hospital Corporation.

- **Phase IA Cultural Resource Assessment for the Proposed Fort Lee 6 Verizon Wireless Communication Facility, Fort Lee, Bergen County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For IVI International, White Plains, New York.

- **Phase I Archaeological Survey for the Proposed Wall 3/Hinks Turkey Farm Verizon Wireless Communications Facility, Wall Township, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase I Archaeological and Historical Survey for the Proposed Matawan 2 Verizon Wireless Communication Facility, Town of Matawan, Monmouth County, New Jersey**. Principal Investigator, archaeological survey of a proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase I Archaeological Survey for the Proposed Pound Ridge Vista Nextel Wireless Communication Facility, Town of Lewisboro, Westchester County, New York**. Principal Investigator, archaeological survey of proposed Nextel cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Union County Courthouse Time Capsule Relocation for the 2005 Centennial Celebration. Elizabeth, Union County, New Jersey**. Principal Investigator. Assisted the Union County Board of Trustees with the relocation of the Union County Courthouse time capsule in advance of the 2005 centennial celebration. For the Union County Board of Trustees.

- **Phase IA Cultural Resource Assessment for the Proposed Vent Plant Rehabilitation, West 30th Street and 6th Avenue, New York, New York**. Principal Investigator, archaeological resource assessment of proposed vent plant installation. Employed GIS technology to georeference historical maps to trace potential archaeological resources in the project area. For New York City Transit.

- **Phase IA Cultural Resource Assessment for the Proposed Wall 3/Hinks Turkey Farm Verizon Wireless Communications Facility, Wall Township, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase IA Cultural Resource Assessment, Proposed Oakwood Avenue Elementary School Addition, City of Orange, Essex County, New Jersey**. As part of the E.O. 215 process, Principal Investigator, cultural resource assessment of an addition to the existing circa 1888 Oakwood Avenue School. For New Jersey School Construction Corporation.

- **Phase I Archaeological Investigations for the Proposed Fence Enclosure of the First Presbyterian Church Grounds, Elizabeth, Union County, New Jersey**. Principal Investigator. For the First Presbyterian Church of Elizabeth, Elizabeth, New Jersey.

- **Phase I Archaeological Investigations for the Proposed Nextel Wireless Communication Facility, Colesville, Town of Wantage, Sussex County, New Jersey**. Principal Investigator,

archaeological survey of proposed Nextel cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase I Archaeological Investigations for the Proposed Verizon Wireless Communication Facility, Pellettown, Town of Wantage, Sussex County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Herbst-Musciano Architects/Planners, Cedar Knolls, New Jersey.

- **Phase III Archaeological Data Recovery Investigations at the Hanover 5 Proposed Telecommunication Facility, Town of Whippany, Morris County, New Jersey**. Principal Investigator, archaeological data recovery of proposed Verizon wireless cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase IB Archaeological Survey for the Proposed Omnipoint Wireless Communication Facility, Town of Pound Ridge, Westchester County, New York**. Principal Investigator, archaeological survey of proposed cell tower installation. For IVI International, White Plains, New York.

- **Phase IA Cultural Resource Assessment, Proposed Peshine Avenue School, Elementary School Replacement, City of Newark, Essex County, New Jersey**. Principal Investigator, cultural resource assessment of proposed new school to be constructed at the present location of the circa 1911 Peshine Avenue Elementary School. Determined the project's potential to affect potential archaeological resources through the use of GIS technology to geo-reference historical maps to trace potential archaeological resources in the project area. For New Jersey School Construction Corporation.

- **Phase IB Archaeological Survey for the Proposed Omnipoint Wireless Communication Facility 195 Greenbrook Road, North Plainfield, Somerset County, New Jersey (Cell Tower Location NJ-06-552C)**. Principal Investigator, archaeological survey of proposed cell tower installation. For IVI International, White Plains, New York.

- **Phase IB Archaeological Survey for the Proposed Omnipoint Wireless Communication Facility, Morristown, Morris County, New Jersey (Cell Tower Location NJ7237b)**. Principal Investigator, archaeological survey of cell tower installation. For IVI International, White Plains, New York.

- **Phase I Cultural Resource Investigation of the Garafalo Property, Town of Bangor, Washington Township, Northampton County, Pennsylvania**. Principal Investigator, archaeological survey of proposed commercial project. For McFall, Layman and Jordan, P.C.

- **Phase IA Cultural Resource Assessment, Proposed Burnet-Warren Elementary School Replacement, City of Newark, Essex County, New Jersey**. As part of the E.O. 215 process, Principal Investigator for cultural resource assessment of proposed new elementary school to be constructed within the limits of the James Street Commons Historic District, a National Register-listed historic district. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment of the Proposed Andover 2 Wireless Telecommunications Facility, State Route 206, Andover Borough, Sussex County, New Jersey**. Principal Investigator, archaeological survey of proposed cell tower installation. For Innovative Engineering, Toms River, New Jersey.

- **Phase I Archaeological Survey of the Proposed Rye Wireless Telecommunications Facility, 615 Milton Road, Rye, Westchester County, New York**. Principal Investigator, archaeological survey of proposed cell tower installation. For IVI International, White Plains, New York.

- **Cultural Resource Eligibility/Effects Investigations for the Proposed Tuckahoe Road (C.R. 557) Bridge Over Cape May Branch Rail Line Replacement, Atlantic County, New Jersey**. Principal Investigator/Field Director, Section 106 compliance activities for NJDOT's proposed improvements to bridge. Involved subsurface archaeological investigation and historic architectural survey in the area of potential effect (APE). The architectural survey indicated that the Tuckahoe Road Bridge had previously been determined not eligible for the National Register of Historic Places. The Cape May Rail Line, also in the APE, was determined to be potentially eligible for inclusion in the National Register as a historic district owing to its role in the development of New Jersey's rail transportation system and in the growth of the state's seashore tourist resort communities. Berger concluded that the proposed bridge replacement would not have an adverse effect on the Cape May Branch Rail Line.

PREVIOUS PROFESSIONAL EXPERIENCE

Greenhouse Consultants Inc., New York, New York. Principal Investigator/Historian/Field Director. Composed technical reports and proposals, developed budgets and marketing strategies, conducted client and regulatory agency consultation. Selected projects are listed below.

- **Phase IB Archaeological Testing of the Proposed Silver Lake Subdivision in the Town of Clinton, Dutchess County, New York**. Principal Investigator. For the Chazen Companies.

- **Phase IA/IB Archaeological Investigations of a Classified Site in the Town of Owego, Tioga County, New York**. Principal Investigator and Historian. For the Chazen Companies.

- **Phase IA/IB/II Archaeological Investigations of the Port Jervis Educational Complex, Port Jervis, Orange County, New York**. Principal Investigator and Historian. For McGoey, Hauser and Edsall PC.

- **Phase IA/IB Archaeological Investigations of the Jockey Hollow Girl Scout Camp, Morristown, New Jersey**. Co-Principal Investigator. For Paulus, Sokolowski and Sartor Engineering, PC.

- **Phase IA/IB Archaeological Investigations of the New York State Route 92 Sidewalk Expansion, Village of Manlius, Orange County, New York**. Principal Investigator and Historian. For Barton and Loguidice, PC.

- **Phase IA Archaeological Sensitivity Investigation, Andros Hills Subdivision, Long Island, New York**. Principal Investigator and Historian. For Bourke, Flanagan, & Asato, PC.

- **Phase IA/IB Archaeological Sensitivity Investigation and Archaeological Survey, Brookside Loop Development, Staten Island, New York**. Principal Investigator and Historian. For FSK Construction Corp.

- **Phase IA Archaeological Sensitivity Investigation, West Street Rezoning, Tribeca North, New York, New York**. Principal Investigator and Historian. For Parsons Brinckerhoff, New York, New York.

- **Southern Research, Columbus, Georgia**. Principal Investigator/Historian/Field Director. Composed technical reports, developed excavation plans, supervised field technicians, and conducted client and regulatory agency consultation.

- **Phase III Archaeological Investigations in the Backyard Area of the Old Governor's Mansion, Milledgeville, Georgia**. Principal Investigator and Historian. For Lord, Aeck, and Sargent and the Old Governor's Mansion.

- **Phase II Archaeological Survey of the Augusta Canal Headgates Area, Columbia County, Georgia**. Principal Investigator and Historian. For the Augusta Canal Authority.

- **Phase III Archaeological Data Recovery at the Site of the New Jacksonville Public Library**. **Jacksonville, Florida**. Principal Investigator and Co-Historian. For Ellis and Associates and the City of Jacksonville.

- **Phase II Archaeological Testing of the 21st Century Chattanooga Waterfront Project Area South of the Riverfront Parkway, Hamilton County, Tennessee**. Principal Investigator and Historian. For Hargreaves Associates on behalf of the River City Company.

- **Archaeological Investigations in the Jekyll Island Club Hotel Parking Lot, Jekyll Island, Georgia**. Principal Investigator and Historian. For the Jaeger Company on behalf of the Jekyll Island Authority.

- **Archaeology in Annapolis Laboratory, University of Maryland, College Park, Maryland**. Laboratory Director. Composed technical reports, supervised laboratory technicians, and managed the artifact collections from 20 years of the Archaeology in Annapolis Project's excavations.

- **University of Maryland, College Park, Maryland**. Field Director. Developed excavation plans, supervised field technicians, and conducted client and regulatory agency consultation.

- **Parsons Brinkerhoff, Rockville, Maryland**. Archaeological Field Technician. Native American Woodland period camp site.

- **URS Greiner Woodward and Clyde, Florence, New Jersey**. Archaeological Field Technician. Various prehistoric and historic archaeological projects.

- **Richard Grubb and Associates, Cranbury, New Jersey**. Archaeological Field Technician. Various prehistoric and historic archaeological projects.

- **Progamme for Belize Archaeology Conservation Area, Orange Walk District, Belize**. Research Assistant/Excavator. Chawak But'o'ob (RB47) Post-Classic Maya domestic center.

- **Cultural Resource Consulting Group (CRCG), Highland Park, New Jersey**. Archaeological Field Technician. Various prehistoric and historic archaeological projects.

ACADEMIC POSITIONS

Graduate Teaching Associate, Department of Anthropology, University of Maryland, College Park, Maryland. Co-Instructor: Anthropology 496/696, University of Maryland Field School in Urban Archaeology, 2001 and 2002. Co-Instructor: Anthropology 240, Introduction to Archaeology, 2000 and 2001.

Teaching Associate, Department of Anthropology, Monmouth University, West Long Branch, New Jersey. Co-Instructor: Anthropology 315, Field Research in Archaeology. 2001.

Teaching Associate, Department of Anthropology, Montclair State University, Upper Montclair, New Jersey. Co-Instructor: Anthropology 470, Archaeological Field Methods. 1998 and 1999.

University of Indianapolis, Indianapolis, Indiana. Excavator/Field School Student. Bronze Age Temple Complex in Dali (Idallion), Cyprus.

University of Liege, Liege, Belgium. Excavator. Eleventh- to eighteenth-century abbey complex in Stavelot, Belgium.

PUBLIC ARCHAEOLOGY/EDUCATIONAL PROJECTS

- Public Interpreter/Designer, Public Archaeology Program. Archaeology in Annapolis/UMD Banneker-Douglass Museum, Phase III. Annapolis, Maryland. July-August 2001.
- Public Interpreter/Designer, Public Archaeology Demonstration: Maryland Day Activity, University of Maryland College Park, Maryland. April 2001.
- Weekend Public Educator/Volunteer: South Street Seaport Museum, New York. April-July 2000.
- Public Interpreter, Public Archaeology Demonstration: Lenne Lenape Cultural Heritage Festival Sandy Hook, New Jersey. November 1997.
- Artifact Display: Dismal Swamp Lithic Artifacts CRCG Displayed in the Lobby of New Jersey Division of Travel and Tourism, Trenton. Native American Late Archaic Lithic Artifacts. June 1997.
- Public Interpreter, Public Archaeology Demonstration: Oxford Furnace, Warren, New Jersey. Warren County Heritage Festival, 19th Century Industrial (Iron Works) Complex. May 1996.

PRESENTATIONS

- One Ounce of Fact: Consumer Trends and Ethnicity in 19th-Century Jacksonville, Florida. Presented at the 60th Annual Meeting of the Southeastern Archaeological Conference in Charlotte, North Carolina. November 2003.
- Archaeology: An Introduction to Our Past, Present, and Future. Presented to the 8th Grade Class of Sarah Wade School, Jacksonville, Florida. December 2002.
- Critical Archaeology in Public: Results from the 2001 Banneker-Douglass Museum/Courthouse Public Archaeology Program. Presented at the 11th Annual Graduate Student Colloquium, University of Maryland, College Park. April 2002.
- African American Archaeology in Public: Public Archaeology at the Banneker Douglass Museum Site. Presented at the 20th annual Archaeology in Annapolis Archaeological Symposium. Annapolis, Maryland. November 2001.
- Archaeology: An Introduction to Our Past, Present, and Future. Presented to the 9th Grade Ancient History Class, McClean High School, Washington D.C. October 2001.

- Just Across the River: The University of Maryland's 2001 Archaeological Investigation of Eastport, Maryland. Presented to the Historic Annapolis Foundation. September 2001.

- Archaeology: The Ultimate 3D Puzzle. Presented to the 6th Grade Class of Ms. Nyhus, Cherokee Grade School, Adelphi, Maryland. May 2001.

- Late Classical Period (AD 600-900) Households in the Eastern Maya Lowlands: Recent Survey Data from the Three Rivers Region of Northwestern Belize, Central America. Co-authored with Stanley L. Walling Ph.D. et al. Presented at the Student Research Conference of the Sigma Xi Honor Society, May 1, 1999.

- Forsaken History: The Role of the Spanish Mission in the Colonization of the American Southeast. Defense of Senior Honors Thesis, Monmouth University, New Jersey. May 1998.

DEBORAH BALDWIN VAN STEEN
The Louis Berger Group, Inc.
Architectural Historian

EDUCATION

- M.S., Historic Preservation, Concentration in History, Columbia University, 2003.
- B.A. magna cum laude, Liberal Studies: History and Design, Minor in Business, Pace University, 1998.
- Certificate, Interior Design, Pace University, 1998.

PROFESSIONAL TRAINING

- Best Practices Workshop. New Jersey Historic Preservation Office, October 2006.
- Preserving the Recent Past. Drew University, Fall 2007.
- The Connecticut Farm Landscape: Open Space and Historic Buildings. Symposium of the Connecticut Trust Historic Preservation and the Litchfield Historical Society, November 2007.
- A Survey of Vernacular Architecture of New Jersey. Drew University, Spring 2008.
- Introduction to the History of American Interiors: 1830-1950. Drew University, Fall 2009.

PROFESSIONAL AFFILIATIONS

- National Trust for Historic Preservation, Forum
- Society of Architectural Historians
- Vernacular Architecture Forum
- Preservation Alumni, Columbia University
- Preservation League of New York State
- Connecticut Trust for Historic Preservation
- Preservation New Jersey
- Preservation Pennsylvania
- Historic Review Commission, Village of Ossining, New York 2000-Present.
- Ossining Historical Society Museum, 1997-Present. President, 2003-2006; Vice President 2006-Present; Board of Trustees, 1997-Present.
- Village Historian, Village of Ossining, New York 2010-Present.

AWARDS

- Columbia University Historic Preservation Program, Outstanding Thesis Award, for *The Architecture of Calvin Pollard (1797-1850)*, 2003.
- Columbia University Preservation Alumni, Inc., Cleo and James Marston Fitch Thesis Grant, 2002.

PROFESSIONAL EXPERIENCE

Ms. Van Steen joined The Louis Berger Group, Inc., as an Architectural Historian in 2007. She has 10 years of professional experience providing an array of cultural resource management services to transportation agencies and municipal governments. She has provided historic preservation services for federal and state-funded transportation projects in New York and New Jersey in compliance with Section 106 of the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Section 14.09 of the New York State Historic Preservation Act of 1980, and New York's State Environmental Quality Review Act. These undertakings have ranged from small rehabilitation planning projects to large corridor studies and have required the documentation and evaluation of a wide variety of historic resources, including college campus, transportation, residential, agricultural, urban, and rural properties. She has managed architectural and cultural resource identification surveys and historical research, conducted determination of eligibility and project effects and impacts analyses, and prepared project documentation and HABS/HAER narrative reports. In addition, while serving on the Ossining Historical Society Museum's Board of Trustees, Ms. Van Steen wrote and administered several historic preservation grants for the conservation treatment of historic objects and buildings and a historic landscape report. She has also prepared educational materials, brochures, and pamphlets. Ms. Van Steen's major projects included those listed below.

- **Cultural Resource Services, Susquehanna to Roseland 500 kV Transmission Line, Luzerne, Lackawanna, Wayne, Pike, Monroe County, Pennsylvania and Warren, Sussex, Morris and Essex County, New Jersey**. Architectural Historian responsible for the implementation of the scope of services for the survey and evaluation of State and National Register eligibility of historic architectural resources adjacent to the 147-mile transmission line right-of-way which included areas of post World War II residential development, twentieth-century seasonal/recreational housing, farmsteads, state forest lands, and the National Park Service Delaware Water Gap National Recreation Area. For PPL Electric Utilities Corporation in Pennsylvania and PSE&G in New Jersey.

- **Cultural Resource Services, Louis Armstrong House Museum National Historic Landmark, Corona, Queens County, New York**. Evaluation of National Register eligibility of properties adjacent to project area and potential impacts to the Louis Armstrong House Museum, a National Historic Landmark, for proposed construction of new Visitors Center. For Dormitory Authority of the State of New York.

- **Cultural Resource Services, Goethals Bridge Replacement Project, Elizabeth, Union County, New Jersey, and Staten Island, Richmond County, New York**. Section 106 and NEPA compliance involving evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to bridge, assessment of adverse effects, and development of stipulations for Memorandum of Agreement. For United States Coast Guard and the Port Authority of New York and New Jersey.

- **Cultural Resource Services, Second Avenue Subway, Phase 1, New York, New York**. Identification and evaluation of National Register eligibility of historic architectural resources adjacent to the proposed station locations for Second Avenue Subway, from East 63rd to East 99th streets. For New York City Transit.

- **Church Cemetery, Addison Township, DuPage County, Illinois**. Forensic Genealogist. Compiled extensive descendant-based genealogies to locate unknown heirs and assisted in determination of next of kin for approximately 800 individuals interred at German church cemetery in Illinois. Applied methods consistent with professional guidelines, including the Genealogical Proof Standard, and prepared supporting documentation on a variety of litigation issues. Exhaustive research included analysis and interpretation of original German church baptism, marriage, and death records dating to the mid-nineteenth century to present day, census records, obituaries, newspaper articles, state death and marriage records, social security death indexes, cross-referenced major genealogical repositories, and reviewed private collections.

- **Cultural Resource Services, Garden State Parkway, Interchanges 9, 10, and 11, Middle Township, Cape May County, New Jersey**. Evaluation of State and National Register eligibility of and potential impacts for historic architectural resources adjacent to the Parkway and related cross streets. For New Jersey Turnpike Authority.

- **Cultural Resource Services, Broadway Triangle Rezoning Project, Williamsburg, Brooklyn, New York**. Survey of historic properties, evaluation of National Register and NYC Landmarks eligibility, and potential impacts for historic architectural resources adjacent to and/or in the proposed rezoning area. For New York City Department of Planning.

- **Cultural Resource Services, Gowanus Canal Corridor Rezoning Project, Gowanus, Brooklyn, New York**. Survey of historic properties, evaluation of National Register and NYC

Landmarks eligibility of and potential impacts for historic architectural resources adjacent to and/or in the proposed rezoning area. For New York City Department of Planning.

- **Cultural Resource Services, Dutch Kills Rezoning Project, Long Island City, Queens, New York**. Survey of historic properties, evaluation of National Register and NYC Landmarks eligibility of and potential impacts for historic architectural resources adjacent to and/or in the proposed rezoning area. For New York City Department of Planning.

- **Brooklyn College Performing Arts Center, Brooklyn, New York**. Evaluation of National Register eligibility of and completion of NYSOPRHP Historic Resource Inventory Form for Gershwin Hall and Whitman Theater. For the Dormitory Authority of the State of New York.

- **Cultural Resource Services, Lehman College New Science Facility, Environmental Review, Bronx, New York**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to proposed science building with emphasis on survey and evaluation of the (twentieth-century) college campus buildings. For the Dormitory Authority of the State of New York.

- **Cultural Resource Services, Fordham University New Residence Halls, Fordham University, Rose Hill Campus, Bronx, New York**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to and/or within the proposed project area. For the Dormitory Authority of the State of New York.

- **Cultural Resource Services, NJ Turnpike Widening Interchange 6-8A, Phase 1, Burlington, Mercer, and Middlesex Counties, New Jersey**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources and historic corridors adjacent to and/or crossing the Turnpike between Exits 6 and 8A. For the New Jersey Turnpike Authority.

- **Cultural Resource Eligibility/Effect Investigation, Two Bridges Road Bridge and West Belt Highway Extension, Townships of Wayne and Fairfield, Borough of Lincoln Park, Passaic, Essex, and Morris Counties, New Jersey**. Evaluation of National Register eligibility of historic architectural resources near the historic bridge over the Pompton River and related roadway improvements. For North Jersey Transportation and Planning Authority and New Jersey Department of Transportation.

- **Cultural Resource Constraints Technical Memo, Dinky Right-of-Way Route 1 BRT Project, Princeton Township, Princeton Borough, and West Windsor Township, Mercer County, New Jersey**. Provided summary of the potential cultural resource constraints identified in the Dinky right-of-way project area of the proposed Route 1 Bus Rapid Transit Project. Conducted field reconnaissance of historic architectural resources adjacent to the proposed BRT right-of-way. For New Jersey Transit.

- **Cultural Resource Services, Central Avenue Bridge Replacement, Phase 1, Rye, New York**. Evaluation of National Register eligibility of historic architectural resources adjacent to historic bridge over Blind Brook. For City of Rye.

- **Phase II Archaeological Investigation for Proposed Improvements to the Woodloch Intersection of SR590 and SR0408, Lackawanna Township, Pike County, Pennsylvania**. Architectural Historian responsible for the implementation of the scope of services for historic architectural resources, assessment of impacts, and evaluation of National Register eligibility of

the historic ruins of former mill with associated raceways, barn foundations, and extant farmhouse located in/adjacent to proposed project right-of-way. Produced Historic Resource Survey forms for Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation. For Pennsylvania Department of Transportation, Engineering District 4-0.

- **Cultural Resource Services for Proposed Replacement Fretz Road Bridge, Lower Salford Township, Montgomery County, Pennsylvania**. Produced Historic Resource Survey Forms for Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation. For Pennsylvania Department of Transportation, Engineering District 6-0.

- **Historic Resource Survey/Eligibility and Effect for Proposed Improvements to the SR171, Jail Hill, Borough of Lanesboro, Susquehanna County, Pennsylvania**. Architectural Historian responsible for the implementation of the scope of services for historic architectural resources, assessment of impacts, and evaluation of National Register eligibility for historic resources located in/adjacent to proposed project right-of-way. Produced Historic Resource Survey Forms for Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation. For Pennsylvania Department of Transportation, Engineering District 4-0.

- **Cultural Resource Services, Sentinel Pipeline Expansion Project, Cultural Resource Survey, New Jersey**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to the proposed metering station locations and pipeline expansion for pipeline in Bergen, Burlington, Mercer, Middlesex, Somerset, and Union counties. For Transcontinental Gas Pipe Line Corporation.

PAST PROFESSIONAL EXPERIENCE

Architectural Historian, Lynn Drobbin & Associates, Pelham, New York. Managed and conducted historic preservation compliance studies for federal and state-funded rail transportation projects in New York, New Jersey, and Pennsylvania. Prepared historic architectural resource background studies and effects assessments in compliance with federal and state historic preservation regulations. Identified and documented buildings, objects, structures, and districts as part of National and State Register eligibility determinations. Prepared HABS/HAER documentations. Selected projects included are listed below.

- **Northern Branch Corridor Rail Project, New Jersey**. Prepared Draft Environmental Impact Statement (DEIS) historic resource analysis and effects assessment. For New Jersey Transit.

- **Monmouth-Ocean-Middlesex Counties Rail Corridor Study, New Jersey**. Historic resource survey and eligibility analysis and preparation of DEIS chapters for planned restoration of rail service. For New Jersey Transit.

- **East 180th Street Station Rehabilitation, New York, New York**. Impacts analysis for rehabilitation of historic rail station listed in the National Register and adjacent subway station. For the New York City Transit, Metropolitan Transit Authority.

- **Metro-North Railroad Stations Assessment Project, Westchester, Bronx, and Dutchess counties, New York**. Identified and documented historic features of five railroad stations. For Metro-North Railroad, Metropolitan Transit Authority.

- **West Trenton Passenger Line Restoration, Mercer County, New Jersey**. Historic resource survey and eligibility analysis for proposed restoration of rail service. For New Jersey Transit.

- **Poughkeepsie Station Improvement Project, Dutchess County, New York**. Historic resource and effects analysis for Section 106 compliance review of historic rail station listed in the National Register. For Metro-North Railroad, Metropolitan Transit Authority.

- **Park Avenue Bridge Replacement Project, Mount Vernon, New York**. Historic research and documentation for historic bridge replacement and preparation of HAER report. For Metro-North Railroad, Metropolitan Transit Authority.

- **Lower Hack Vertical Lift Bridge Rehabilitation Project, Jersey City, New Jersey**. Effects assessment for rehabilitation of historic concrete and steel lift bridge. For New Jersey Transit.

- **Lackawanna Cutoff Passenger Restoration Project, New Jersey and Pennsylvania**. Field survey and historic resource eligibility analysis for proposed restoration of rail service. For New Jersey Transit.

- **Pelham Station Adaptive Reuse Project, Pelham, New York**. Assessment of project impacts for proposed alterations and improvements to historic railroad station. For Metro-North Railroad, Metropolitan Transit Authority.

Historian and Historic Preservation Consultant, Ossining, New York. Provided research on local properties through local land records, historical maps, newspapers, census records, photographs, early tax records, and genealogical information. Clients included Charles Lockwood, author of *Bricks and Brownstone*, expert and consultant on restoration of historic townhouse facades and interiors.

Teaching Assistant, Columbia University Graduate School of Architecture, Planning and Preservation. Assisted professor teaching "Architectural History Before 1876" graduate class. Planned and organized Lower Hudson Valley architectural field study.

Graduate Intern, Historic Districts Council (HDC), New York, New York. Researched and wrote additional text for new edition of Historic Districts Council's (New York City historic preservation advocacy agency) publication *Creating an Historic* District. Updated Certification of Appropriateness database. Previewed historic district applications prior to submittal for NYC Landmarks Preservation Commission review.

Sing Sing Prison Museum Committee, Ossining, New York. Committee formed as part of a planning initiative and feasibility study for a proposed Sing Sing Prison museum, to be located in the 1825 original cellblock (remains) and the WPA era power plant, both at the historic prison. Initial work included facility planning, marketing surveys, and tourism projections. The project, which is would be located in a fully operational correctional facility, offers a variety of planning, tourism, economic development, and historic preservation challenges.

Program Development Assistant, Ossining Heritage Area Tourism Committee, Ossining, New York. Partnered with Village and Town of Ossining to develop tourism initiative at Sing Sing Prison encompassing the riverfront, the downtown New York State Heritage Area, and historic portions of the downtown as portion of viable economic development plan. Plan proposed establishment of a museum facility at the prison in the original cell block (built 1825-1828) and former power plant.

Economic Development Assistant, The Alliance for Downtown Ossining (ADO), Ossining, New York. Organized and facilitated informational program emphasizing the benefits of historic preservation as a municipal economic revitalization tool. Identified historic preservation components of economic

development plan including historic districts, levels of preservation, sympathetic renovation, and historic building adaptive reuse. Outlined aesthetic and developmental aspects of the Crescent, Ossining's historic downtown area listed on the National Register. Produced educational brochure on Ossining's historic districts and buildings. Represented the ADO as advocate for economic growth, historic preservation, and increased pedestrian presence in the central business district.

PAPERS AND PRESENTATIONS

- "Early Chilmark Park" House & Garden Tour. Organized event, wrote tour booklet, and conducted tours, Ossining, New York, 2004.

- The Architecture of Calvin Pollard (1797-1850). Study of a prolific and little-known New York City architect in practice during the second quarter of the nineteenth century. Historic Preservation Thesis, Columbia University, 2003.

- Historic Homes Tour 2000. Photographed and presented photographic tour of Ossining's historic residences. The presentation included over 20 houses and featured building interiors and exteriors documenting Ossining's architectural styles from pre-Revolutionary era through 1920s Neoclassical revival. Ossining Historical Society and Ossining Public Library, 2000 and 2001.

- Downtown. Program on the historical development, growth and entrepreneurs of downtown Ossining during the nineteenth and early twentieth centuries. Ossining Historical Society, 2000.

- Architectural Treasures. In *Images of America: Ossining Remembered*, edited by Carl Oechsner. Arcadia, Charleston, 1999 (reprinted 2006). Overview of mansions and estates of Ossining in the nineteenth century.

- Ossining, New York: Journey from Urban Renewal to Historic Preservation. Pace University, 1998.

- Historic Destinations & Tourism of the Hudson River Town of Westchester. Pace University, 1998.

- S. Marvin McCord, Ossining Architect. Pace University, 1997.

ZACHARY J. DAVIS
The Louis Berger Group, Inc.
Principal Archaeologist

EDUCATION

- Interdepartmental Doctoral Program in Anthropological Science, State University of New York at Stony Brook, 2000-2005.
- M.A., Anthropology, State University of New York at Stony Brook, 2000.
- M.A., Archaeology, Institute of Archaeology, University of London, 1994.
- B.A., Archaeological Studies, Boston University, 1993.

PROFESSIONAL REGISTRATIONS

- Register of Professional Archaeologists (RPA)

TECHNICAL TRAINING

- 8-hour refresher for Hazardous Waste Operations and Emergency Response, Emilcott Associates, Inc., October 3, 2008.
- Cultural Resources Best Practices Workshop, 7-Hour Training Program, New Jersey Historic Preservation Office, October 27, 2006.
- 40-Hour H&S for Hazardous Waste Operations and Emergency Response meeting the training requirements of 29 CFR 1910.120. Emilcott Associates, Inc., March 15, 2004.
- Trenching and Excavation Safety—OSHA Construction Industry Standards, Subpart P (29 CFR 1926.650-652). Emilcott Associates, Inc., February 19, 2004.
- Introduction to Section 106 Review (Ralston Cox, instructor), February 20-21, 2002.
- Introduction to GPS using the Trimble Pro XR (Mike Popoloski, instructor), March 19, 2001.

PROFESSIONAL AFFILIATIONS

- Society for American Archaeology
- Millburn-Short Hills Historical Society

PROFESSIONAL EXPERIENCE

Mr. Davis's background includes archaeological investigations at prehistoric sites dating to the Paleoindian through the Late Woodland periods and historic sites dating to the seventeenth century through the early twentieth century. As a Principal Archaeologist he is responsible for client interaction, preparation of innovative research designs, and overall technical supervision and implementation of research and field projects. He also prepares technical reports and agreement documents in compliance with Section 106 of the National Historic Preservation Act (1966), Section 4(f) of the Department of Transportation Act of 1966, and state and local regulations for projects in the metropolitan New York City area and the Northeast and Middle Atlantic. In addition, Mr. Davis has extensive experience with lithic material analysis and Geographic Information Systems database development and analysis for cultural resources. Since joining Berger, Mr. Davis's major projects include the following.

- **Cultural Resource Services, Second Avenue Subway, Phase 1, New York, New York**. Oversight and **c**oordination of cultural resource compliance for final design and construction of Phase 1 of the Second Avenue Subway, from East 63rd to East 99th streets. Responsible for drafting the archaeological field testing plans, archaeological monitoring, and implementing archaeological

fieldwork in advance of and during construction. Coordinated historic architectural resource evaluations of properties adjacent to the proposed ancillary structures associated with the new subway station. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Gowanus Canal Corridor Rezoning, Brooklyn, New York**. Project Manager for the proposed rezoning of a 24-block area located along the Gowanus Canal in Brooklyn. Rezoning was designed to implement a mixed-use district to support a wide range of uses, both residential and commercial. Research was conducted on the ownership and occupation history of 16 lots, with the documentary study finding that each of the lots or portions of each had the potential to contain intact archaeological deposits associated with the residential occupancy of the lots and/or the historic construction of the Gowanus Canal bulkhead, part of the National Register-eligible Gowanus Canal Historic District. Of the properties identified and evaluated as part of this study, 12 individual properties were recommended as eligible for listing in the State and National Registers. For the New York City Department of City Planning.

- **Phase I/II Cultural Resource Assessment, Armed Forces Reserve Center and Implementation of BRAC 05 Realignment Actions, Preferred Site & Alternative 2 Site, Gloucester and Winslow Townships, Camden County, New Jersey**. Project Manager for cultural resource investigations associated with the construction of a new AFRC facility in Camden County. Assessment included background and archival research, an architectural survey, a pedestrian reconnaissance, and a systematic subsurface archaeological survey within the proposed areas of potential effects, yielding two previously unidentified archaeological sites, with one determined eligible for listing in the National Register. For the United States Department of the Army, 99th Regional Support Command.

- **Phase I Archaeological Assessment, GSA Leased Office Space, City of Oswego, Oswego County, New York**. Project Manager for an archaeological investigation of a new Social Security Administration building to be constructed in the City of Oswego. Assessment included background and archival research and a pedestrian reconnaissance of the area of potential effect. For the United States General Services Administration.

- **Phase IA Cultural Resource Assessment, Broadway Triangle Redevelopment Project, Williamsburg, Brooklyn, New York**. Project Manager for the proposed rezoning of a nine-block area located in the Williamsburg area of Brooklyn. Rezoning was designed to implement a mixed-use district to support a wide range of uses, both residential and commercial. Research was conducted on the ownership and occupation history of the rezoning area. The project was found to have no effect on archaeological resources. Of the properties identified and evaluated as part of this study, five were recommended as eligible for listing in the State and National Registers. For the New York City Department of Housing Preservation and Development.

- **Phase IA Cultural Resource Assessment, Newark Liberty International Airport, Redevelopment and Modernization of Terminal A, Elizabeth, Union County and Newark, Essex County, New Jersey**. Project Manager for a cultural resource assessment of proposed improvements to Terminal A at Newark Liberty International Airport. Assessment included determination of archaeological resource potential and historic architectural resources within view of the project's area of potential effect. For the Port Authority of New York and New Jersey.

- **Cultural Resource Eligibility/Effects, Improvements to County Route 571, Princeton/Hightstown Road, Princeton Junction, Mercer County, New Jersey**. Project Manager

for completing the eligibility/effects documentation for proposed improvements to County Route 571. Tasks included determination of the project's archaeological resource potential, evaluation of the presence/absence of archaeological resources, and a survey of the historic architectural resources within view of the project's area of potential effect. For the Delaware Valley Regional Planning Commission.

- **Phase IA Cultural Resource Assessment, Fordham University New Residence Halls, Fordham University Rose Hill Campus, Bronx, New York**. Project Manager for a cultural resource assessment of new residence halls to be located on the southwest portion of the Fordham University campus in the Bronx. For the Dormitory Authority of the State of New York on behalf of Fordham University.

- **Archaeological Documentation, Hudson River Bulkhead, World Trade Center PATH Terminal, New York City**. Project Manager for the documentation of the late nineteenth-century Hudson River Bulkhead located underneath the West Side Highway and within the footprint of the proposed underground pedestrian connector between the new WTC PATH station and the World Financial Center. Tasks included monitoring construction activities and documenting the extent, nature, and design of the Hudson River Bulkhead within the project area. For the Port Authority of New York and New Jersey.

- **Phase IA Archaeological Assessment, Proposed Vent Plants, West 53rd and 55th Streets and Eighth Avenue, New York, New York**. Project Manager for an archaeological resource assessment of two proposed vent plant installations, located in midtown Manhattan. Employed GIS technology to georeference historic maps to trace potential historic archaeological resources within the project area and utilized historic elevation survey data to determine extent of disturbance from construction of Eighth Avenue in the early nineteenth century. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Dutch Kills Rezoning, Queens, New York**. Project Manager for the proposed rezoning of a 40-block area adjacent to the Sunnyside Yards and north of Queens Plaza and Long Island City. Rezoning was designed to implement mixed-use and contextual zoning districts to support the wide range of uses found in Dutch Kills. Research was conducted on the ownership and occupation history of the five lots, with the documentary study finding that each of the five lots or portions of each had the potential for intact archaeological deposits. Of the properties identified and evaluated as part of this study, 10 individual properties and one historic district were recommended as eligible for listing in the State and National Registers. Three of these properties were also recommended as New York City Landmark-eligible. For the New York City Department of City Planning.

- **Phase IA/IB Cultural Resource Assessment, Beacon Institute for Rivers and Estuaries, Beacon, New York**. Project Manager for Phase IA archaeological assessment and limited Phase IB archaeological field survey of the proposed location for the Center for Advanced Environmental Technology, positioned on the remnants of a nineteenth- and twentieth-century historic brick work. Study involved historical and cartographic research, identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For the Dormitory Authority of the State of New York and the New York State Office of Parks, Recreation and Historic Preservation on behalf of the Beacon Institute for Rivers and Estuaries.

- **Phase IA Cultural Resource Assessment, Proposed New Primary/Intermediate School at PS/IS 48, William Wordsworth School, Queens, New York**. Project Manager for the cultural resource assessment of a new primary/intermediary school adjacent to a historic school building. For the New York City School Construction Authority.

- **Cultural Resource Constraints Technical Memo, Dinky Right-of-Way Route 1 BRT Project, Princeton Township, Princeton Borough, and West Windsor Township, Mercer County, New Jersey**. Project manager for a study to identify potential cultural resource constraints within the Dinky right-of-way project area of the proposed Route 1 Bus Rapid Transit Project, between Princeton University and Princeton Junction. For New Jersey Transit.

- **Phase IA Cultural Resource Assessment, Replacement of the Central Avenue Bridge over Blind Brook, Rye, New York**. Project manager for cultural resource assessment of project area, including background research, on-site evaluation, limited field testing and historic architectural survey and evaluation of the bridge and surrounding area. For the City of Rye, New York.

- **Phase IA/IB Archaeological Investigation, Southern Water Pollution Control Facility Expansion Project, Stafford Township, New Jersey**. Project manager for an archaeological assessment and subsurface survey conducted for compliance with the environmental approvals required for a loan application submitted to the New Jersey Department of Environmental Protection Environmental Infrastructure Trust. This study involved historical and contextual background research, archaeological site file and historic property searches at the New Jersey State Museum and the New Jersey Historic Preservation Office, as well as a pedestrian reconnaissance and a subsurface survey. For the Ocean County Utilities Authority.

- **Cultural Resources Eligibility/Effects, Garden State Parkway, Interchange 10 Improvements, Cape May Court House, New Jersey**. Project manager for cultural resource services associated with the environmental compliance to design three new interchanges targeted at eliminating signalized intersections on the National Register eligible Garden State Parkway in Cape May County. This study involved background research, field efforts to identify the presence/absence of archaeological resources, recommendation of five previously unidentified archaeological sites as eligible for listing in the National Register and survey of historic architectural resources within the view of the proposed project. For the New Jersey Turnpike Authority.

- **Phase IA Cultural Resource Assessment, Lehman College New Science Facility Project, Lehman College, Bronx, New York**. Project Manager for the cultural resource assessment conducted for the proposed construction of a new science facility at the Lehman College Campus in Bronx, New York. For the Dormitory Authority of the State of New York.

- **Phase IA Cultural Resource Assessment, Proposed Oak Point Detention Facility, Block 2604, Lot 174, Bronx, New York**. Project Manager for Phase IA archaeological assessment of a late nineteenth- to early twentieth-century rail yard, reviewed under CEQR. This study involved historic and cartographic research, the identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For the New York City Department of Corrections.

- **Phase I Archaeological Investigation, Stream Restoration and Related Work in the Sweet Brook Bluebelt, Annadale, Staten Island, New York**. Project Manager for archaeological

investigations in advance of the restoration and alteration of two sites along the Sweet Brook Bluebelt and its associated wetlands in Annadale, Staten Island, New York. For the JRC Construction Corporation.

- **Phase IB Archaeological Survey, Eagle Academy for Young Men, Block 2923, Lots 17, 23, and 26, Bronx, New York**. Project Manager for archaeological field testing at a proposed New York City school location in the Tremont section of the Bronx. Excavations identified, evaluated, and mitigated a buried historic trash scatter and bottle dump feature dating to the early to mid-twentieth century. For the New York City School Construction Authority.

- **Phase IA Cultural Resource Assessment, Burlington Sod Farm, Springfield Township, Burlington County, New Jersey**. Project Manager for a Phase IA cultural resource assessment of a 640-acre agricultural property slated to become a new county fairgrounds. This study involved historic and cartographic research, the identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For the Freeholders of Burlington County.

- **Combined Phase IA/IB Archaeological Assessment, Alcan Aluminum Corporation Focused Remedial Investigation Project, Oswego County, New York**. Project Manager for a combined Phase IA archaeological assessment and Phase IB archaeological field survey under SEQRA for the Alcan Facility prior to the execution of a project designed to mitigate contaminated soils. For ARCADIS/BBL.

- **Phase IB Archaeological Survey, Jamaica Avenue School, Block 4102, Lots 19, 27, 33, 35 and 36**, **Cypress Hills, Brooklyn, Kings County, New York**. Project Manager for archaeological trenching at a proposed New York City school location in the Cypress Hills section of Brooklyn. Excavations identified, evaluated, and mitigated extensive backyard deposits dating to the late nineteenth through early twentieth centuries. For the New York City School Construction Authority.

- **Phase IA Cultural Resource Assessment, Proposed Eagle Academy for Young Men, East 176th Street, Block 2923, Lots 17, 23, and 26, Bronx, New York.** Project Manager for a Phase IA archaeological assessment for a proposed school building in Bronx, New York. This study involved historic and cartographic research, identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For New York City School Construction Authority.

- **Phase IB Archaeological Survey, Rockaway Boulevard Site, Rockaway Boulevard and Nassau Expressway, Block 14260, Lot 1, Jamaica, Queens County, New York**. Principal Investigator for an archaeological survey of a proposed New York City Transit Bus parking facility, located adjacent to JFK International Airport. Survey consisted of excavation of shovel tests across the project area. For New York City Transit.

- **Phase IA Cultural Resource Assessment, CCNY/ASRC Science Facility Project, City College of New York Campus, New York, New York**. Project Manager and lead researcher for an archaeological assessment and historic architectural survey of the proposed location for the Advanced Science Research Center Facility Project for the City College of New York. Study involved historic and cartographic research, the identification and analysis of past disturbances and/or prior settlement and land use, use of GIS technology to locate the proposed plans on historical maps, and the

assessment of the project's potential effect on historic properties. Identified the potential location of a nineteenth-century burial vault within the proposed project area. For the Dormitory Authority of the State of New York.

- **Phase IB Archaeological Survey, World Trade Center PATH Terminal, New York City**. Project Manager for archaeological investigations in advance of construction of the new WTC PATH Terminal. Coordinated excavation of a 170-foot-long trench to 15 feet below the surface, following OSHA safety regulations. Identified, evaluated for National Register eligibility, and mitigated late eighteenth- and early nineteenth-century backyard residential archaeological features. For the Port Authority of New York and New Jersey.

- **Phase IA Archaeological Assessment, Rockaway Boulevard Site, Rockaway Boulevard and Nassau Expressway, Block 14260, Lot 1, Jamaica, Queens County, New York**. Principal Investigator for an archaeological resource assessment of a proposed New York City Transit Bus parking facility, located adjacent to JFK International Airport. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Phase I Cultural Resource Assessment, Trenton-Morrisville Toll Bridge Rehabilitation and One Auxiliary Northbound Lane, Morrisville, Pennsylvania, and Trenton, New Jersey**. Project Manager for a cultural resource assessment of improvements to interchanges and the Trenton-Morrisville Toll Bridge spanning the Delaware River. Study involved archaeological assessment of proposed ground disturbance and historic architectural assessment of proposed interchange improvements to local structures, including the National Historic Landmark Delaware Division of the Pennsylvania Canal. For the Delaware River Joint Toll Bridge Commission.

- **Archaeological Monitoring, Condominiums at Cooke Mill, Market and Jersey Streets, Block H0850, Lot 21, City of Paterson, Passaic County, New Jersey**. Principal Investigator for an archaeological monitoring project at the former location of the Cooke Locomotive and Machine Works, which manufactured locomotives from 1852 until 1926. For Silk Mills Ventures, LLC and the City of Paterson Historic Preservation Commission.

- **Phase IA Cultural Resource Assessment, New Stapleton Waterfront Plan, Staten Island, New York**. Project Manager for the cultural resource assessment of a mixed-use development and 12-acre park on the site of the former Navy Homeport in the Stapleton community of Staten Island. Historical deed research was conducted for 11 development parcels, all of which lacked potential for deposits of residential archaeological resources. Analysis of the historic shoreline evolution revealed five locations with the potential to contain historic archaeological resources associated with the waterfront development in the nineteenth century. One historic architectural resource was found to meet eligibility criteria. For the New York City Economic Development Corporation.

- **Replacement/Rehabilitation of the Kosciuszko Bridge, Brooklyn-Queens Expressway (I-278), Queens and Kings Counties, New York**. Provided archaeological consultation services, including the review of previously completed cultural resource documentation, assisted with the preparation of the scope of work for the Phase IB archaeological field testing, and reviewed the archaeological work plan. Conducted as part of an environmental impact statement, enabling the client to meet its requirements under Section 106 of the *National Historic Preservation Act* and Section 4(f) of the *National Transportation Act*. For New York State Department of Transportation.

- **Phase IA Archaeological Assessment, Jamaica Avenue School, Block 4102, Lots 19, 27, 33, 35 and 36**, **Cypress Hills, Brooklyn, Kings County, New York**. Principal Investigator for an archaeological resource assessment of a proposed New York City school location in the Cypress Hills section of Brooklyn. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For the New York City School Construction Authority.

- **Phase IA Archaeological Assessment, Remedial Options Pilot Study, Grasse River Study Area, Alcoa-Massena, Massena, New York**. Principal Investigator for the Phase IA archaeological assessment of an early twentieth-century Alcoa fabricating, ingot, and extrusion and smelting plant under the jurisdiction of the U.S. EPA as a Superfund Site. Study involved the research and analysis of past disturbances and potential for historic archaeological resources associated with the industrial use of the project area. For Blasland, Bouck and Lee, Inc.

- **Phase IA Archaeological Assessment, Proposed Ventilation Fan Plant Rehabilitation,, West 30th Street and Sixth Avenue, New York, New York**. Project manager for an archaeological resource assessment of a proposed vent plant rehabilitation project servicing four NYCT subway lines. The archaeological assessment evaluated the proposed project's potential to adversely affect previously undisturbed archaeological deposits. After consulting historical maps and the present-day mapping of the subway line and utilities, it was determined that the project's area of potential effect lacked archaeological potential because of the disturbances created by the utilities within the sidewalks and streetbeds of West 30th Street and 6th Avenue. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Contextual Study, 153rd Street Pedestrian Bridge Access at Fort Washington Park, Manhattan, New York**. Served as Principal Investigator to assist with the completion of the required environmental documentation for a new pedestrian bridge to provide access from Riverside Drive and 151st Street to Fort Washington Park, crossing over rail lines and the Henry Hudson Parkway (Route 9A). As part of the environmental documentation, a contextual study of the project area was completed, which included an inventory of all historic properties listed and eligible for listing in the state and national registers. For New York State Department of Transportation.

- **Phase IA Archaeological Assessment, Hebrew Academy of Brooklyn/Yeshiva R'tzahd, 965 East 107th Street, Block 8215, Lots 12 and 21, Brooklyn, Kings County, New York**. Principal Investigator for an archaeological resource assessment of a proposed New York City school location in the Canarsie section of Brooklyn. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For the New York City School Construction Authority.

- **Phase I Archaeological Survey, Mount Vernon Avenue Bridge, Chatham, Morris County, Summit, Union County, New Jersey**. Project manager for Phase I archaeological assessment of the proposed replacement for the Mount Vernon Avenue Bridge spanning the Passaic River between the Township of Chatham and the City of Summit. Involved assessing the project's potential to affect archaeological resources adjacent to the existing bridge, constructed in 1906, and archaeological fieldwork to document the presence/absence of archaeological resources. No archaeological deposits were identified within the project's area of potential effect. For the County of Morris, Department of Public Works, and the County of Union, Department of Public Works.

- **Phase IA Cultural Resource Assessment, East Orange Demonstration Project, Pre-K to 12th Grade School for the Performing Arts, City of East Orange, Essex County, New Jersey**. Principal Investigator for a cultural resource assessment of a proposed new school to be constructed at the present location of the circa 1910 East Orange High School. Determined the project's potential to affect potential archaeological resources and coordinated the determination of the East Orange High School's National Register eligibility and the recordation of the school prior to demolition. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Archaeological Assessment, Proposed Vent Plant Installation, West 21st Street and Sixth Avenue, New York, New York**. Principal Investigator for an archaeological resource assessment of a proposed vent plant installation, located in Chelsea. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Proposed Oakwood Avenue Elementary School Addition, City of Orange, Essex County, New Jersey**. As part of the E.O. 215 process, served as the Principal Investigator for a cultural resource assessment of an addition to the existing circa 1888 Oakwood Avenue School. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment, Harlem Hospital Center Modernization, New York, New York**. Project manager for the cultural resource assessment of the proposed modernization project for Harlem Hospital. Project included archaeological assessment of the project's area of potential effect and the historic architectural evaluation of the surrounding area and the preservation, removal, storage, and adaptive reuse of five Works Progress Administration (WPA)-commissioned murals within buildings slated for demolition. For the Dormitory Authority of the State of New York and the New York City Health and Hospitals Corporation.

- **Phase IA Cultural Resource Assessment, Proposed Peshine Avenue School, Elementary School Replacement, City of Newark, Essex County, New Jersey**. Principal Investigator for a cultural resource assessment of a proposed new school to be constructed at the present location of the circa 1911 Peshine Avenue Elementary School. Determined the project's potential to affect potential archaeological resources through the use of GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Cultural Resource Screening, PATH to Newark Airport, Preliminary Design, Newark, New Jersey**. Project Manager for a cultural resource screening to identify previously documented historic properties within the corridor between Newark Penn Station and Newark Liberty International Airport. For the Port Authority of New York and New Jersey.

- **Phase IA Archaeological Assessment, Hudson Yards/Number 7 Subway Line Extension, New York, New York**. Assisted with the analysis of archaeological resource potential for 39 lots on the west side of Manhattan and determined the potential effect of alternatives on cultural resources. For New York City Department of City Planning and New York City Transit.

- **Phase IB Archaeological Survey, Proposed Vent Plant Installation, Chrystie and Stanton Streets, New York, New York**. Principal Investigator for an archaeological survey consisting of a backhoe trench excavated to assess the presence or absence of late nineteenth- and early twentieth-century front yard archaeological resources. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Proposed Grove Street Elementary School Replacement, City of Irvington, Essex County, New Jersey**. As part of the E.O. 215 process, served as the Principal Investigator for a cultural resource assessment of a proposed new elementary school to be constructed within an existing residential neighborhood. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment, Proposed Burnet-Warren Elementary School Replacement, City of Newark, Essex County, New Jersey**. As part of the E.O. 215 process, served as Principal Investigator for a cultural resource assessment of a proposed new elementary school to be constructed within the limits of the James Street Commons Historic District, a National Register listed historic district. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Cultural Resource Eligibility/Effects Investigations for the Proposed Tuckahoe Road (C.R. 557) Bridge Over Cape May Branch Rail Line Replacement, Atlantic County, New Jersey**. Principal Investigator for Section 106 compliance activities for NJDOT's proposed improvements to the Tuckahoe Road Bridge. Project involved subsurface archaeological investigation and historic architectural survey within the area of potential effect (APE). The architectural survey indicated that the Tuckahoe Road Bridge had previously been determined not eligible for inclusion in the National Register of Historic Places. The Cape May Rail Line, also located within the APE, was determined to be potentially eligible for inclusion in the National Register as a historic district owing to its role in the development of New Jersey's rail transportation system and in the growth of the state's seashore tourist resort communities. Based on the review of project plans, Berger concluded that the proposed bridge replacement project would not have an adverse effect on the National Register eligible Cape May Branch Rail Line.

- **Phase IA Archaeological Assessment, Proposed Fan Plant Rehabilitation, 52nd Street and Sixth Avenue, New York, New York**. Principal Investigator for an archaeological resource assessment of a proposed fan plant rehabilitation, located in midtown Manhattan. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **New Embassy Compound, Baghdad, Iraq**. Research assistant for cultural resource investigations associated with construction of a new embassy compound in Baghdad, Iraq. Tasks included securing historical maps of Baghdad, georeferencing historical maps to modern mapping, and drafting portions of the report's historic background section. For the U.S. Department of State, Overseas Buildings Operation.

- **Cultural Resource Screening, Proposed Middle School Replacement, City of Irvington, Essex County, New Jersey**. As part of the Environmental Assessment process, served as the Principal Investigator for a cultural resource assessment of a proposed new elementary school to be constructed

within an existing residential neighborhood. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Archaeological Assessment, New South Ferry Terminal, New York, New York**. Responsible for the archaeological resource assessment of a proposed subway terminal project in Battery Park. Required extensive cartographic research documenting the historic evolution of the Lower Manhattan shoreline. Employed GIS technology to georeference numerous historical maps in order to trace potential historic archaeological resources within the project area. Coordinated review with New York City Landmarks Commission and New York State Office of Parks, Recreation and Historic Preservation. Drafted portions of the Memorandum of Agreement and the entirety of the Archaeological Resource Management Plan to be enacted during construction. For New York City Transit.

- **Phase IA Archaeological Assessment, Proposed Fulton Street Transit Center, Fulton Street and Broadway, New York, New York**. Principal Investigator for an archaeological resource assessment of the proposed downtown transit facility, located at Fulton Street and Broadway. Reviewed historic maps and documents and summarized past disturbances to the project area to calculate the project area's potential for archaeological resources. Drafted portions of the project's Programmatic Agreement. For New York City Transit.

- **Phase IA Archaeological Assessment, Proposed Fan Plant Rehabilitation, Lafayette and Flatbush Avenues, Brooklyn, New York**. Principal Investigator for an archaeological resource assessment of a proposed fan plant rehabilitation, located in Fort Green, Brooklyn. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Triborough Bridge Rehabilitation Project, Randall's and Ward's Islands, New York, New York**. Principal Investigator. A strong possibility for human burials from the Manhattan Psychiatric Center necessitated archaeological monitoring by an RPA-certified archaeologist during all geotechnical borings for the project. Fieldwork included the observation of soil stratigraphy, inspection for human remains, and recordation of archaeological materials. No human remains were identified during the testing, however; specifications related to archaeological issues and the potential for human remains were drafted and incorporated into the bid documents for the construction contracts.

- **Cultural Resource Constraints, Louise Nevelson Plaza Redesign, William Street, Maiden Lane and Gold Street, New York, New York**. Project manager for the preparation of cultural resource screening report to identify previously documented historic resources within the proximity of the proposed project and assessment of archaeological potential within the proposed project's area of potential effect. For the Lower Manhattan Development Corporation.

- **Phase IA Archaeological Assessment, Proposed Vent Plant Installation, Chrystie and Stanton Streets, New York, New York**. Principal Investigator for an archaeological resource assessment of a proposed vent plant installation, located on Manhattan's Lower East Side. Employed GIS technology to georeference historic maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Phase IB Archaeological Survey, SUNY College at Purchase, New Residence Hall, Purchase, New York**. Principal Investigator for an archaeological field survey of a 2-acre parcel slated for development as new residence halls. Limited archaeological testing revealed the absence of potential culture-bearing soil horizons in highly disturbed locations. For the Dormitory Authority of the State of New York.

- **Phase IA Archaeological Assessment, Niagara Mohawk, Hudson (Water Street) Site, City of Hudson, New York**. Principal Investigator for the Phase IA archaeological assessment of a late nineteenth-/early twentieth-century coal-to-gas generating facility located on the banks of the Hudson River. Study involves the research and analysis of past disturbances and potential for historic archaeological resources associated with the industrial use of the project area. For Blasland, Bouck and Lee, Inc.

- **Phase I Archaeological Investigation, Sweet Brook Drainage Area, Carlton Boulevard, Annadale, Staten Island, New York**. Principal Investigator for a Phase I archaeological survey for sewage installation project along the Sweet Brook in southern Staten Island. For JRC Construction Corporation at the request of NYC DEP.

- **Phase I Archaeological Survey, Luzerne County Road No. 9, Jackson, Lehman, and Dallas Townships, Luzerne County, Pennsylvania**. Documented the results of a previously conducted road-way survey, located along Luzerne County Road 9, designed to assess the project's potential impact on late historic period archaeological deposits. For Pennsylvania Department of Transportation Engineering District 4-0.

- **Cultural Resource Constraints Assessment, Route 9 and Garden State Parkway, Cape May County, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the South Jersey Transportation Planning Organization.

- **Stage IA Archaeological Assessment, Cross Harbor Freight Improvement Project, Greenville Yards, Jersey City, New Jersey**. Co-Principal Investigator for the Phase IA archaeological assessment of the Greenville Yard. Study involved the research and analysis of past disturbances and potential for prehistoric and historic period resources. For Allee King Rosen & Fleming, Inc. in association with New York City Economic Development Corporation (NYCEDC).

- **Cultural Resource Constraints Assessment, Route 17, Bergen County, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the North Jersey Transportation Planning Organization.

- **Cultural Resource Constraints Assessment, Route 22, Essex and Union Counties, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the North Jersey Transportation Planning Organization.

- **Cultural Resource Constraints Assessment, Route 57 , Warren County, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project

corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the North Jersey Transportation Planning Organization.

- **Phase IA Archaeological Assessment, East 126th Street Bus Garage, New York, New York**. Responsible for the archaeological and architectural site file review at New York City Landmarks Commission (LPC), background research, and archaeological assessment for the half-block project area. For New York City Transit.

- **Cultural Resource Eligibility/Effects Documentation for Final Scope Development of Routes 1 and 9 at North Avenue, City of Elizabeth, New Jersey**. Principal Investigator for the identification and evaluation of archaeological resources (Phase I/II) and historic architectural properties (eligibility/effect) within the proposed project area for roadway improvements. Also conducted all background research and prepared archaeological report. For the New Jersey Department of Transportation.

- **Hudson Energy Project, Hudson River Bulkhead at Pier 92, Manhattan, New York**. Responsible for the archaeological and architectural site file review at New York City Landmarks Commission (LPC), background research, and field inspection of the study area from the bulkhead at Pier 92 to the ConEd substation at West 94th Street in Manhattan. For Genpower Hudson Energy.

- **New Jersey Cellular Telecommunications**. Principal Investigator for several Phase IA Archaeological Assessments and Historic Architectural Resource assessments for proposed Nextel cell tower installation in Essex, Berger, Morris, Sussex, Warren, Hunterdon, Somerset, Middlesex, and Monmouth counties. For IVI Environmental, Inc.

- **La Tourette Park, Staten Island, New York**. Principal Investigator for a Historic Architectural Resource assessment of a proposed Omnipoint cell tower installation in Richmond County, New York. For Goodkind and O'Dea, Inc.

- **U.P.N. Pallet Co. Cell Tower, Penns Grove, New Jersey**. Principal Investigator for a Phase IB archaeological assessment of a proposed AT&T cell tower installation in Salem County, New Jersey. For Rescom Environmental Corporation.

- **Clayton Cell Tower, Clayton, New Jersey**. Principal Investigator for a Phase IB archaeological assessment of a proposed AT&T cell tower installation in Gloucester County, New Jersey. For Rescom Environmental Corporation.

- **Peach County Cell Tower, Mantua, New Jersey**. Principal Investigator for a Phase IB archaeological assessment of a proposed AT&T cell tower installation in Gloucester County, New Jersey. For Rescom Environmental Corporation.

- **P.S. 234-Q, Long Island City, Queens, New York**. Principal Investigator for a Phase IB archaeological assessment for a proposed New York City public school in Astoria, Queens. For Parsons Brinckerhoff, Inc and the New York City School Construction Authority.

- **Arthur Kill Road Bus Maintenance Facility, Staten Island, New York**. Principal Investigator for a Phase IB archaeological survey for prehistoric and historic resources. For New York City Transit.

- **Arbutus Avenue Sewer Project, Staten Island, New York**. Principal Investigator for a Phase I archaeological survey for sewage installation project along the Arbutus Creek. For JRC Construction Corporation.

- **Two Bridges Road Bridge, Lincoln Park, Wayne and Fairfield, New Jersey**. Principal Investigator for cultural resource screening of archaeological and historic architectural properties, including five known prehistoric Native American sites, several historic residences predating 1950, and the 1887 National Register-eligible steel truss bridge. Project involved assessing archaeological sensitivity for the area surrounding the confluence of the Passaic and Pompton rivers. For the County of Passaic.

- **Interchange 142 (Garden State Parkway and I-78), Hillside, Irvington, and Union, New Jersey**. Principal Investigator for a Phase IB archaeological survey along the Garden State Parkway at Exit 142, straddling the Union/Essex County line. For the New Jersey Highway Authority.

- **Interchange 142 (Garden State Parkway and I-78), Hillside, Irvington, and Union, New Jersey**. Contributed to the Historic Architectural Evaluation with background research on and evaluation of the Elizabeth River Park, a National Register-eligible park in Union County. For the New Jersey Highway Authority.

PREVIOUS PROFESSIONAL EXPERIENCE

- **Calverton Naval Weapons Industrial Reserve, Calverton, New York**. Geographic Information Systems analyst. Integrated GIS analysis with lithic analysis to interpret prehistoric activity patterns.

- **PS 56R Site, Staten Island, New York**. Lab Director. Analysis, curation, and data entry for cultural material derived from the mitigation of a primarily Late Archaic prehistoric site.

- **Calverton Naval Weapons Industrial Reserve, Calverton, New York**. Field Supervisor. Cultural resource survey of 6,000-acre parcel with several early to mid-twentieth-century buildings and several Late Archaic and Late Woodland prehistoric sites.

- **Russian Mission, Bronx, New York**. Lithic Analyst. Cultural resource survey of a Late Archaic/Woodland quartz quarry site.

- **Long Island College Hospital, Brooklyn, New York**. Excavator. Monitoring heavy machine excavation of eighteenth-, nineteenth-, and twentieth-century historical archaeological deposits for the construction of a parking garage along Atlantic Avenue.

- **Robin's Island, Southold, New York**. Field Supervisor and Lithic Analyst. Survey of 450-acre island located in the Peconic Bay, revealing several prehistoric and historic sites.

- **Hudson Valley Rod & Gun Club, Pawling, New York**. Excavator. Mitigation of a Middle and Late Archaic prehistoric site.

- **Umm el Tlel, Syria**. Excavator. Long-term excavations of an open-air site containing cultural material from the terminal Lower Palaeolithic, through the Middle, Upper, and Epi-Palaeolithic, to the Neolithic.

- **Abri Castanet, Sergeac (Perígord), France**. Excavator. Long-term excavations of an early Upper Palaeolithic rockshelter in the southwest of France.

- **Le col de Jiboui, Haut-Diois (Drôme), France**. Excavator. Salvage excavations of an open-air Middle Palaeolithic site in the French Alps.

- **Fouilles Préhistoriques à Cagny, Cagny (Nord), France**. Excavator. Excavation of two open-air Lower Palaeolithic sites located in northern France.

- **African Meeting House, Nantucket, Massachusetts**. Excavator. Assisted with the excavation and interpretation of archaeological deposits surrounding this early nineteenth-century structure, the second constructed African Meeting House in America. Supervisor: Mary Beaudry, Boston University.

- **Spencer-Pierce-Little Farm, Newbury, Massachusetts**. Excavator. Boston University archaeological field school at a late seventeenth-century homestead. Supervisor: Mary Beaudry, Boston University.

ACADEMIC POSITIONS

Graduate Teaching Associate, Department of Anthropology, SUNY at Stony Brook. Primary Instructor: Anthropology 402, Problems in Archaeology - Landscape exploitation strategies in the Eurasian Palaeolithic.

Graduate Teaching Assistant, Department of Anthropology, SUNY at Stony Brook. Primary Teaching Assistant for Anthropology 102, Introduction to Cultural Anthropology; Primary Teaching Assistant for Anthropology 356, Urban Anthropology; Primary Teaching Assistant for Anthropology 104, Introduction to Archaeology; Primary Teaching Assistant for Anthropology 290, Ancient Science and Technology.

Graduate Teaching Assistant, Department of Anthropology, SUNY at Stony Brook. Lab Instructor for Anthropology 418, Lithic Technology; Lab Instructor for Anthropology 420, Geographic Information Systems in Environmental Analysis.

HONORS/AWARDS

- Graduate Council commendation for excellence in teaching by a graduate student, SUNY at Stony Brook
- General grant for thesis research, L.S.B. Leakey Foundation
- Grant for thesis research, Geological Society of America
- Grant for thesis related research, IDPAS, SUNY at Stony Brook
- Travel grant to the Annual Meeting of the Paleoanthropology Society, Columbus
- Travel grant to the 63rd Annual Meeting of the Society for American Archaeology, Seattle
- Travel grant for summer fieldwork, Sigma Xi Research Foundation
- General research grant, IDPAS, SUNY at Stony Brook
- Travel grant to the 62nd Annual Meeting of the Society for American Archaeology, Nashville

PUBLICATIONS

- Controlled Experiments with Middle Paleolithic Spear Points: Levallois Points, by J.J. Shea, K.S. Brown, and Z.J. Davis. In *Experimental Archaeology: Replicating Past Objects, Behaviors, and Processes*, edited by J. R. Mathieu, pp. 55-72. British Archaeological Reports, International Series 1035, Oxford. 2002.

- Experimental Test of Middle Palaeolithic Spear Points Using a Calibrated Crossbow, by J.J. Shea, Z.J. Davis, and K.S. Brown. *Journal of Archaeological Science* 28:807-816. 2001.

- Quantifying Lithic Curation: An Experimental Test of Dibble and Pelcin's Original Flake-Tool Mass Predictor. By Z.J. Davis and J.J. Shea. *Journal of Archaeological Science* 25:603-610. 1998.

PAPERS PRESENTED

- Paleoindian Lithic Foragers in the Delaware Water Gap: Integrating Lithic Resource Distribution and Lithic Technological Strategies. Paper presented at the January 2003 meeting of the Archaeological Society of New Jersey, Trenton, New Jersey. 2003.

- Costs and Benefits of Levallois Flake Production: An Economic Perspective on the Variability in Middle Palaeolithic Stone Tool Assemblages. Paper presented at the 65th Annual Meeting of the Society for American Archaeology, Philadelphia. 2000.

- Levantine Mousterian Mobility Patterns: The View from Mt. Carmel, Israel. Paper presented at the 1999 Paleoanthropology Society Meetings, Columbus. 1999.

- Experimental Test of Middle Paleolithic Hunting Weapons: Preliminary Results (with J.J. Shea and K.S. Brown). Paper presented at the 64th Annual Meeting of the Society for American Archaeology, Chicago. 1999.

- The Analytical Potential of Refitting Studies: History and Synthesis of Applications. Paper presented at the 63rd Annual Meeting of the Society for American Archaeology, Seattle. 1998.

- The PS 56R Site: A Vosburg Habitation on Staten Island, New York (with A.M. Pappalardo). Paper presented at the 62nd Annual Meeting of the Society for American Archaeology, Nashville. 1997.

CONFERENCE SYMPOSIA ORGANIZED

- Refitting Studies in New and Old World Lithic Analyses. Symposium organized for the 63rd Annual Meeting of the Society for American Archaeology, Seattle. 1998.

APPENDIX I

TRAFFIC

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

McMAHON ASSOCIATES, INC.
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ASSOCIATES
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MEMORANDUM

TO: Mr. Kurt Frederick, Weston Solutions, Inc.

FROM: Kenneth D. O'Brien, P.E.

DATE: June 29, 2010

SUBJECT: Traffic Impact Analysis Memo
Proposed Southport Development Project
McMahon Project No. 809567.11

DRAFT

As requested, McMahon Associates, Inc. has completed a traffic analysis of the existing and future traffic conditions in the vicinity of the proposed Southport Development Project, to be located at the southern end of South Delaware Avenue, south of the Packer Avenue Marine Terminal, in South Philadelphia. The intersections studied are depicted in **Figure 1**. It is our understanding that the current plan indicates access to the development will be provided primarily via an extension of South Columbus Boulevard into the site.

The scope of this traffic impact study includes an evaluation of the existing weekday morning, weekday midday, and weekday afternoon peak hours. An evaluation of the future opening year (2014) and the future horizon year (2024), both without development and upon full build-out of the proposed container terminal was performed at each of the following study intersections:

- S. Broad Street and Packer Avenue
- Eastbound I-76 Ramp/Darien Street and Packer Avenue
- Pattison Avenue and Lawrence Street
- Pattison Avenue and Front Street
- Front Street and Packer Avenue
- Front Street and Westbound I-76 Off Ramp/Southbound I-95 On Ramp
- Front Street and Southbound I-95 Off Ramp/Northbound I-95 On Ramp
- Front Street and Oregon Avenue
- Columbus Boulevard and Oregon Avenue
- S. Columbus Boulevard and Packer Avenue Marine Terminal
- S. Delaware Avenue and Packer Avenue Marine Terminal

Existing Traffic Volumes

Daily traffic counts were conducted in the vicinity of the site in December 2009, for a continuous 7-day period. Based on the counts, the two-way daily traffic volume is approximately:

- 5,800 vehicles per day along Pattison Avenue, between Lawrence Street and Front Street
- 3,600 vehicles per day along Pattison Avenue, between Front Street and Packer Avenue Marine Terminal Access
- 3,200 vehicles per day along Columbus Boulevard, between Packer Avenue Marine Terminal Access and Oregon Avenue
- 9,400 vehicles per day along Oregon Avenue, between Columbus Boulevard and Front Street
- 6,400 vehicles per day along Front Street, between Pattison Avenue and Packer Avenue

Manual turning movement traffic counts were completed at all of the study area intersections during the typical weekday (5:00 AM to 7:00 PM). In order to assess the existing traffic conditions, these existing traffic volumes were subjected to detailed capacity/level-of-service analysis, in accordance with accepted methodologies, for the highest peak hour during each weekday morning (5:00 AM to 9:00 AM), weekday midday (12:00 PM to 3:00 PM), and weekday afternoon (3:00 PM to 7:00 PM) peak period, which serves as the basis for this existing conditions evaluation. The *Revised Navy Yard Access Traffic Report for Temporary Access* prepared by Boles, Smyth Assoc. Inc & DMJM Harris/AECOM, last revised July 27, 2006 was reviewed for consistency of the traffic volumes at the S. Columbus Boulevard/ S. Delaware Avenue/Packer Avenue intersection. It should be noted that where discrepancies occurred, the higher of the two volumes was used to provide a conservative assessment of existing conditions.

Seasonal adjustment factors contained in the PennDOT publication, *2006 Pennsylvania Traffic Data,* were reviewed to ensure that the collected counts reflect typical conditions. The collected traffic data reflects higher than average data, and therefore, seasonal adjustment factors were not utilized to adjust the data. The four highest consecutive 15-minute peak intervals during these traffic count periods constitute the peak hours that are the basis of this traffic analysis. It should be noted that while most of the intersections' single highest peak hour during the morning and midday peak period occurred at approximately 8:00 AM to 9:00 AM and 12:00 PM to 1:00 PM, respectively, there was no such consistency during the weekday afternoon peak period, with the highest peak hour occurring at different times for the various study intersections ranging from 3:00 PM to 7:00 PM.

The resultant weekday morning, weekday midday, and weekday afternoon peak hour traffic volumes have been summarized in **Figures 2, 3,** and **4**, respectively.

Roadway Characteristics

The study area roadway network and characteristics are summarized below in **Table 1.**

Table 1. Existing Roadway Characteristics

Roadway	Roadway Jurisdiction	Travel Lanes (per direction)	Shoulders	Speed Limit
S. Broad Street (S.R. 0611)	State	3	No	NPSL
Packer Avenue	City	2-3	Yes	30 mph
Darien Street	City	1	Yes	25 mph
Pattison Avenue	City	2	Yes	30 mph
Lawrence Street	City	1-2	Variable	NPSL
Front Street	City	1-2	Yes	35 mph
Oregon Avenue (S.R. 2001)	State	2	Yes	30 mph
Christopher Columbus Boulevard (S.R. 2011)	City/State	2	No	30 mph

NPSL = No Posted Speed Limit

Planned Roadway Improvements

Through discussions with the City at the start of this study, the following roadways improvements are planned in the vicinity of the proposed development:

- MPMS 70231 – Swanson Street, Snyder Avenue to Oregon Avenue Reconstruction
- MPMS 64804 – Delaware Avenue Signals, Oregon Avenue to Race Street
- MPMS 80951 – Cruise Terminal Intermodal Parking Facility

In order to determine how to properly account for each of these planned improvements, we coordinated with the Philadelphia Streets Department and the Delaware Valley Regional Planning Commission (DVRPC), as well as the Delaware River Port Authority. Through those discussions, it was clear that MPMS 70231 currently has no construction funding and there are no plans to begin construction at this time or in the foreseeable future. Additionally, the MPMS 64804 project also has no funding or timetable and the details of what this improvement will entail, if it does move forward, are not clear at this time. Furthermore, MPMS 80951 is expected to provide an alternate, more convenient location to accommodate parking that already occurs within the Navy Base for the Cruise Terminal. As a result, the construction of the Intermodal Parking Facility, for which an exact location has not been determined and no construction date scheduled, is not expected to change traffic operations or patterns within the study area of this project.

Future Traffic Volumes Without Development

This section presents projected traffic volumes without the development of the proposed container terminal for the future opening year 2014, and future horizon year 2024 (ten years after the anticipated opening year). The future without development traffic volumes were estimated by increasing the existing 2009 peak hour traffic volumes to account for regional and local traffic growth, as described below. The opening year (2014) without development traffic volumes for the weekday morning, weekday midday, and weekday afternoon peak hours are illustrated in **Figures 5, 6**, and **7**, respectively. The future horizon year (2024) without development traffic volumes for the weekday morning, weekday midday, and weekday afternoon peak hours are illustrated in **Figures 8, 9,** and **10**, respectively.

Regional Traffic Growth

To account for regional traffic growth, traffic growth from developments outside the immediate area of this project site, the existing traffic volumes were increased by an annual traffic growth rate of 0.5 percent, as recommended by the City of Philadelphia. In order to determine the 2014 traffic volumes, traffic volumes were increased by 0.5 percent, compounded for 5 years, or a total of 2.53 percent. In order to determine 2024 traffic volumes, traffic volumes were increased by 0.5 percent compounded for 15 years, or a total of 7.77 percent.

Local Traffic Growth

To account for local traffic growth, traffic growth from specific developments in the vicinity of this project site, the City of Philadelphia was contacted to identify any other future developments expected to have a significant effect on traffic conditions. As a result, traffic associated with the proposed Mustin Field Intermodal Facility was included in the analysis. To understand how to properly account for this potential future development, we coordinated with the Philadelphia Streets Department, DVRPC, and Norfolk Southern. Based on the information provided, this facility may ultimately be developed into an intermodal facility for Norfolk Southern, potentially replacing its existing facility in Morrisville, PA. However, it is unclear when or if this development will occur. Furthermore, if it does occur, the specific information on its access and amount of traffic that would be generated would need to be finalized. In order to provide a conservative assessment of the impact of future Mustin Field traffic on the study area most impacted by the Southport Development Project, it was assumed that any development of the Mustin Field would access Delaware Avenue. Additionally, it was assumed that 20 percent of the projected daily traffic volume to be generated by the Mustin Field development would occur during each of the study peak hours. Based on this information, projected traffic for the proposed Mustin Field Intermodal Facility was also added to the 2014 and 2024 future traffic volumes without the development of the proposed Southport Development Project.

Future Traffic Volumes With Development

Evaluation of the proposed container terminal development is based upon the incremental increase in traffic volumes generated by the development during the peak hours, as described below.

Trip Generation

Traffic volumes generated by the proposed container terminal development were prepared based upon the container volume expected to be transiting the roadways throughout the port region on a daily basis. Data provided in the *Southport Development Project Traffic Report Study*, prepared by Halcrow Inc, was used to determine the expected traffic volumes. **Table 2** presents the anticipated vehicular trip generation for the proposed development.

Table 2. Vehicular Trip Generation

	Weekday Morning Peak Hour			Weekday Midday Peak Hour			Weekday Afternoon Peak Hour		
Land Use	In	Out	Total	In	Out	Total	In	Out	Total
Proposed									
Truck Trips	156	156	312	156	156	312	110	110	220
Employee Trips[1]	200	40	240	40	200	240	10	40	50
Total Trips	356	196	552	196	356	552	120	150	270

(1) Employee trip generation directional distribution characteristics were based upon data published in ITE's ***Trip Generation, 8th Edition,*** for ITE Land Use Code 110, General Light Industrial.

Trip Distribution and Assignment

Site-generated traffic will approach and depart the site via different routes depending on factors such as the existing traffic patterns, location of major roadways, the location of the development's site access, as well as the expected routing that will be encouraged by the City. The resulting expected distribution percentages for the anticipated directions of approach and departure, which were also based on information provided in the *Southport Development Project Traffic Report Study*, prepared by Halcrow Inc. are illustrated in **Figure 11**.

Application of the percentages illustrated in Figure 11, to the new peak hour trips contained in Table 2, provides an estimate of site traffic to be added to the study area. The site-generated traffic volumes were added to the future without development traffic volumes to result in total future peak hour traffic volumes with development for each peak hour. The 2014 future traffic volumes with development are illustrated in **Figures 12, 13,** and **14** for the weekday morning, weekday midday, and weekday afternoon peak hours, respectively, and the 2024 future traffic volumes with development are

illustrated in **Figures 15, 16,** and **17**, for the weekday morning, weekday midday, and weekday afternoon peak hours, respectively.

Capacity/Level-of-Service Analysis

The peak hour traffic volumes were analyzed to determine the existing operating conditions and future operating conditions, both without and with development of the Southport Development Project , in accordance with the standard techniques contained in the current *Highway Capacity Manual (2000)*. In the surrounding area, PennDOT District 6-0, as well as many local municipalities, generally considers level-of-service (LOS) A through D acceptable operating conditions while LOS E represents conditions approaching capacity and LOS F indicates that traffic volumes have exceeded available capacity.

The results of the capacity/level-of-service analyses are illustrated in **Figures 18, 19, 20, 21 and 22** for the 2009 existing, 2014 future without development, 2024 future without development, 2014 future with development, and 2024 future with development peak hour traffic conditions, respectively. The analysis results are summarized below for each study intersection.

S. Broad Street and Packer Avenue

This signalized intersection currently operates at acceptable conditions (LOS B overall and LOS C or better for all movements) during the weekday morning, weekday midday, and weekday afternoon peak hours. With the development of the proposed terminal, traffic signal improvements are needed to mitigate the impact of the development; with optimization of the traffic signal timings, this intersection will continue to operate acceptably in the future under with-development conditions, during all peak hours.

Eastbound I-76 Ramp/Darien Street and Packer Avenue

This signalized intersection presently operates at acceptable conditions during all three peak hours (LOS C overall and LOS D or better for all movements). During the 2014 and 2024 future conditions, the I-76 off-ramp left-turn movement will function with delay (LOS E or F) during the weekday afternoon peak hours. However, with optimization of the traffic signal timings, this intersection will operate acceptably in the future conditions during all three peak hours.

Pattison Avenue and Lawrence Street

This signalized intersection currently operates at acceptable conditions (LOS B or better overall and LOS D or better for all movements) during the weekday morning, weekday midday, and weekday afternoon peak hours. Traffic signal improvements are needed to mitigate the impact of the development of the terminal; therefore, with optimization of the traffic signal timings, this intersection will continue to operate acceptably in the future with development conditions during all peak hours.

Pattison Avenue and Front Street

Under existing conditions, this signalized intersection presently operates at highly acceptable conditions (LOS B or better overall and for all movements). During future conditions without and with the proposed development, the intersection will operate with acceptable LOS C or better conditions during all peak hours.

Front Street and Packer Avenue

Under existing and future without development conditions, this signalized intersection operates with delay (LOS E) on the southbound Front Street through movement. All other movements operate at LOS D or better and the overall intersection operates at LOS D or better during all peak hours. Optimization of the signal timings would improve this operation to LOS D or better for all movements in the future 2014 and 2024 with development conditions.

Front Street and Westbound I-76 Off Ramp/Southbound I-95 On Ramp

Under existing conditions, this signalized intersection presently operates at acceptable conditions and will continue to operate with acceptable conditions (LOS D or better) during future conditions without and with the proposed development.

Front Street and Southbound I-95 Off Ramp/Northbound I-95 On Ramp

This signalized intersection currently operates at acceptable conditions (LOS C overall and LOS D or better for all movements) during the weekday morning, weekday midday, and weekday afternoon peak hours. During future conditions, the northbound Front Street left-turn movement operates with delay (LOS E or F) during the weekday afternoon peak hour only. Optimization of the signal timings would improve this operation to LOS D or better for all movements in the future 2014 and 2024 with development conditions.

Front Street and Oregon Avenue

This signalized intersection currently operates with overall delay (LOS E or F) during all peak hours and will continue to operate with delay during future conditions. Specifically, the eastbound Oregon Avenue approach and the northbound Front Street left-turn lane operate with heavy delay. However, the impact of the development can be mitigated with optimization of the traffic signal timings, with delay at this intersection being greatly reduced.

Columbus Boulevard and Oregon Avenue

This signalized intersection currently operates at overall highly acceptable LOS B during all peak hours, with all movements operating at LOS C or better. With optimization of the traffic signal timing to mitigate the impact of the development, all movements at the intersection will continue to operate at acceptable LOS D or better conditions during both 2014 and 2024 future conditions.

S. Columbus Boulevard and Packer Avenue Marine Terminal

This unsignalized intersection presently operates at acceptable conditions during all three peak hours and will continue to operate acceptably in future without development conditions. During the 2014 and 2024 future with development conditions, it is recommended that Southport traffic be directed to utilize Oregon Avenue to travel between S. Columbus Boulevard and S. Delaware Avenue, instead of Packer Avenue. This will allow site traffic to utilize the traffic signal at the intersection of Oregon Avenue and Columbus Boulevard. With this recommendation, the intersection of S. Columbus Boulevard and the Packer Avenue Marine Terminal Access will operate at acceptable LOS D or better operation during each of the three peak hours without further improvement.

S. Delaware Avenue and Packer Avenue Marine Terminal

This unsignalized intersection operates at acceptable conditions during all three peak hours in existing and future without development conditions. During future with development conditions, it is again recommended that Southport traffic be directed to utilize Oregon Avenue to travel between S. Columbus Boulevard and S. Delaware Avenue, allowing them to utilize the traffic signal at the intersection of Oregon Avenue and Columbus Boulevard. With this recommendation, the eastbound Packer Avenue approach, as well as the S. Delaware Avenue approaches will continue to operate at acceptable LOS D or better operation. The westbound Packer Avenue Marine terminal approach will operate at LOS F during the weekday morning peak hour, due primarily to the additional traffic on S. Delaware Avenue. This delay will only be experienced by the relatively small number of vehicles exiting the Marine Terminal during this period, 55 vehicles, which is less than one per minute, during only the weekday morning peak hour. Since signalization of this intersection is not warranted according to the warrant criteria listed in the **Manual on Uniform Traffic Control Devices (MUTCD)**, the only modification that would provide LOS D or better operating conditions on this approach is to restrict exiting movements to right-turn movements only. This would require vehicles exiting the Packer Avenue Terminal to turn right and utilize Oregon Avenue to travel to Columbus Boulevard. This increased activity at Oregon Avenue and Columbus Boulevard can be accommodated and still maintain acceptable LOS D or better operation.

However, given the heavy delay is only expected to be experienced during one peak hour, it is recommended that the intersection be monitored, as development in the area increases, including the potential Mustin Field development, and the turn restriction only be implemented if the actual delay becomes excessive.

Proposed Development Improvements

In conjunction with the proposed Southport Development Project, the following improvements are proposed:

- **S. Broad Street and Packer Avenue**
  - Optimize Traffic Signal Timings

- **Eastbound I-76 Ramp/Darien Street and Packer Avenue**
  - Optimize Traffic Signal Timings

- **Pattison Avenue and Lawrence Street**
  - Optimize Traffic Signal Timings

- **Front Street and Packer Avenue**
  - Optimize Traffic Signal Timings

- **Front Street and Southbound I-95 Off Ramp/Northbound I-95 On Ramp**
  - Optimize Traffic Signal Timings

- **Front Street and Oregon Avenue**
  - Optimize Traffic Signal Timings

- **Columbus Boulevard and Oregon Avenue**
  - Optimize Traffic Signal Timings

- **S. Columbus Boulevard and Packer Avenue Marine Terminal**
  - Restrict Southport traffic from using Packer Avenue to travel between S. Columbus Boulevard and S. Delaware Avenue, requiring this traffic to utilize Oregon Avenue, and the traffic signal at Oregon Avenue and Columbus Boulevard instead.

- **S. Delaware Avenue and Packer Avenue Marine Terminal**
  - Restrict Southport traffic from using Packer Avenue to travel between S. Columbus Boulevard and S. Delaware Avenue, requiring this traffic to utilize Oregon Avenue, and the traffic signal at Oregon Avenue and Columbus Boulevard instead.
  - Monitor traffic conditions on the Packer Avenue Marine Terminal access approach and, if delay becomes excessive, restrict the access approach to right-turn movements only, requiring Packer Avenue Marine Terminal traffic to also utilize Oregon Avenue instead of Packer Avenue.

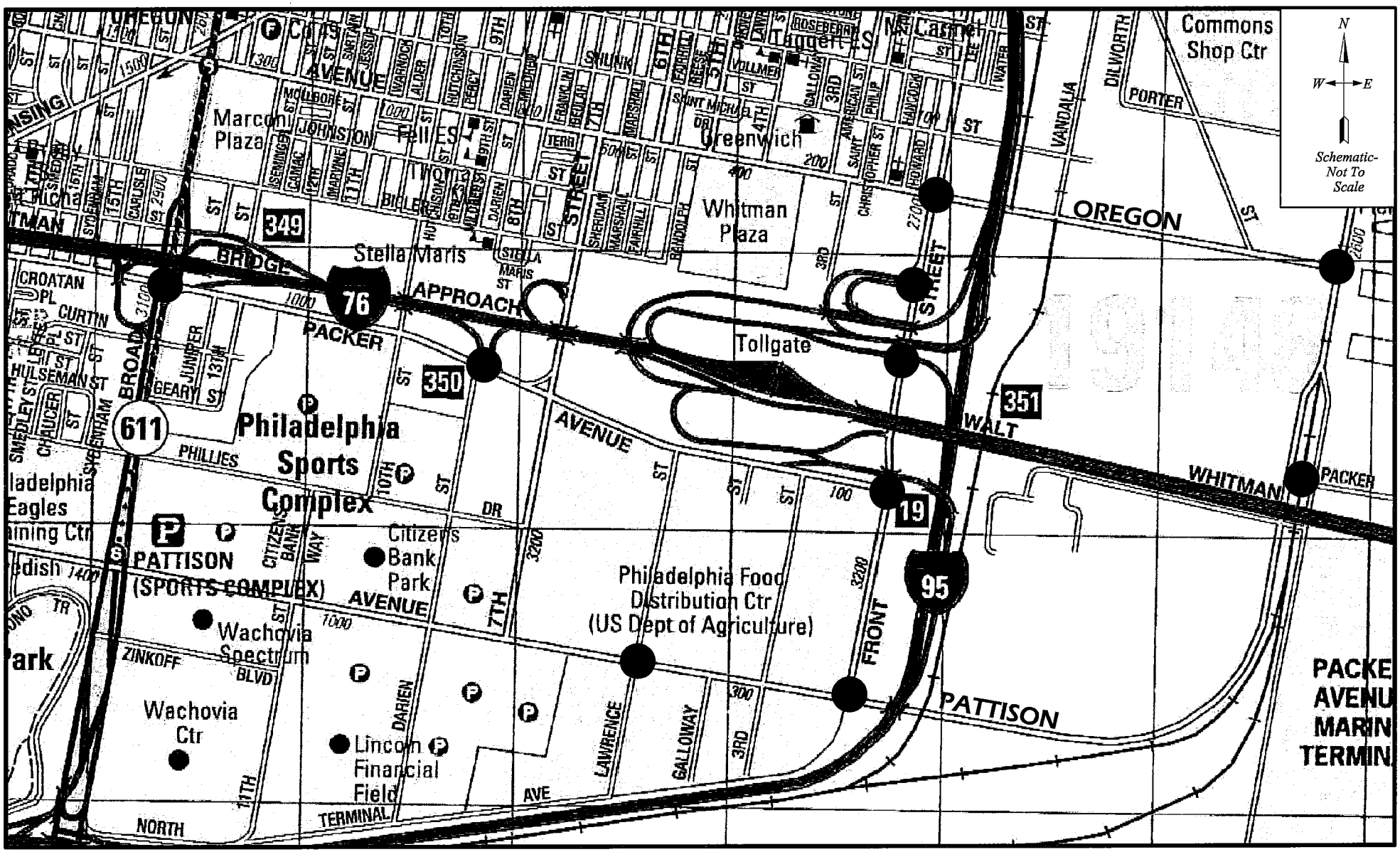

FIGURE 1

Study Area

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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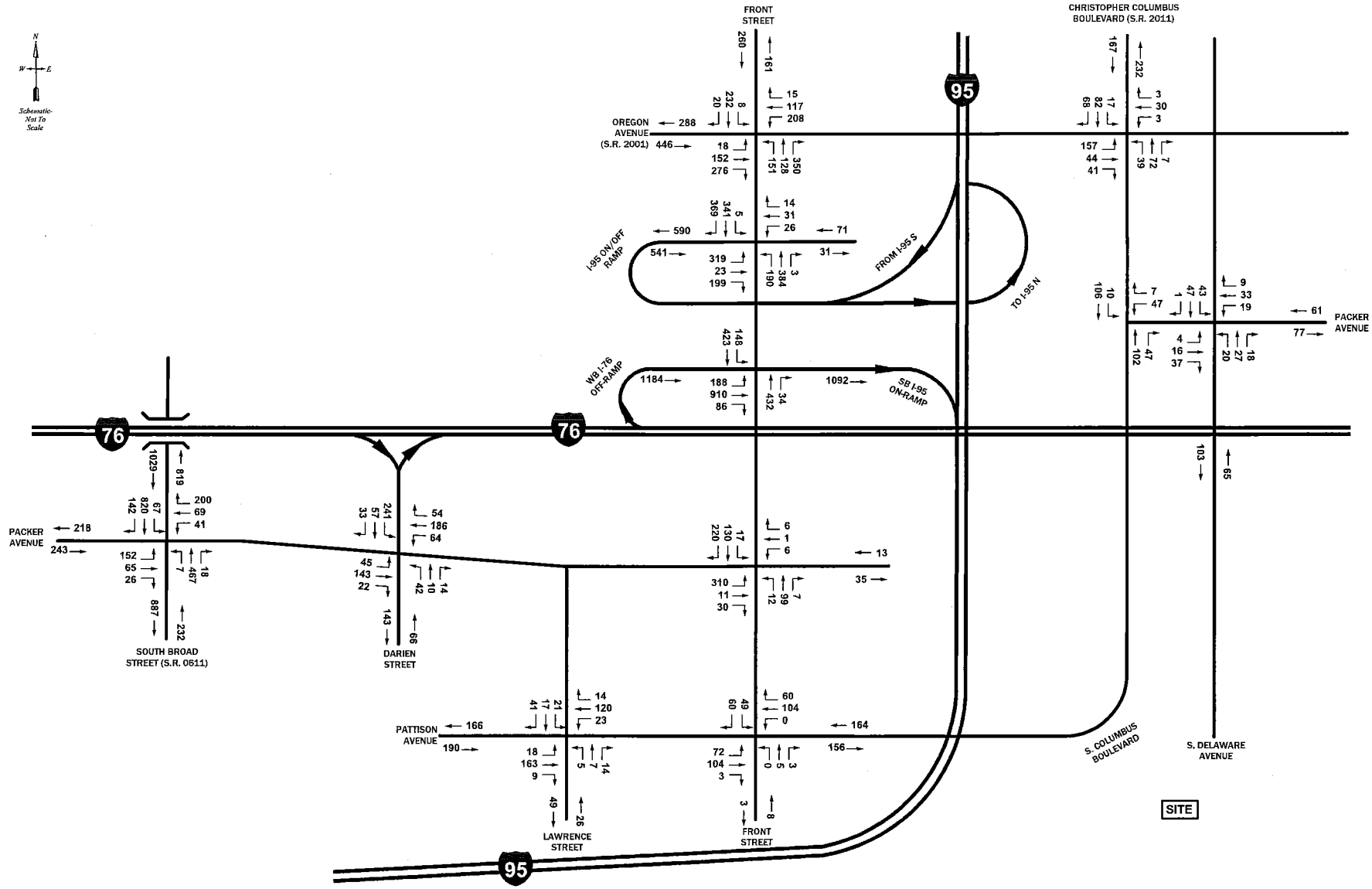

FIGURE 2

2009 Existing Weekday Morning Peak Hour Traffic Volumes

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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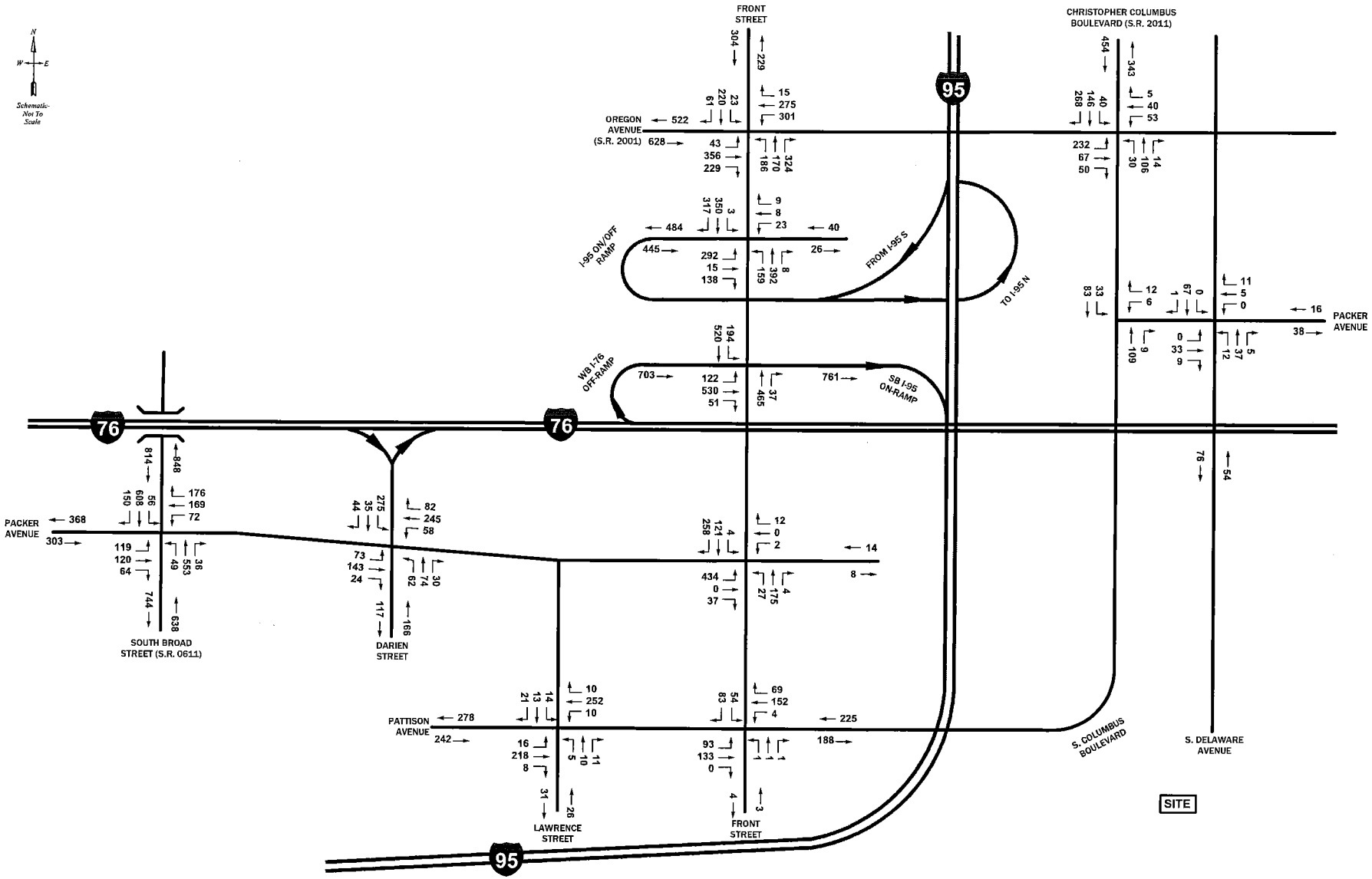

FIGURE 3

2009 Existing Weekday Midday Peak Hour Traffic Volumes

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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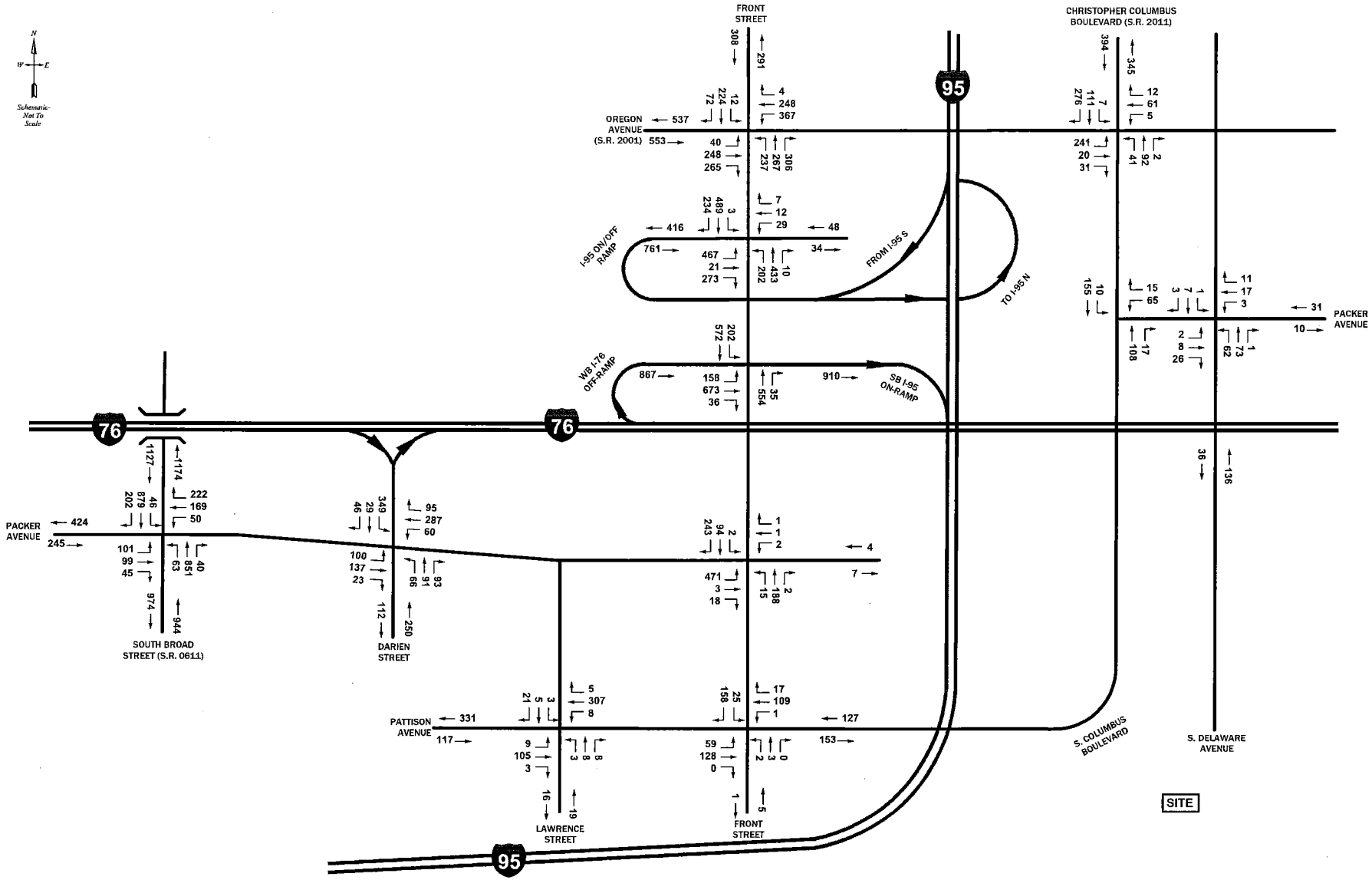

FIGURE 4

2009 Existing Weekday Afternoon Peak Hour Traffic Volumes

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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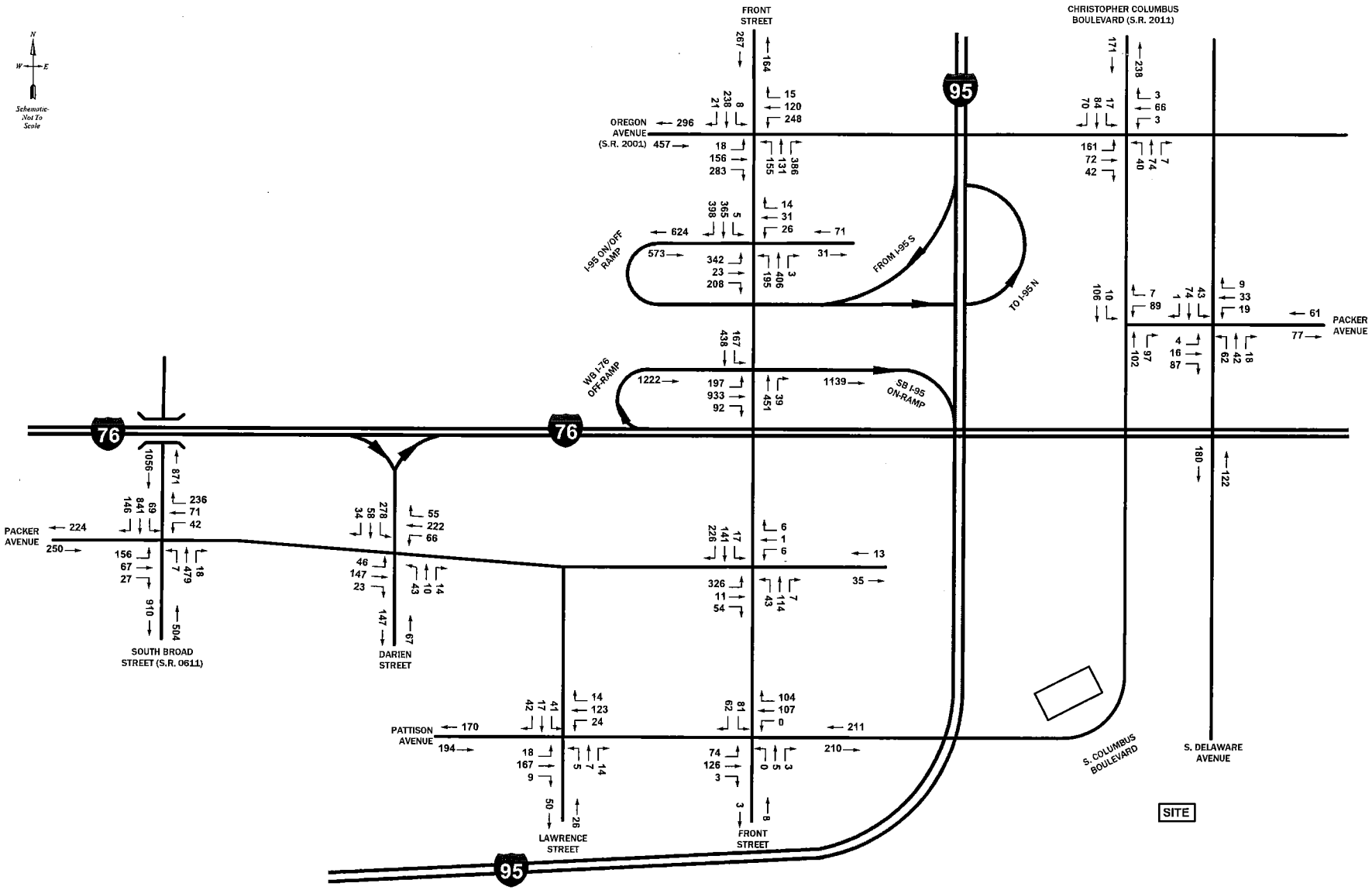

FIGURE 5

2014 Future Weekday Morning Peak Hour Traffic Volumes without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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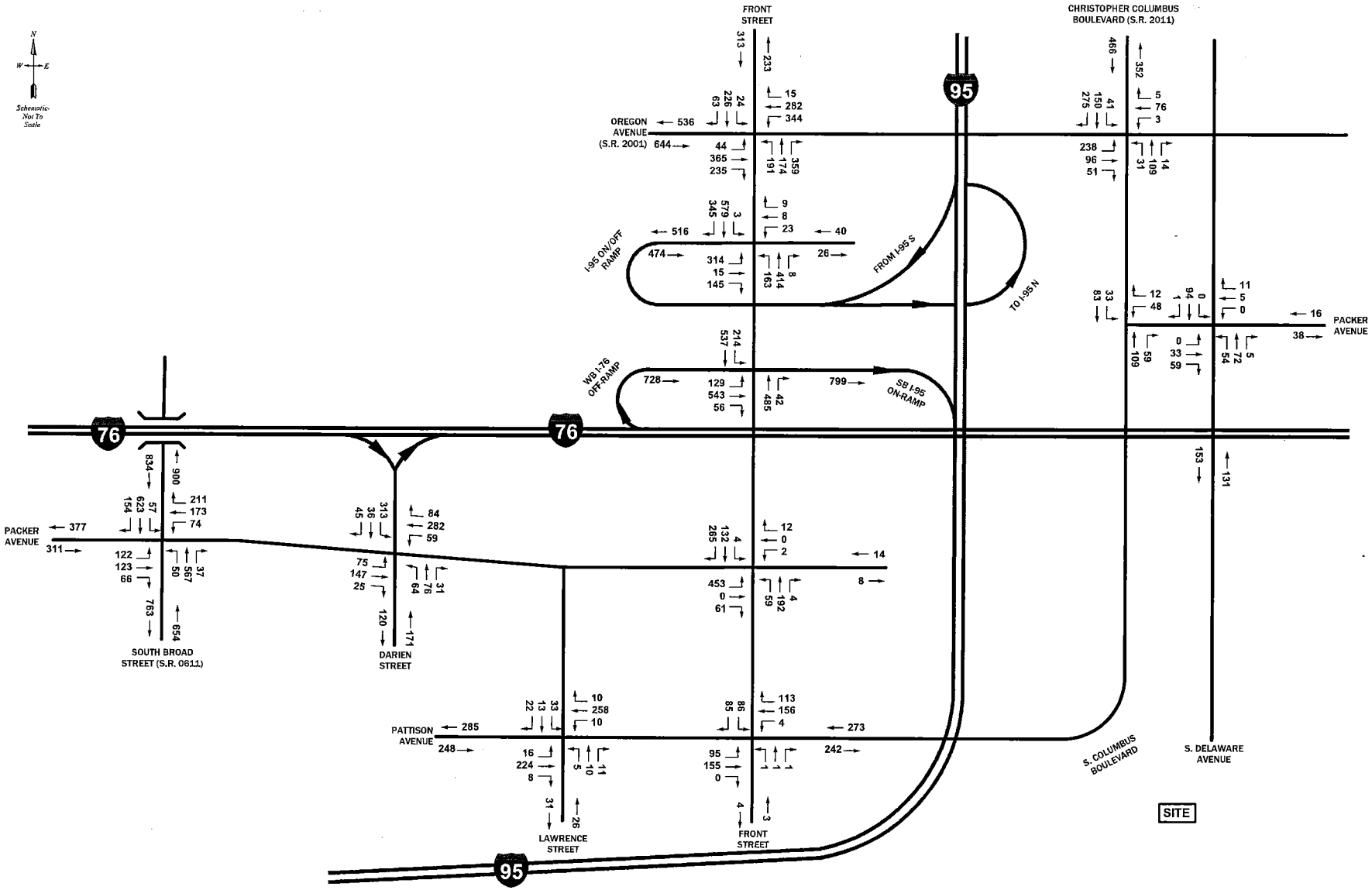

FIGURE 6

2014 Future Weekday Midday Peak Hour Traffic Volumes without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

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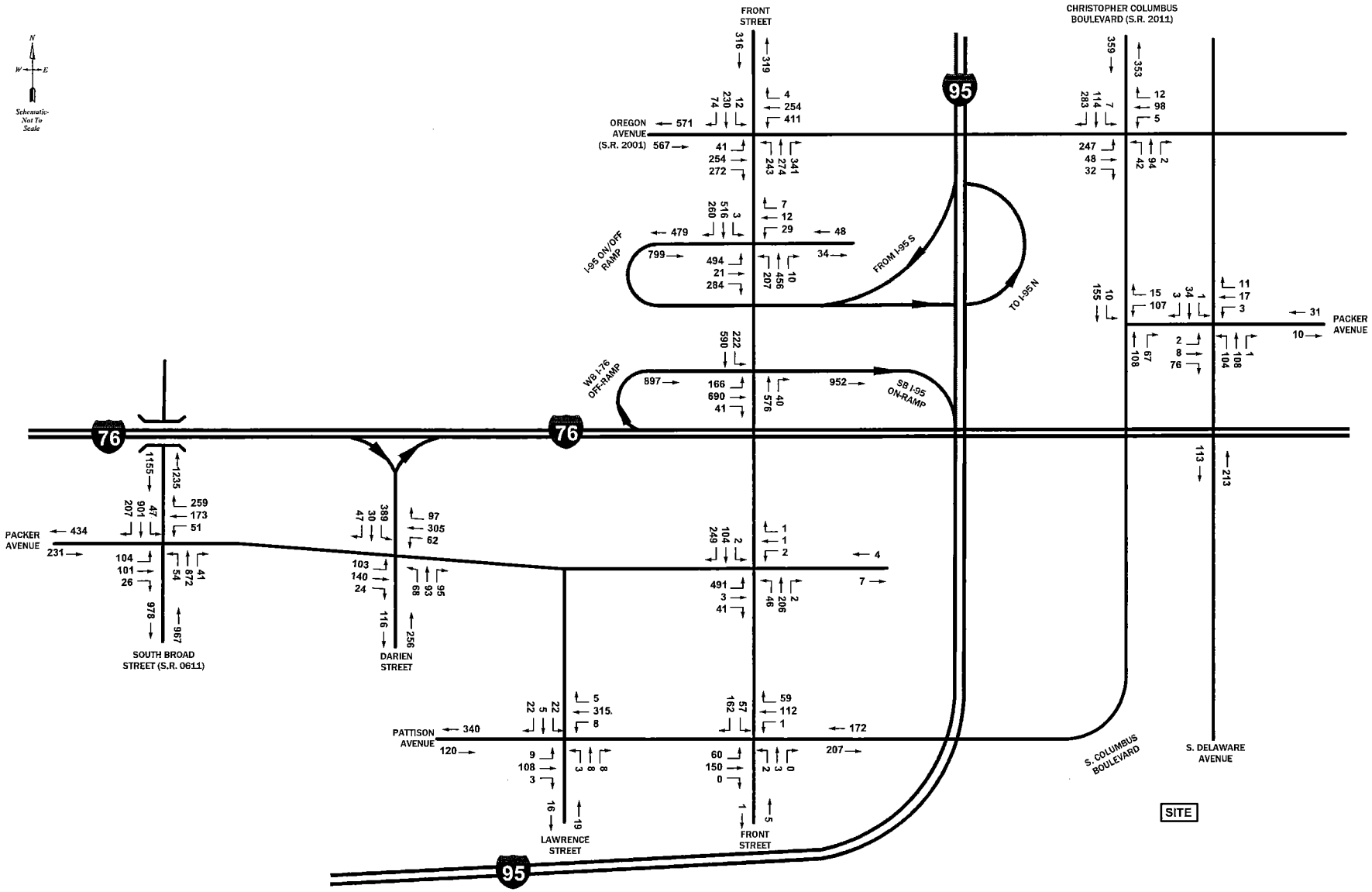

FIGURE 7

2014 Future Weekday Afternoon Peak Hour Traffic Volumes without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

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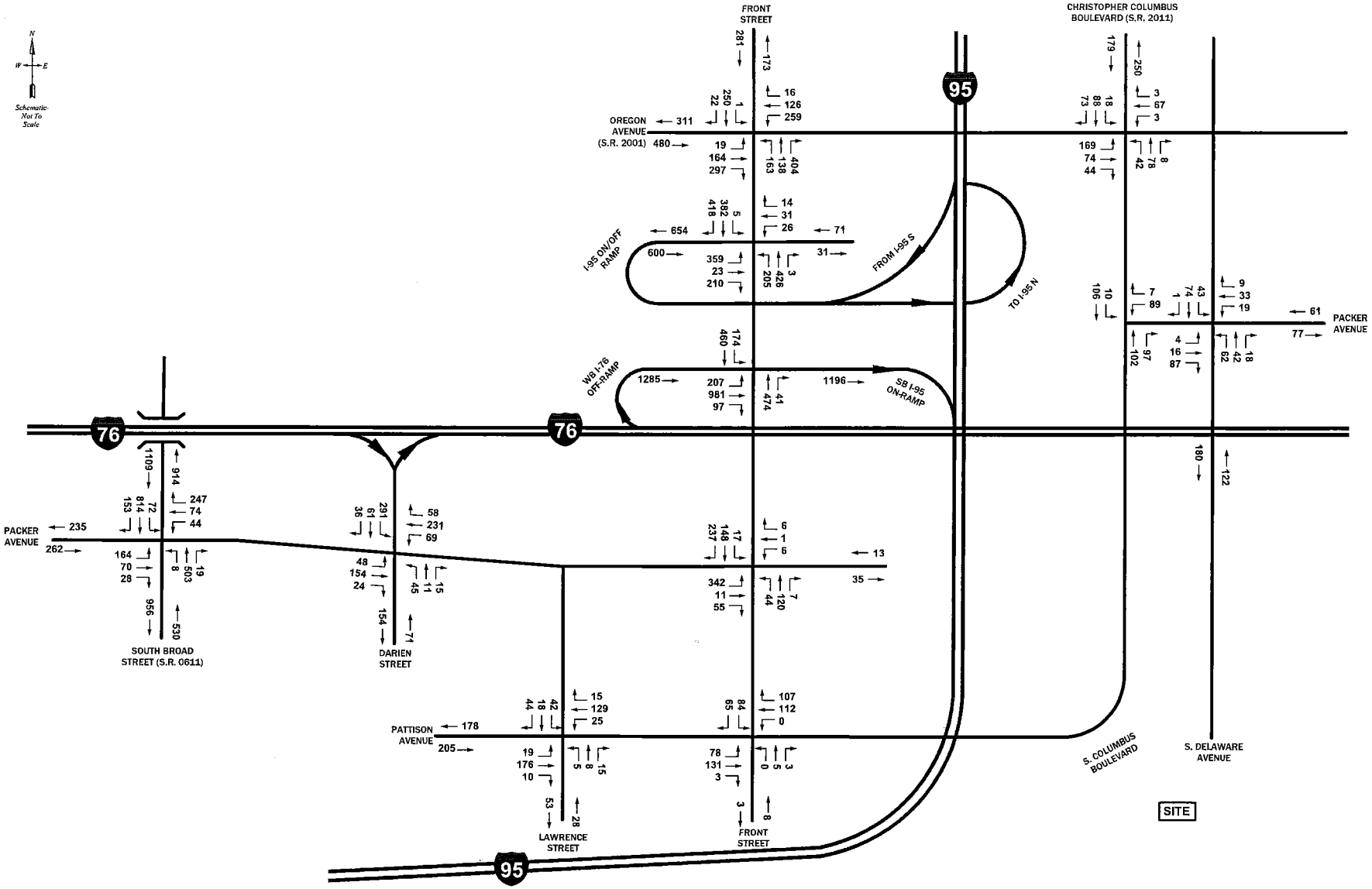

FIGURE 8

2024 Future Weekday Morning Peak Hour Traffic Volumes without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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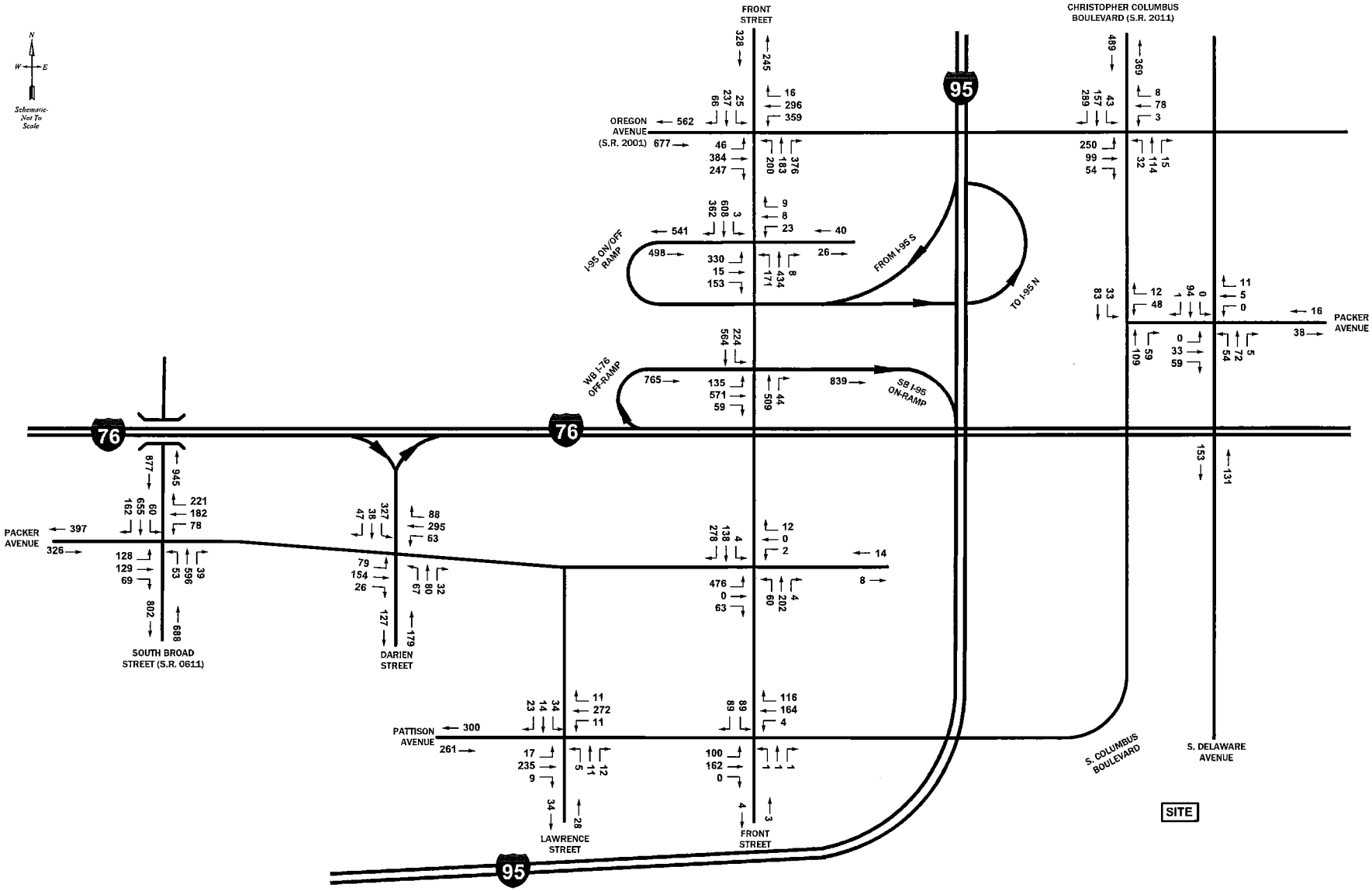

FIGURE 9

2024 Future Weekday Midday Peak Hour Traffic Volumes without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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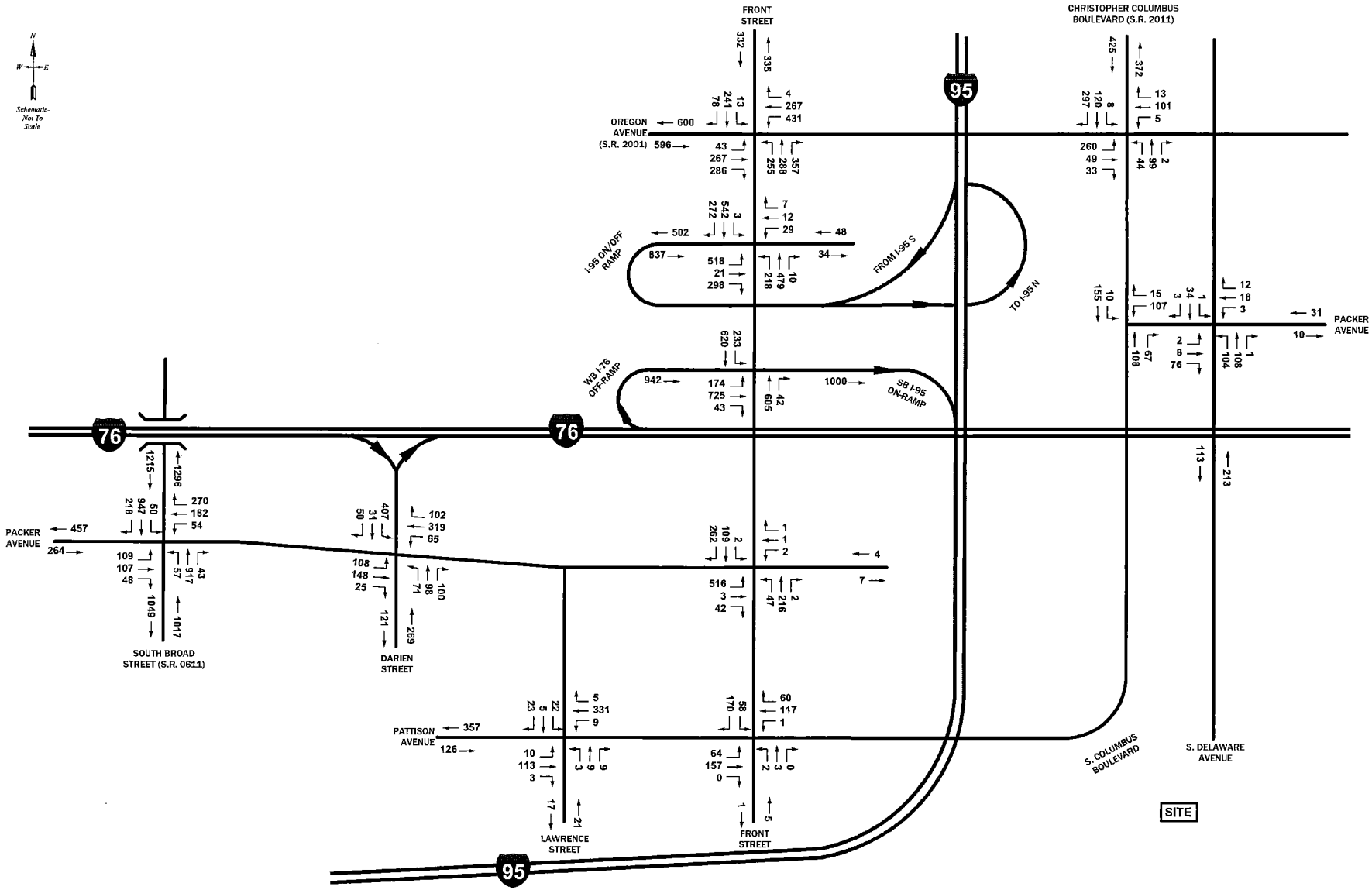

FIGURE 10

2024 Future Weekday Afternoon Peak Hour Traffic Volumes without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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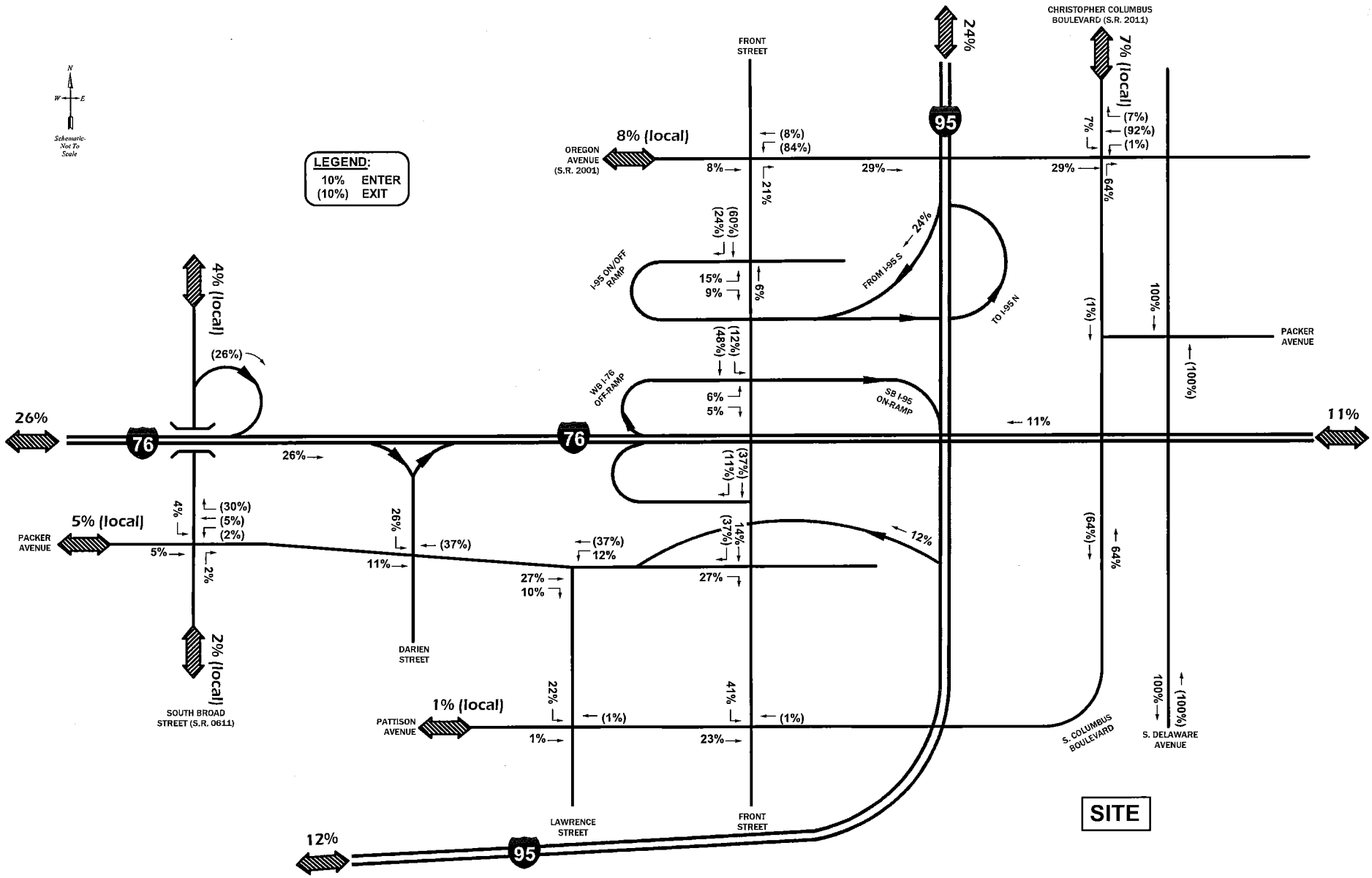

FIGURE 11

Overall Truck Trip Distribution

PROPOSED SOUTHPORT CONTAINER DEVELOPMENT

CITY OF PHILADELPHIA, PA

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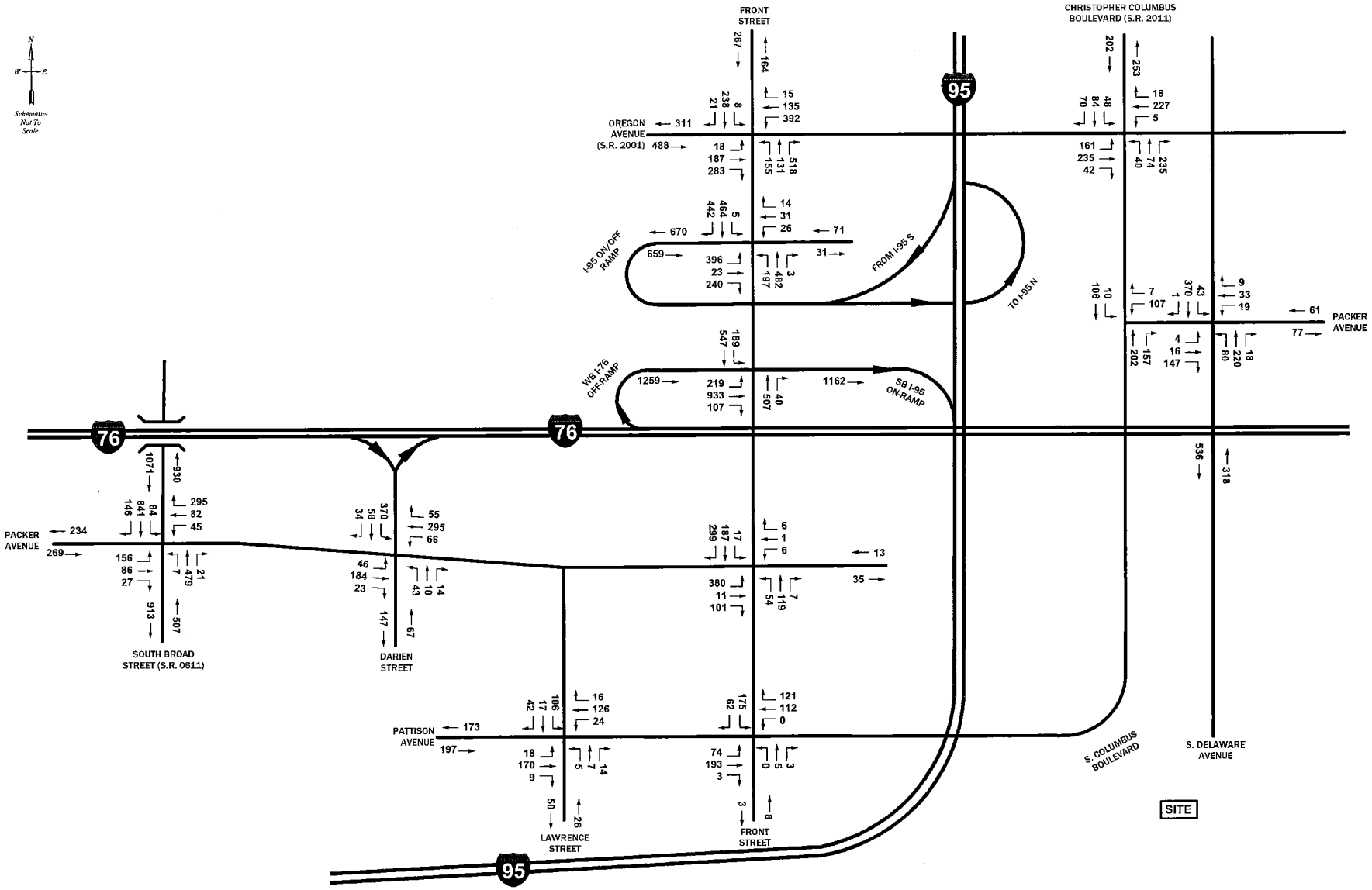

FIGURE 12

2014 Future Weekday Morning Peak Hour Traffic Volumes with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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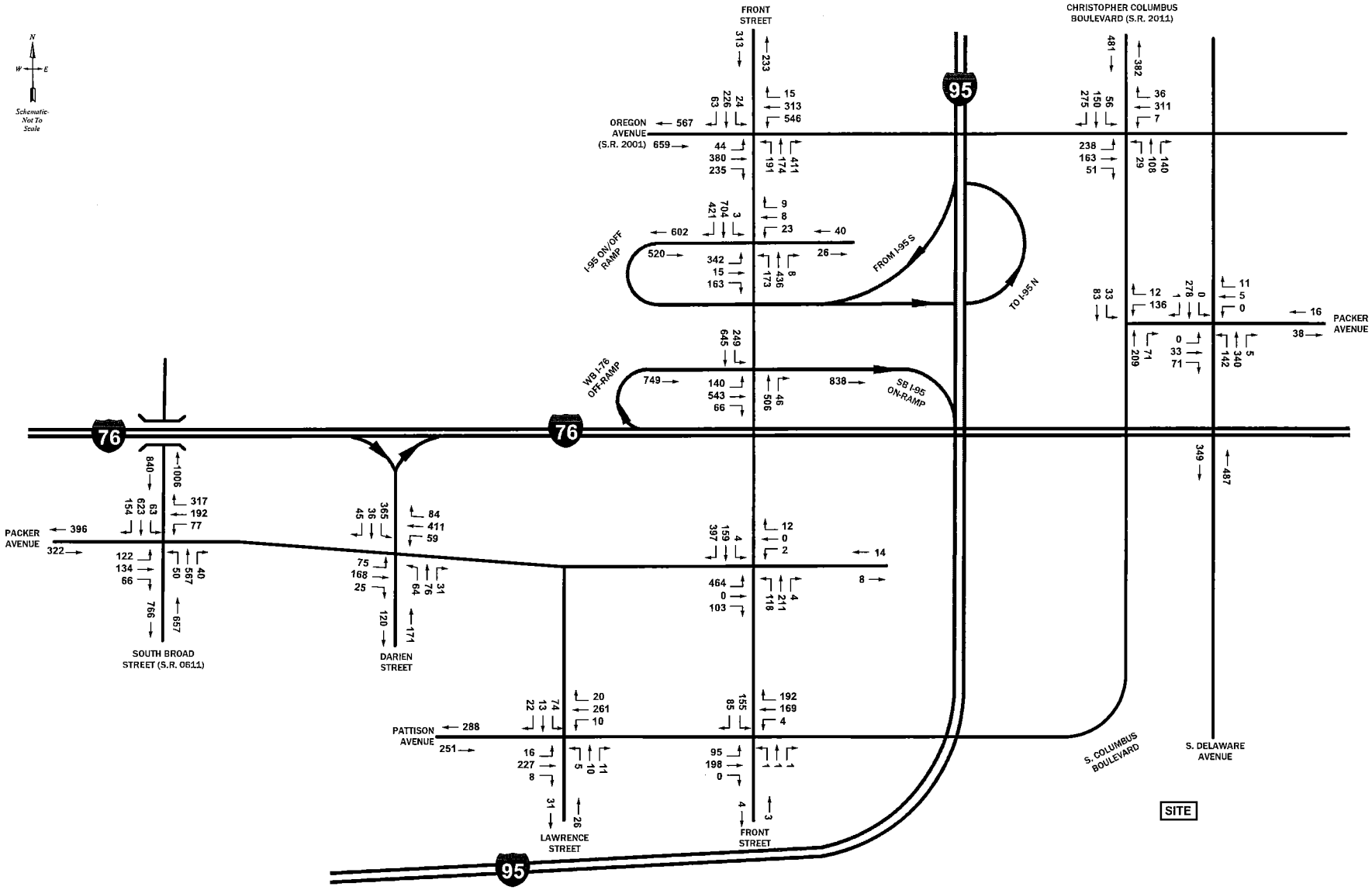

FIGURE 13

2014 Future Weekday Midday Peak Hour Traffic Volumes with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

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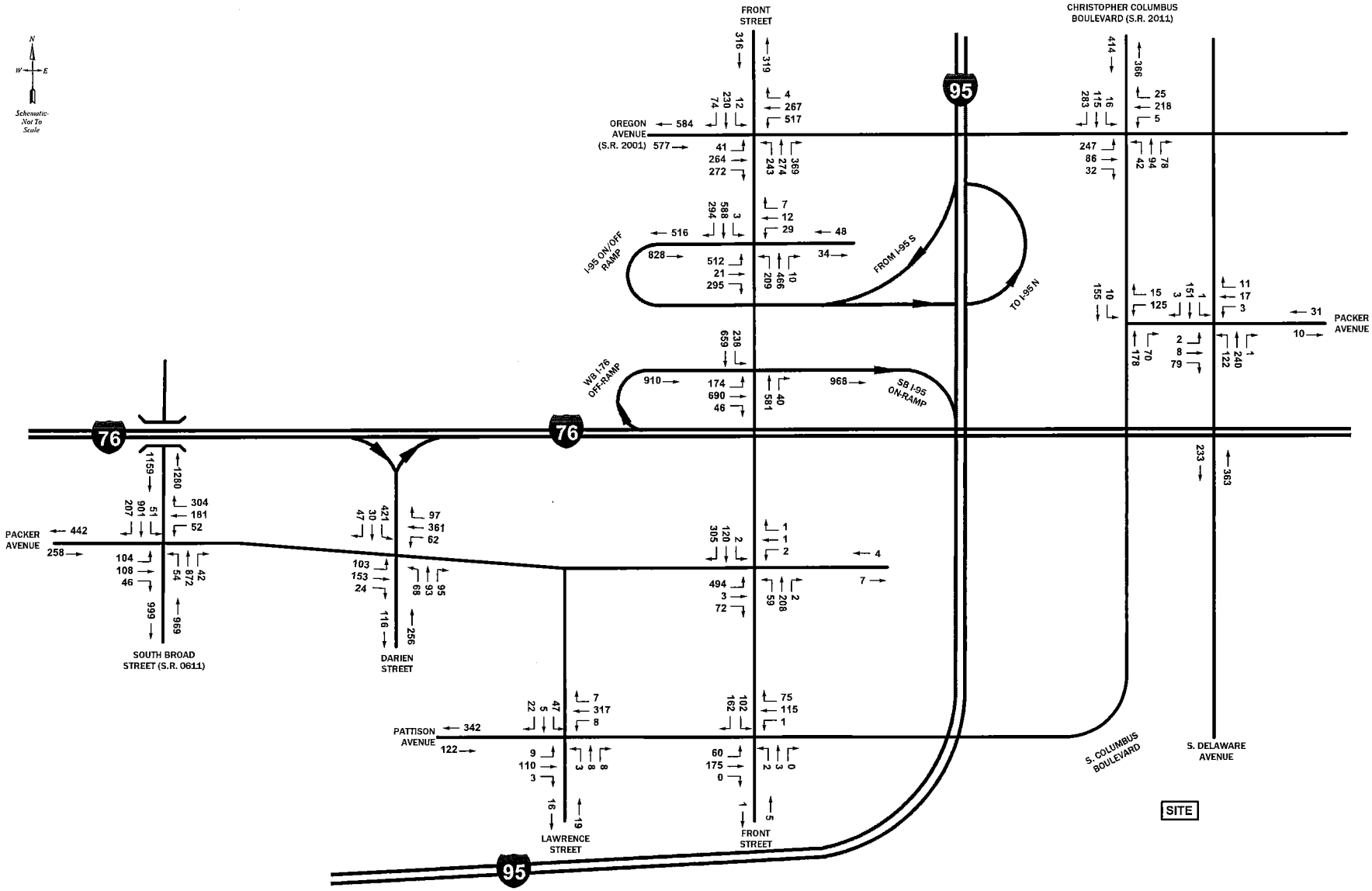

FIGURE 14

2014 Future Weekday Afternoon Peak Hour Traffic Volumes with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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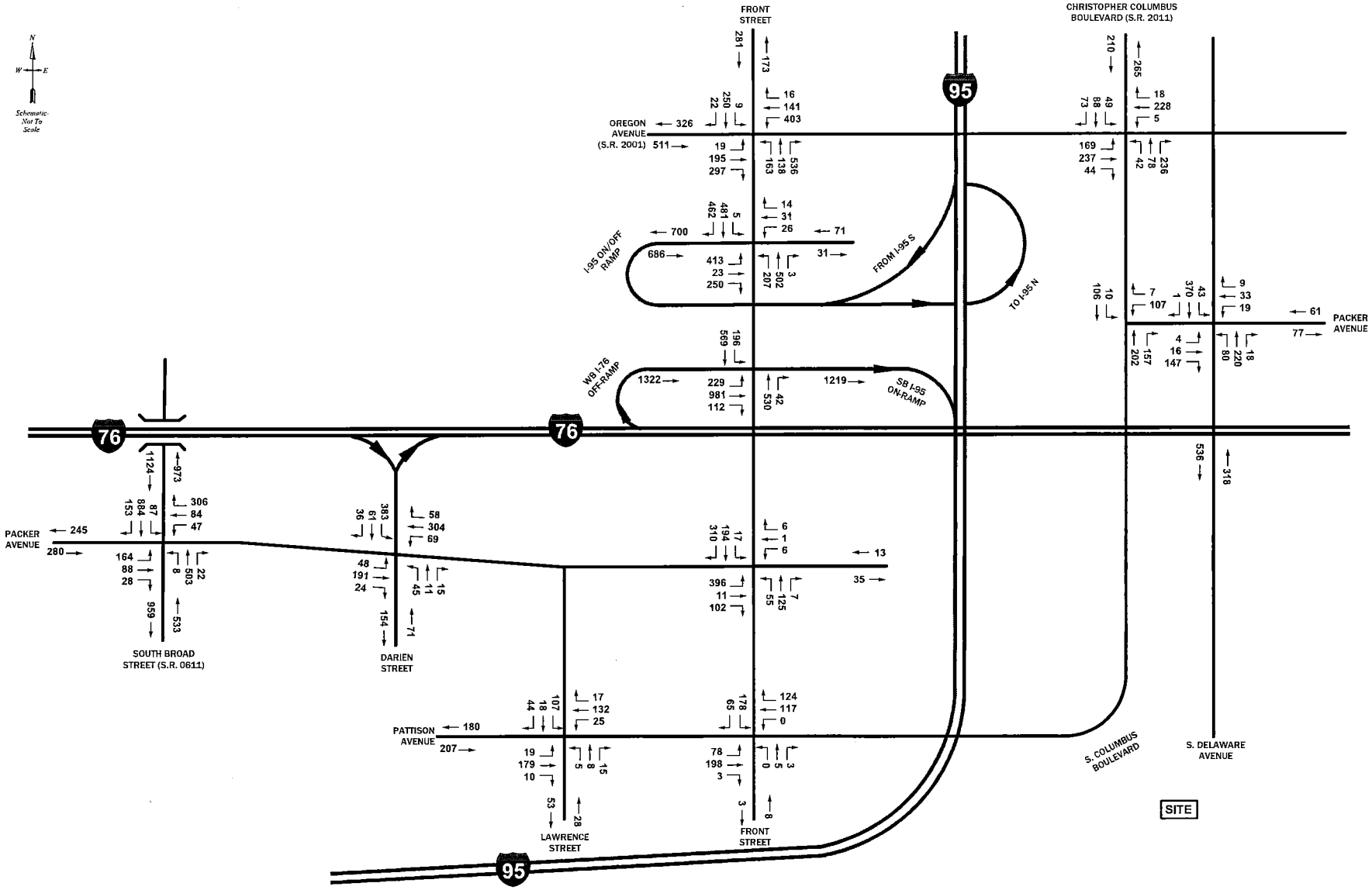

FIGURE 15

2024 Future Weekday Morning Peak Hour Traffic Volumes with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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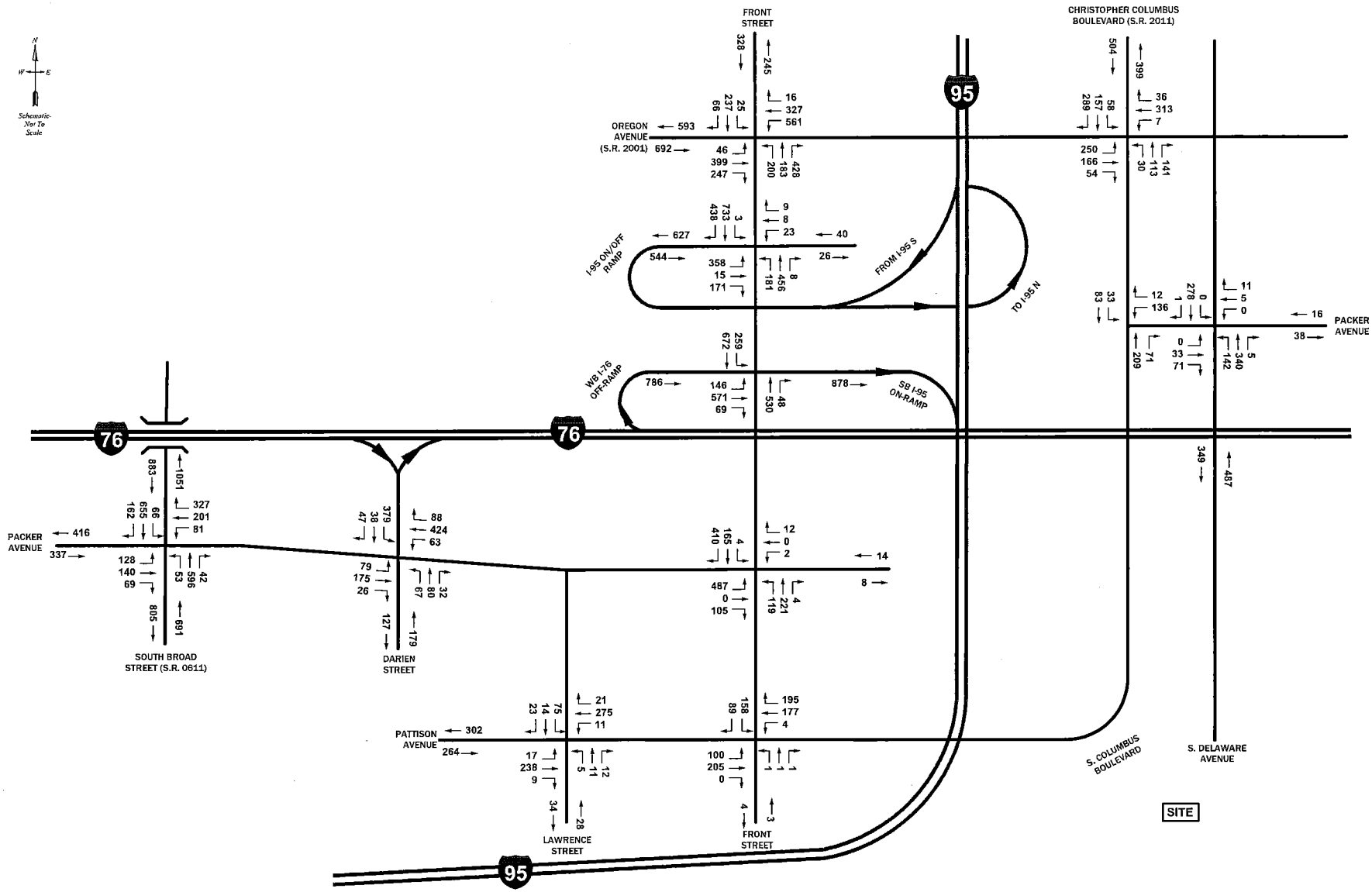

FIGURE 16

2024 Future Weekday Midday Peak Hour Traffic Volumes with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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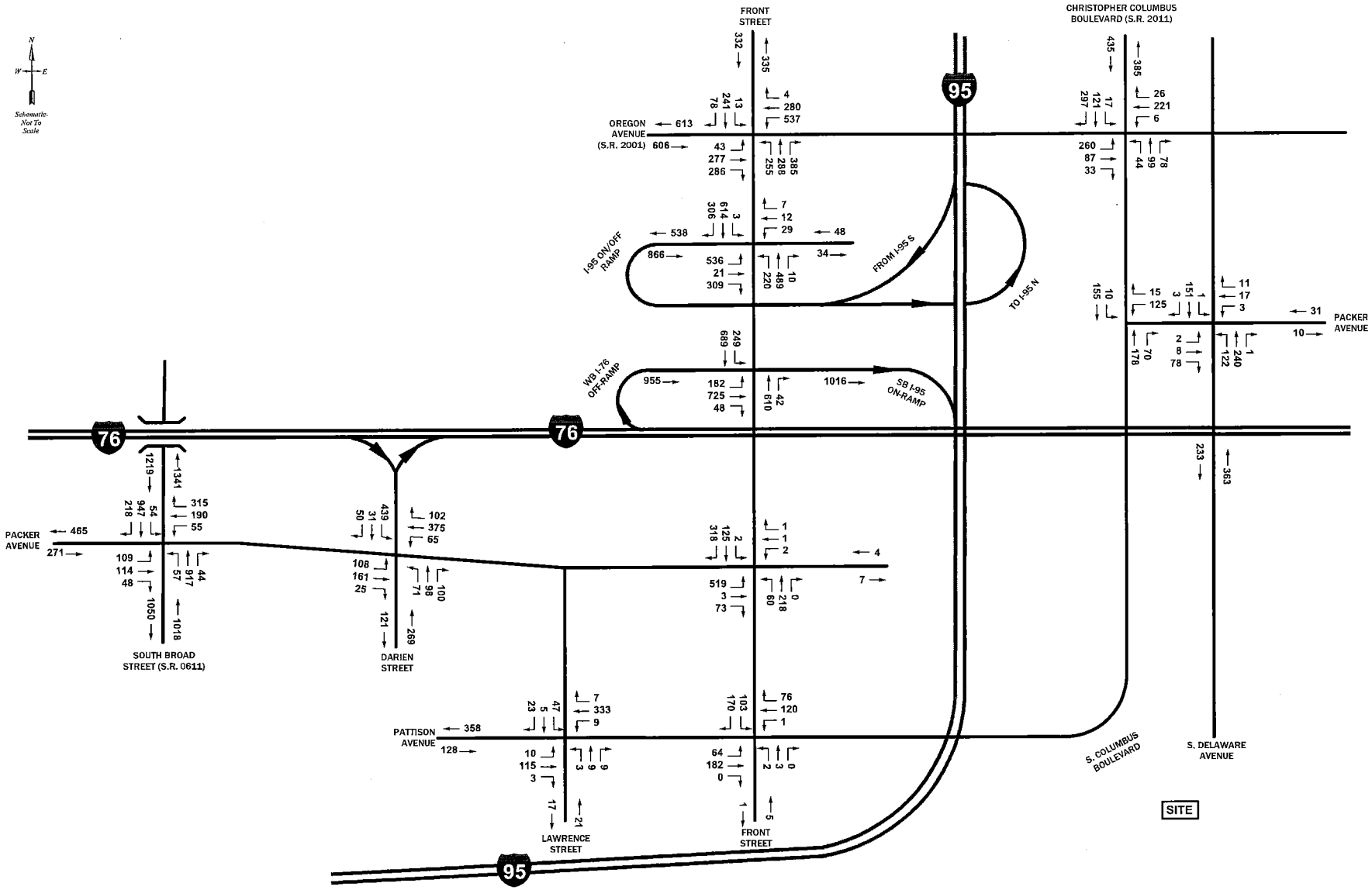

FIGURE 17

2024 Future Weekday Afternoon Peak Hour Traffic Volumes with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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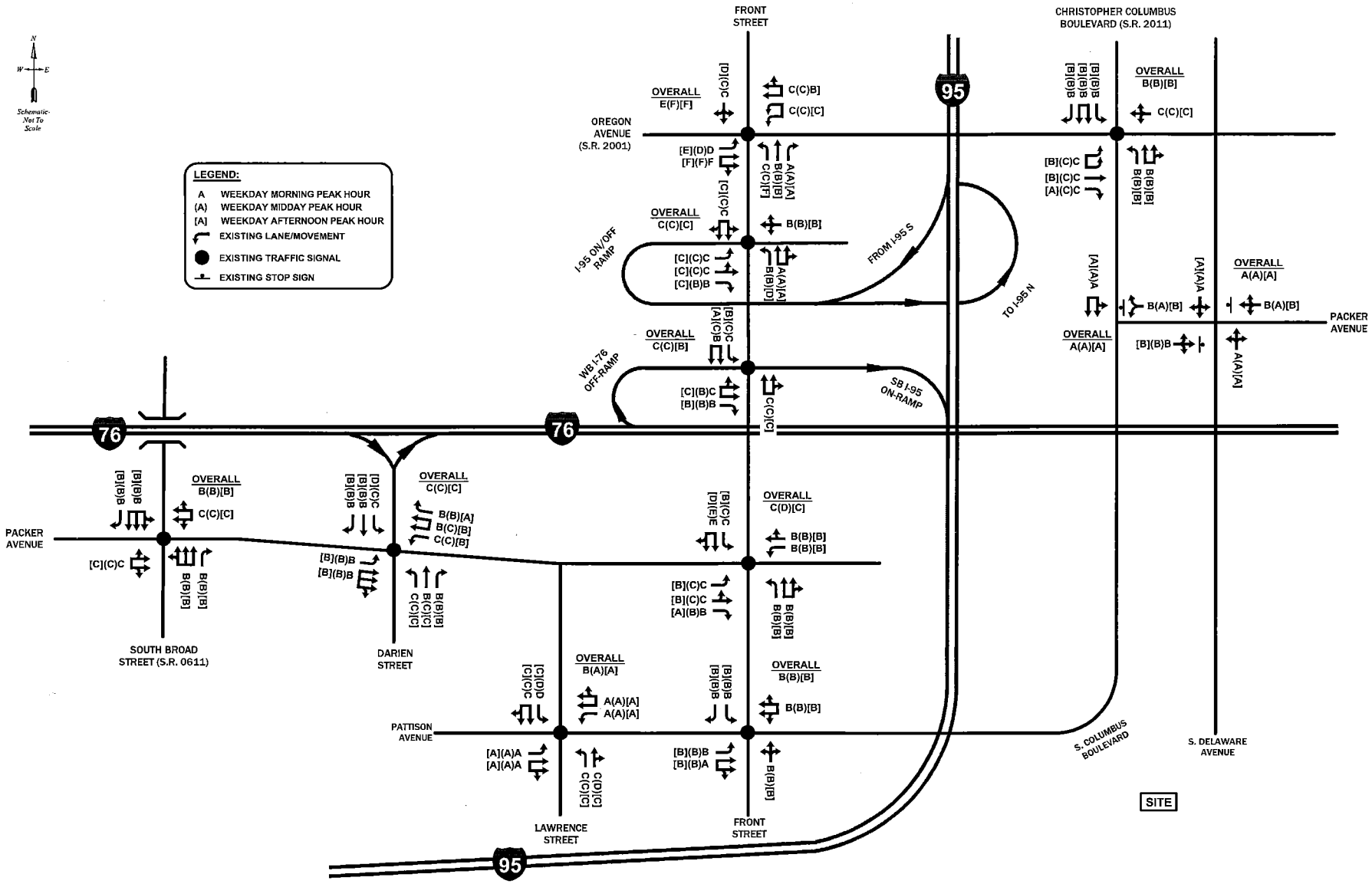

FIGURE 18

2009 Existing Levels of Service

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(4/14/10-LBK) i:\Eng\809567\Dwg\Figures\Figure18.dwg

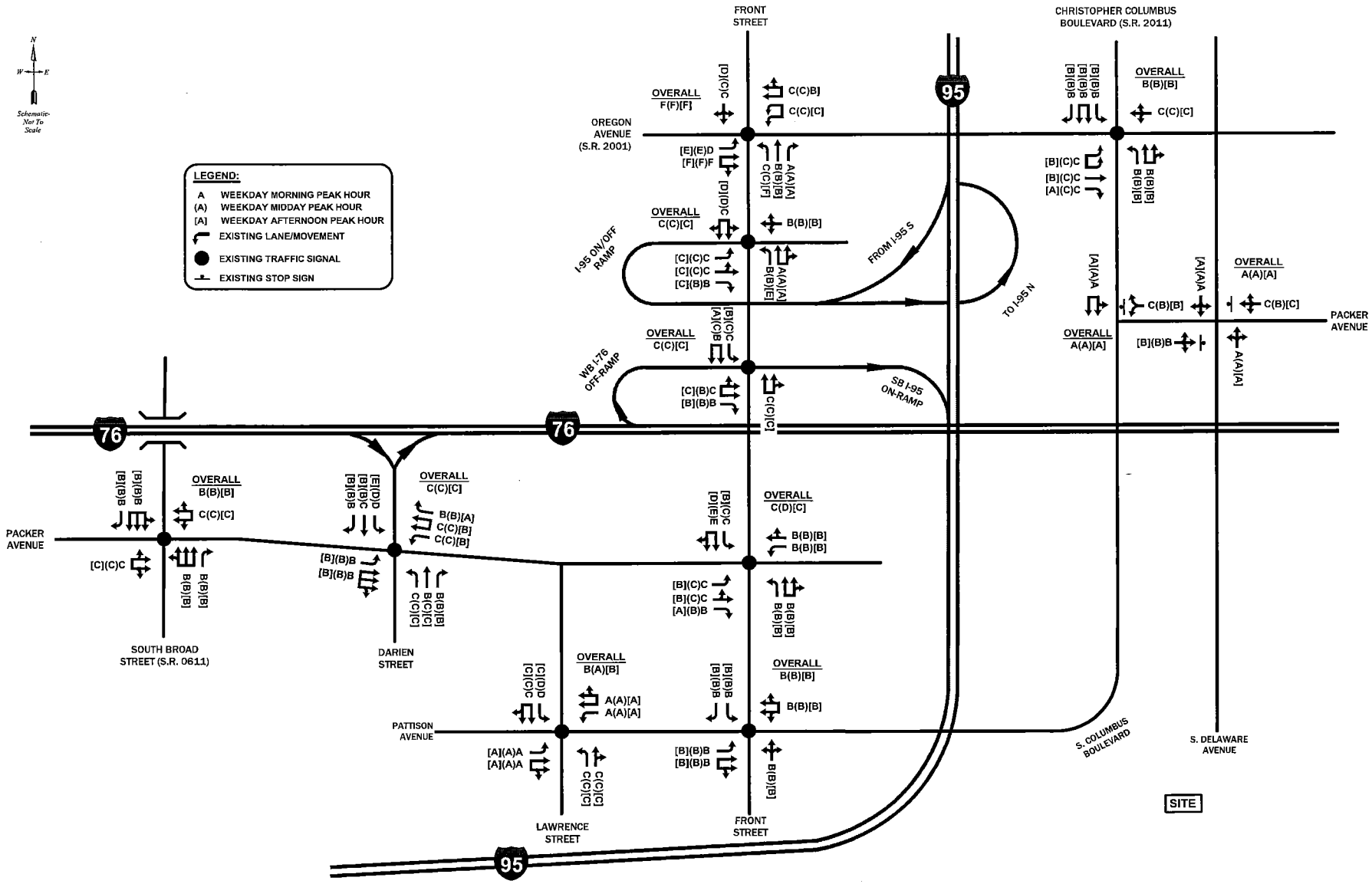

FIGURE 19

2014 Future Levels of Service without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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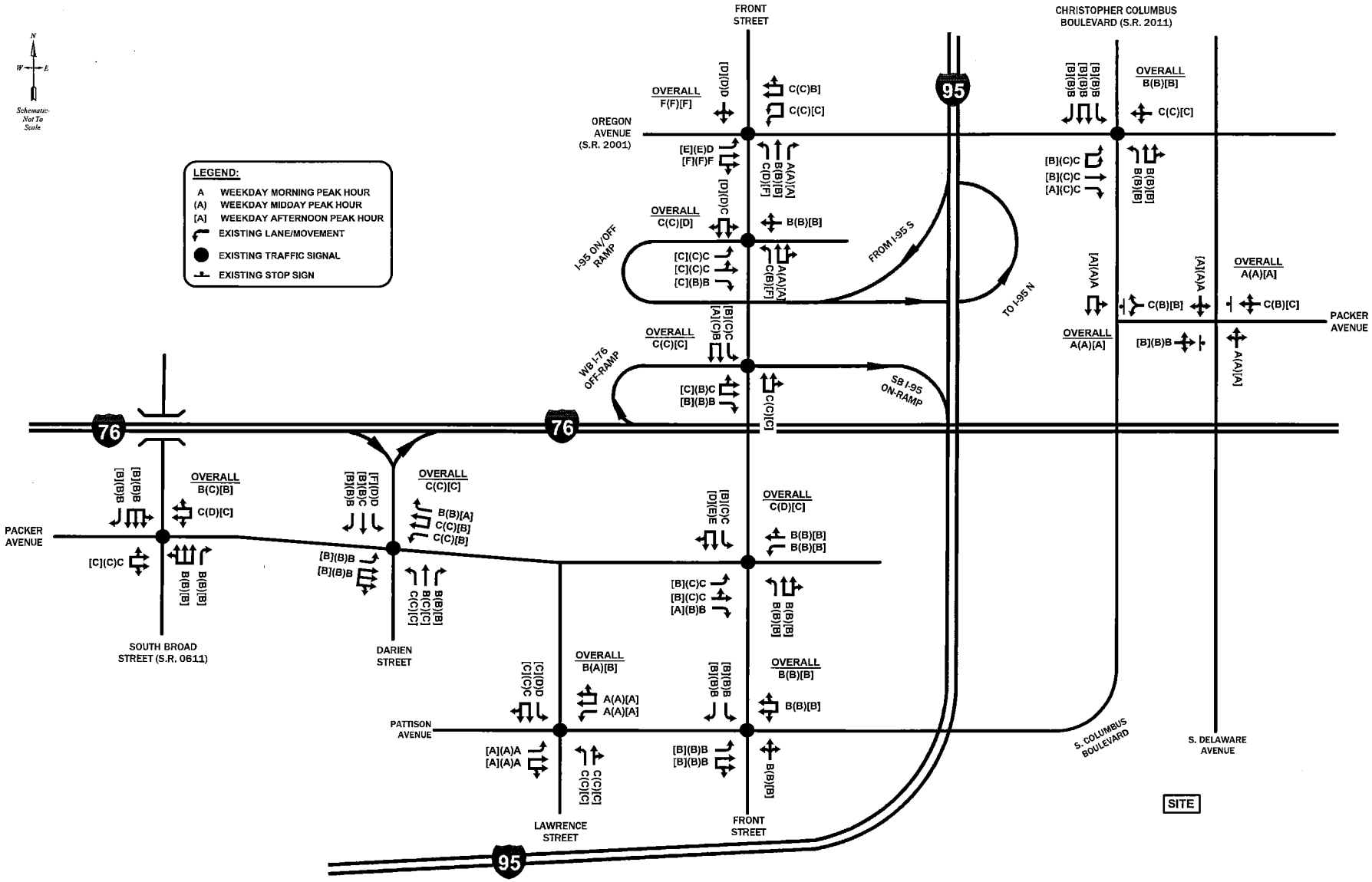

FIGURE 20

2024 Future Levels of Service without Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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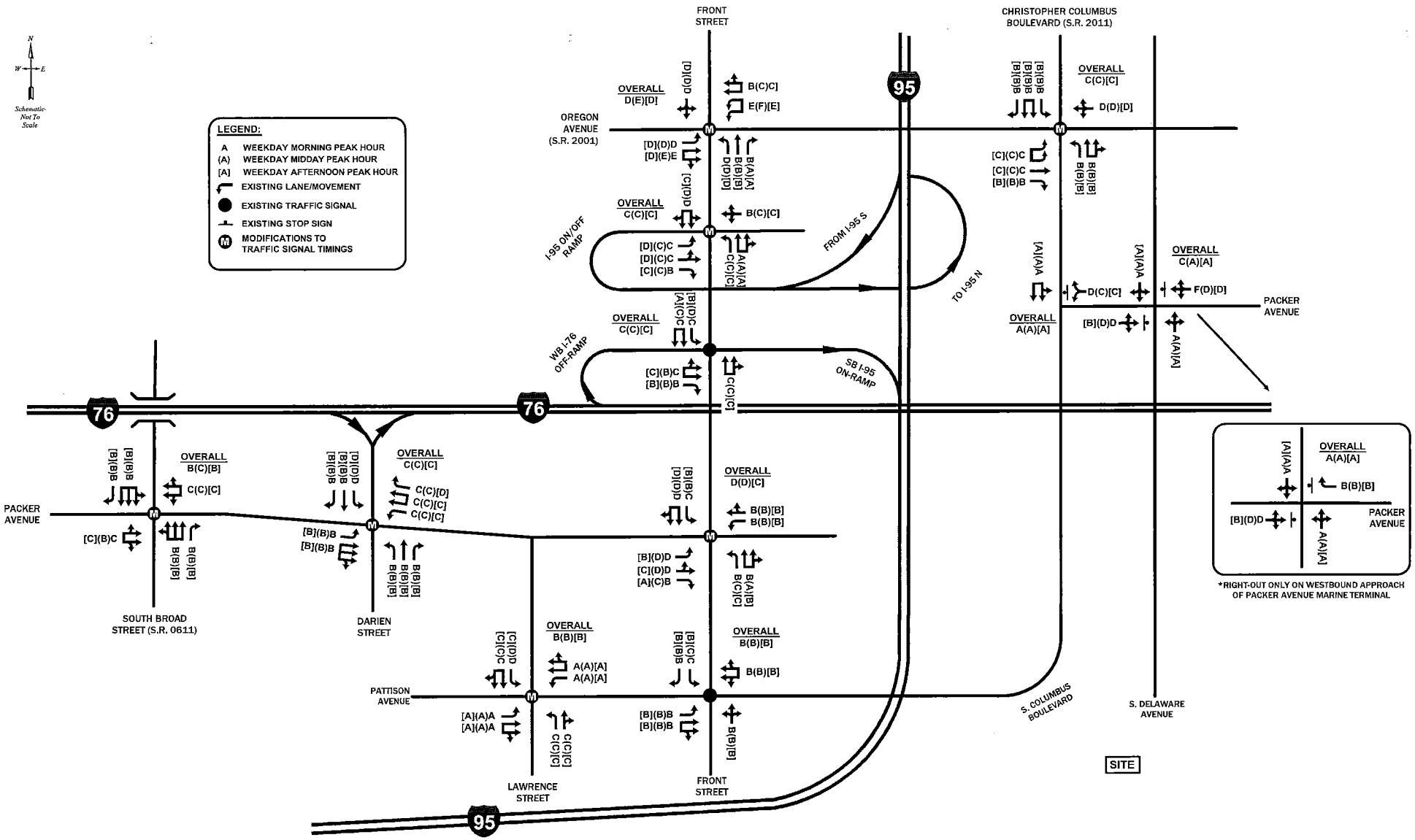

FIGURE 21

2014 Future Levels of Service with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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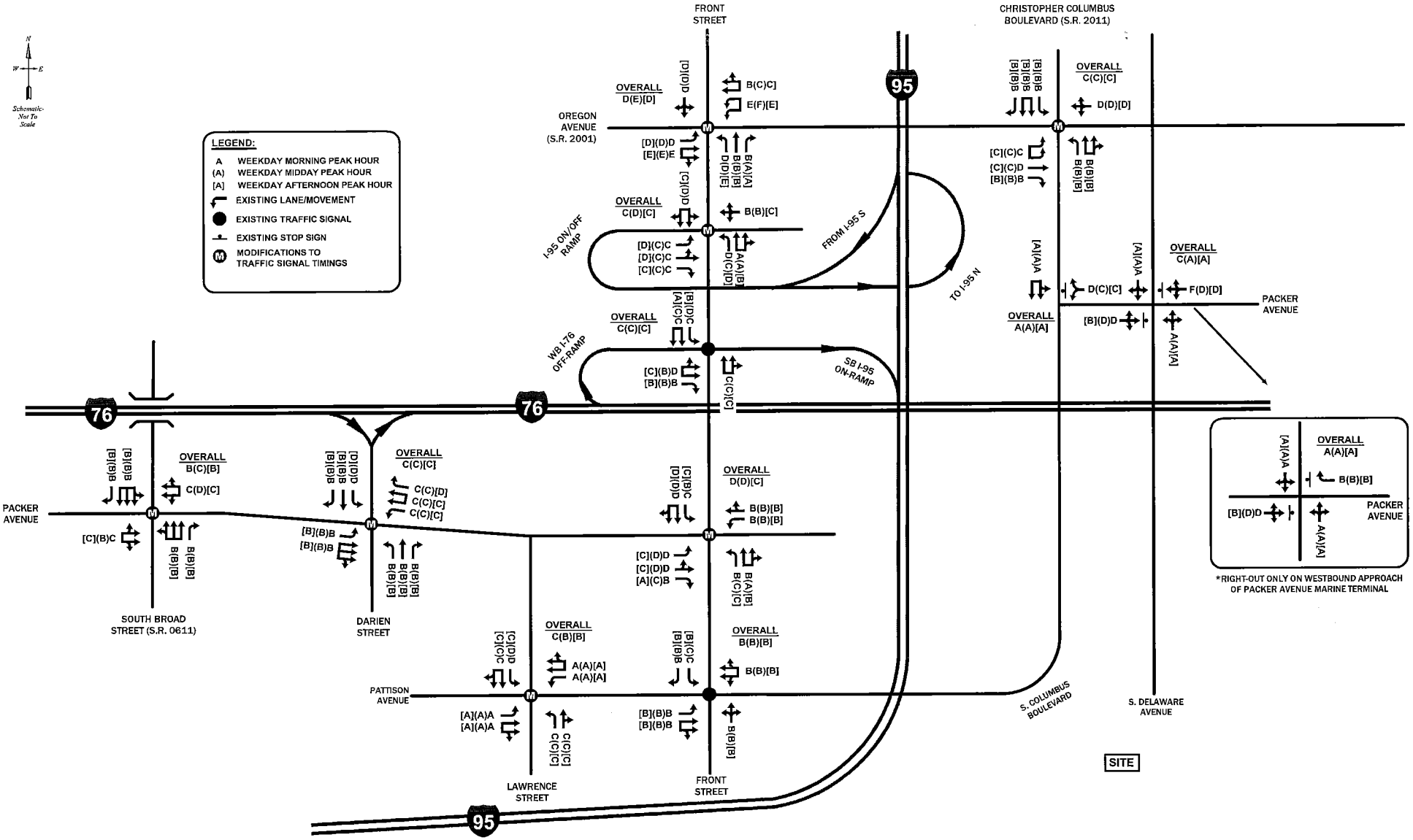

FIGURE 22

2024 Future Levels of Service with Development

PROPOSED SOUTHPORT DEVELOPMENT PROJECT

CITY OF PHILADELPHIA, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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APPENDIX J

AIR EMISSIONS

Southport Development Project
Summary Emissions From Proposed Action

Emissions During Construction

Activity	Emissions (tpy)						
	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	CO_{2eq}
Construction	59.3	23.3	4.2	28.1	9.0	1.8	8,500
Dredging	66.4	5.5	2.5	3.6	3.5	0.033	3,510
Traffic	7.8	1.9	0.56	0.29	0.22	0.024	2,571
Asphalt Paving	0.0	0.0	56.0	0.0	0.0	0.0	0.0
Generators	2.2	0.79	0.16	0.19	0.18	7.04E-04	467
Total for each year of construction (2 years total)	**67.8**	**15.8**	**31.7**	**16.1**	**6.5**	**0.92**	**7,524**

Note: CO_{2e} is in short tons per year

Philadelphia-Wilm., PA-NJ-DE PM2.5 Nonattainment Area Emissions (9 County Area)[a]

PM2.5 Nonattainment Area	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Total Annual Emissions (tpy)	**217,589**	**208,568**	**1,196,149**	**80,553**	**19,566**	**111,726**

Phil.-Wilm.-Atlantic City, PA-NJ-MD-DE Ozone Nonattainment Area Emissions (18 County Area)[a]

Ozone Nonattainment Area	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Total Annual Emissions (tpy)	**325,070**	**321,782**	**1,738,144**	**114,876**	**33,833**	**194,480**

Philadelphia-Wilm., PA-NJ-DE PM2.5 Nonattainment Area Emissions (9 County Area)

During Construction	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Percent of Area Emissions	0.015%	0.033%	0.001%	0.020%	0.033%	0.001%

Phil.-Wilm.-Atlantic City, PA-NJ-MD-DE Ozone Nonattainment Area Emissions (18 County Area)

During Construction	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Percent of Area Emissions	0.010%	0.021%	0.001%	0.014%	0.019%	0.000%

Notes:

a Source: USEPA AIRData; Emissions come from an extract of USEPA's National Emission Inventory (NEI). Data for year 2002 were extracted from the NEI final version August 2008. NEI is an emissions database developed by USEPA, 2002 is the latest year of emissions available. http://www.epa.gov/air/data/geosel.html

Loading Excavated Material to Trucks and Truck Dumping

	M (moisture content)	U (mean wind speed)	k_{PM10} (particle size multiplier)	$k_{PM2.5}$ (particle size multiplier)	Mass Soil Excavated (ton/yr)	Emission Rates	
						PM_{10} (ton/yr)	$PM_{2.5}$ (ton/yr)
Fugitive Dust	3.4	8.0	0.35	0.11	23,773	**0.012**	**3.67E-03**

Construction

	Acres	d (duration of project, months)	EF (PM_{10}/acre/month)	EF ($PM_{2.5}$/acre/month)	Emission Rates	
					PM_{10} (ton/yr)	$PM_{2.5}$ (ton/yr)
Fugitive Dust	50	4.3	0.11	0.023	**23.9**	**5.0**

Equipment Operation (Exhaust Emissions)

Type	Estimated Hours of Operation (hr/yr)	Modeled Equpment Type	Emission Factor (lb/hr)						
			VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Dump Truck - Offroad	10,200	Off-highway Trucks (diesel)	0.23	4.0	1.4	0.23	0.22	0.11	546
Large Crane - 250 ton	2,600	Diesel Crane	0.062	0.91	0.24	0.049	0.047	0.025	117
Small Crane - 30 ton	6,800	Diesel Crane	0.062	0.91	0.24	0.049	0.047	0.025	117
Excavator	3,600	Excavators (diesel)	0.057	0.76	0.33	0.063	0.062	0.025	121
Bulldozer	14,800	Crawl Tractors/ Dozers (diesel)	0.089	1.3	0.56	0.093	0.091	0.038	182
Backhoe	12,800	Tractors/Loaders/ Backhoes (diesel)	0.053	0.27	0.25	0.040	0.039	6.17E-03	28.7
Grader	38,800	Grader (diesel)	0.069	0.89	0.34	0.070	0.068	0.030	143
Offroad Forklift	6,200	Forklift (diesel)	0.037	0.42	0.27	0.044	0.042	0.012	54.0
Roller	400	Rollers (diesel)	0.041	0.49	0.27	0.045	0.044	0.014	67.1
Sweeper	400	Sweepers/ Scrubbers (diesel)	0.028	0.35	0.13	0.026	0.025	0.011	50.5
Utility Van	800	Off-highway Trucks (diesel)	0.23	3.95	1.4	0.23	0.22	0.11	546
Delivery Van/Truck	800	Off-highway Trucks (diesel)	0.23	3.95	1.4	0.23	0.22	0.11	546
Cement Pumper Truck	600	Off-highway Trucks (diesel)	0.020	0.18	0.084	0.015	0.014	3.74E-03	16.5
Asphalt Paver	400	Paver (diesel)	0.049	0.62	0.30	0.053	0.052	0.019	88.9

Equipment Operation (Exhaust Emissions Continued)

Type	Emissions (tons/yr)						
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Dump Truck - Offroad	1.2	20.2	7.2	1.2	1.1	0.58	2,783
Large Crane - 250 ton	0.081	1.2	0.31	0.063	0.061	0.032	151
Small Crane - 30 ton	0.21	3.1	0.81	0.17	0.16	0.083	396
Excavator	0.10	1.4	0.59	0.11	0.11	0.046	217
Bulldozer	0.66	9.6	4.1	0.69	0.67	0.28	1,348
Backhoe	0.34	1.7	1.6	0.26	0.25	0.039	183
Grader	1.3	17.3	6.6	1.4	1.3	0.58	2,771
Offroad Forklift	0.12	1.3	0.84	0.14	0.13	0.036	168
Roller	8.11E-03	0.10	0.053	9.10E-03	8.82E-03	2.86E-03	13
Sweeper	5.59E-03	0.070	0.026	5.12E-03	4.97E-03	2.16E-03	10
Utility Van	0.093	1.6	0.56	0.092	0.089	0.045	218
Delivery Van/Truck	0.093	1.6	0.56	0.092	0.089	0.045	218
Cement Pumper Truck	5.92E-03	0.053	0.025	0.0045	4.24E-03	1.12E-03	4.9
Asphalt Paver	9.87E-03	0.12	0.059	0.011	0.010	3.77E-03	17.8
Totals	**4.2**	**59.3**	**23.3**	**4.2**	**4.0**	**1.8**	**8,500**

Dredging Operations	Count	Marine Vehicle kW/hr - Propulsion	Kw/hr - Aux	Operating with Propulsion Engines	Operating with Auxilliary Engines	Average kW	LF
Dredges	2	1,531	214	2,000	2,000	873	31%
Tugs	4	1,540	100	1,169	1,371	763	31%

Dredging Operations	Emission Factors (g/kWhr)								
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	N_2O	CH_4
Dredges	0.50	13.2	1.1	0.72	0.70	0.0065	690	0.020	0.090
Tugs	0.50	13.2	1.1	0.72	0.70	0.0065	690	0.020	0.090
Dredging Operations	**Emission (tons/yr)**								
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	N_2O	CH_4
Dredges	1.2	31.5	2.6	1.7	1.7	0.015	1,644	0.048	0.21
Tugs	1.3	34.9	2.9	1.9	1.8	0.017	1,825	0.053	0.24
Totals	**2.5**	**66.4**	**5.5**	**3.6**	**3.5**	**0.033**	**3,470**	**0.10**	**0.45**

SO_2 Emission factors are based on specific fuel sulfur content. (1.5%) and adjusted for 2008 NonRoad Diesel for Locomotives and Marine (NRLM) = 500 ppm

		Emission Factors (g/mi)[a]							Emission Rate (tpy)						
On-Road Vehicle Type	**Miles traveled per yr**	**NO_x**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**NO_x**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**
Auto Vehicle	946,500	0.720	11.750	0.7935	0.0250	0.0114	0.0095	515.0	0.75	12.3	0.83	0.026	0.012	0.010	537
Cement Truck	144,000	4.280	1.058	0.3085	0.1584	0.1222	0.0132	1415.1	0.68	0.17	0.049	0.025	0.019	2.10E-03	225
Dump Truck	1,504,000	4.280	1.058	0.3085	0.1584	0.1222	0.0132	1415.1	7.1	1.75	0.51	0.26	0.20	0.022	2,346
								Totals	**7.8**	**1.9**	**0.56**	**0.29**	**0.22**	**0.024**	**2,571**

Generator Hours	**Generator Rating (hp)**	**Load Factor**	Emission Factors (g/hp-hr)							Emission Rate (tpy)						
			NO_x	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**NO_x**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**
9,600	141	0.59	2.5	0.90	0.18	0.22	0.21	8.00E-04	530.5	**2.2**	**0.79**	**0.16**	**0.19**	**0.18**	**7.04E-04**	**467**

		Emission Factors (lb/ft^3 asphalt)[b]							Emission Rate (tpy)						
Asphalt Paving Area (ft^2)	**Amount Asphalt Used (ft^3)**	**NO_x**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**NO_x**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**
2,178,009	544,502	0.0	0.0	2.06	0.0	0.0	0.0	0.0	**0.0**	**0.0**	**56.0**	**0.0**	**0.0**	**0.0**	**0.0**

VOC Emissions from Asphalt Evaporation (AP-42)

Density of Asphalt	68.56	lb/ft^3
Volume Percent of Asphalt which Evaporates	3	%
Depth of asphalt paving	3	inches

Notes:

a See vehicle emission calculations for description of Mobile6 emission factors used.

b It was assumed that emulsified (Grade E-3) rapid setting (cationic) asphalt will be used. If emulsion grades E-1 and E-2 are used then VOC emissions would be negligible.

Construction Total Summary (tpy)

VOC	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**N_2O**	**CH_4**	**CO_{2e}**
63.5	**136**	**31.6**	**32.2**	**12.9**	**1.8**	**15,007**	**0.10**	**0.45**	**15,048**

APPENDIX K

MITIGATION

Figure 1	Southport Marine Terminal Concept Plan Final Phase (G-5)
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Figure 4	Wetland/Water Mitigation Creation and Enhancement Areas Former Jack's Marina
Figure 5	Habitat and Grading Plan Jack's Marina

FINAL

MITIGATION PLAN
WETLAND, OPEN WATER, AND
SENSITIVE SPECIES MITIGATION PLAN

SOUTHPORT DEVELOPMENT PROJECT

PHILADELPHIA, PA

Prepared for:

PHILADELPHIA REGIONAL PORT AUTHORITY

3460 N. Delaware Avenue

Philadelphia, PA 19134

DECEMBER 2012

Prepared by:

Weston Solutions, Inc.

1400 Weston Way

West Chester, Pennsylvania

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ATTACHMENT 1: RECENT MITIGATION PLAN REPORTS

1.A Arsenault, J. 2010. Submerged Aquatic Vegetation Survey; A Study Completed for the Neshaminy State Park Area, Bucks County, Pennsylvania.

1.B Arsenault, J. 2011. Neshaminy State Park & Jack's Marina Vascular Plant Survey.

1.C Herpetological Associates, Inc. 2011. Phase I Habitat Assessment for Redbelly Turtle, Southern Leopard Frog, New Jersey Chorus Frog, and Northern Cricket Frog, and Phase II Nest Surveys for Redbelly Turtle at the Southport Wetland Mitigation Project, Neshaminy State Park, Berwyn Township, Bucks County, Pennsylvania.

1.D Louis Berger Group, Inc. 2010. Southport Development Project, Neshaminy State Park and Jack's Marina Wetland Mitigation, Bensalem and Bristol Townships, Bucks County, Pennsylvania; Phase 1A Cultural Resources Assessment.

1.E Normandeau Associates, Inc. 2010. Fish and Benthic Macroinvertebrate Survey in Neshaminy Creek, Bucks County, Pennsylvania in October 2010.

1.F Normandeau Associates, Inc. 2010. Response to Regulatory Agency Concerns about Shading of Aquatic Habitat at the Proposed Southport Development Project.

1.G Normandeau Associates, Inc. 2010. A Comparison of Fish Assemblage and Habitat: Southport Development Project and Lower Tidal Neshaminy Creek.

1.H Normandeau Associates, Inc. 2010. Essential Fish Habitat Assessment at the Southport Development Project.

1.I Normandeau Associates, Inc. 2010. A Biological Assessment of Shortnose Sturgeon (Acipenser brevirostrum) and Atlantic Sturgeon (Acipenser oxyrinchus) Populations in the Upper Tidal Delaware River: Potential Impacts of the Southport Development project.

1.J Weston Solutions, Inc. 2010. Draft Wetland, Open Waters and Sensitive Species Mitigation Plan; Southport Development Project, Philadelphia, PA.

1.K Weston Solutions, Inc. 2011. Site Characterization Activities at Jack's Marina and Neshaminy State Park, Neshaminy, Pennsylvania.

ATTACHMENT 2: REPORTS FROM PRIOR PROPOSED DEVELOPMENT AT JACK'S MARINA.

CD ROM ENCLOSED CONTAINS PDF COPIES OF THIS MITIGATION PLAN, FIGURES, AND APPENDICES. HARD COPIES OF APPENDICES ARE AVAILABLE UPON REQUEST.

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LIST OF ACRONYMS

AST	aboveground storage tank
bgs	below ground surface
CDF	confined disposal facility
CENAP	U.S. Army Corps of Engineers, Philadelphia District
CWA	Clean Water Act
cy	cubic yard
DCNR	Department of Conservation and Natural Resources
DGS	Department of General Services
DRCC	Delaware River City Corporation
DRWC	Delaware River Waterfront Corporation
EA	Environmental Assessment
ECP	Environmental Condition of Property
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	floor area ratio
FEMA	Federal Emergency Management Agency
ft	feet, foot
ft^2	square feet, foot
GIS	geographic information system
GPS	global positioning system
JD	jurisdictional determination
JM	Jack's Marina
JPA	Joint Permit Application
KIPC	Keystone Industrial Port Complex
MHW	mean high water
MLW	mean low water
MLLW	mean lower low water
MTBE	methyl tert-butyl ether
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act

LIST OF ACRONYMS (CONTINUED)

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSP	Neshaminy State Park
PADEP	Pennsylvania Department of Environmental Protection
PDE	Partnership for the Delaware Estuary
PEC	Pennsylvania Environmental Council
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PHL	Philadelphia International Airport
PHMC	Pennsylvania Historical and Museum Commission
PIDC	Philadelphia Industrial Development Corporation
PNDI	Pennsylvania Natural Diversity Inventory
PRPA	Philadelphia Regional Port Authority
PWD	Philadelphia Water Department
RMG	rail-mounted gantry
RMP	Resource Management Plan
RTE	rare, threatened, or endangered species
RTG	rubber-tire gantry
SAV	submerged aquatic vegetation
SSA	sole source aquifer
TEU	twenty-foot equivalent unit
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
WRD	Waterfront Redevelopment District
WESTON®	Weston Solutions, Inc.

1. INTRODUCTION

The Commonwealth of Pennsylvania ("Commonwealth"), acting through the Department of General Services (DGS), and the Philadelphia Regional Port Authority (PRPA), an independent agency of the Commonwealth, are proposing to develop a new marine terminal (Southport) to be located in the City of Philadelphia, PA. The proposed Southport Terminal site **(Figure 1**) extends along the Delaware River, from the east end of the former Philadelphia Naval Shipyard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal.

Wetlands and other waters regulated under federal and state law will be impacted from the proposed Southport project, requiring compensatory mitigation. A draft mitigation plan was included with the July 2010 Joint Permit Application (JPA) and Environmental Assessment (EA), which was submitted to the U. S. Army Corps of Engineers (USACE) Philadelphia District (CENAP) and the Pennsylvania Department of Environmental Protection (PADEP) Southeast Region. A copy was also submitted to the Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Game Commission (PGC), PA Department of Conservation and Natural Resources (DCNR), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and U.S. Environmental Protection Agency (EPA). This plan was prepared following the format prescribed by CENAP and the EPA guidance "Compensatory Mitigation for Losses of Aquatic Resources, Final Rule." The JPA and the mitigation plan included therein demonstrated that the federal and state standards for determining mitigation (avoidance, minimization and compensation) requirements for impacts to wetlands and other waters were substantively met.

A detailed compensation plan was provided to offset unavoidable impact to regulated wetlands, waters and sensitive habitats and species resulting from implementation of the Southport project. For the purpose of discussing avoidance measures and mitigation at the Southport site, the Southport project footprint is divided into two areas: (1) The land development of the terminal facility, including pile-supported wharves along the north and east edge of the site; and (2) the 38.33-acre dredging footprint (berthing area or dredged template) east of the facility between the wharf edge and the existing Delaware River federal navigation channel.

The proposed mitigation included two primary components: (1) design considerations at the Southport site to minimize the loss of deep water habitat and (2) compensation at the abandoned

Jack's Marina (JM) adjacent to Neshaminy State Park (NSP) for impacts to Southport's terrestrial wetland (non-tidal and tidal) and shallow water habitats. The JM mitigation site is located at the confluence of the Delaware River and Neshaminy Creek approximately 20 river miles upstream from the Southport site.

1.1 SUMMARY DESCRIPTION OF RESPONSE TO COMMENTS

The Revised Mitigation Plan (Response to Comments) addresses agency comments on the proposed mitigation for the Southport Development project submitted with the July 2010 JPA. The revised mitigation plan has been prepared to support the Draft Final EA (Fall 2012) and relevant sections of the revised mitigation plan have been updated accordingly. The most significant changes are regarding The proposed layout of the wetland mitigation site was reconfigured to reflect a configuration entirely within Jack's Marina (JM) and further detail is provided on the avoidance, minimization, and compensation at Southport. The revised mitigation plan includes all relevant sections from the July 2010 Mitigation Plan and is intended to be as comprehensive and consistent as possible. Also significant is PRPA, an independent agency of the Commonwealth of PA obtaining ownership of all real estate within the footprints of the Southport Site and wetland mitigation site.

Numerous studies have been conducted and subsequent reports have been prepared to support mitigation efforts for the Southport Development project and selected wetland mitigation site (JM). Many were completed specifically to address comments received on the draft EA during fall 2010 This includes ecological and environmental surveys conducted at both NSP and JM in 2010 (Arsenault, 2010, 2011; Herpetological Associates, Inc., 2011; Normandeau Associates, Inc., 2010a; Weston Solutions, Inc., 2011) to further characterize the preferred wetland mitigation site and in response to a Pennsylvania Natural Diversity Inventory (PNDI) review. In general, the results of these surveys support previous investigations of these sites. Copies of these reports and additional supporting documents are provided in Attachment 1, which is presented on the CD accompanying this document.

Some of the key comments addressed in this revised mitigation plan include:

- Compensating for the loss of wetland/water resources at a 1:1 creation-to-loss ratio;

- Demonstrating that the preservation and enhancement of existing intertidal and aquatic habitat at JM is a primary component of the proposed mitigation;
- Maximizing intertidal area at JM to include more mudflat habitat;
- Enhancing existing habitats (upland, intertidal and subtidal) at JM;
- Addressing comments related to fish habitat and mitigation at both the Southport site following construction and the JM site (such as minimal environmental benefit to fisheries under pile-supported wharves at Southport);
- Considering potential for site contamination at JM from past use of the property.

Site investigations (environmental/soil borings) conducted by Weston Solutions, Inc. (WESTON®) (2011) determined that soils sampled at JM and NSP met PADEP clean fill guidelines. Based on these findings, the estimated net cut for proposed mitigation at JM (current estimate of grading materials) can be reused as fill at the Southport site. No soils from NSP will be excavated or graded as part of the mitigation plan.

Subsequent to the submission of the JPA, the applicant recalculated the size of some regulated habitats (intertidal, subtidal and deep water) at the Southport site using updated topographic survey and bathymetry data and more accurate regulatory definitions of wetland categories and Waters of the United States. This resulted in some adjustments to the size of regulated area categories (e.g., tidal, subtidal and deep water). In addition, impacts to the southern shoreline area that would result from the proposed bank stabilization were reassessed and preservation of habitat was maximized. The resultant minimization and avoidance at Southport in combination with mitigation at JM results in a net mitigation credit of over 2 acres. The acreages of the impacts, avoidance and minimization at Southport, mitigation credits, and net benefit at JM are shown in **Table 1**. Further description of the valuations in this table is presented in Sections 5 through 7.

Table 1

Impacts and Mitigation
Southport Marine Terminal and
Jack's Marina

Refer to Figures 2 and 3 for graphic delineation of Areas A through F and impacts at the Southport Site and Figure 5 for graphic delineation of the mitigation areas at Jack's Marina.

Habitat/Location	SOUTHPORT				SOUTHPORT		Total
	Impacts				Retained/Created		
	Permanent vs. Temporary				Subaqueous Habitat Remaining After Temporary Impacts by Creation/Retainage of Habitat [b]		Net Loss
	Existing Habitat Type (Acres)	Permanent (Convert to Upland or non-habitat)	Temporary (Remain as habitat areas)	Total Impacts (A)	Habitat Type Retained/Created	Total Acres (B)	
Intertidal	**5.88**	**2.79**	**3.09**	5.88 a	**Total Intertidal**	**1.60** c	**-4.28**
Area A (North Pile Wharf)	0.11	0.11	0.00				
Area B (North Bulkhead Fill)	1.74	1.74	0.00				
Area C (East Wharf)	1.62	0.00	1.62				
Area D (Southeast Site Fill)	0.65	0.65	0.00				
Area E (South Shore Stabilization)	1.03	0.29	0.74		Intertidal Habitat retained by South shore rip-rap	0.87	
Intertidal Stormwater Channel	**0.73**	0.00	0.73		Intertidal habitat retained by stormwater channel relocation.	0.73	
Subtidal	**7.10**	**4.20**	**2.90**	7.10 d	**Total Subtidal**	**1.75** c	**-5.35**
Area A (North Pile Wharf)	0.89	0.00	0.89				
Area B (North Bulkhead Fill)	3.31	3.31	0.00				
Area C (East Wharf)	0.54	0.00	0.54				
Area D (Southeast Site Fill)	0.60	0.60	0.00				
Area E (South Shore Stabilization)	1.53	0.29	1.24		Subtidal habitat retained by South shore rip-rap	1.75	
Area F (Dredged Template)	0.23	0.00	0.23		Subtidal (0.23 AC) converted to Deep water included below.		
Deep Water	**42.81**	**1.09**	**41.72**	42.81	**Total Deepwater**	**42.24**	**-0.57**
Area A (North Pile Wharf)	0.21	0.00	0.21		Deep water retained under North Wharf	0.63 e	
Area B (North Bulkhead Fill)	0.00	0.00	0.00				
Area C (East Pile Wharf)	1.93	0.00	1.93		Deep water retained under East Wharf	2.44 e	
Area D (Southeast Site Fill)	0.80	0.80	0.00				
Area E (South Shore Stabiilization)	1.77	0.29	1.48		Deep water Habitat retained by South Shore Revetment	0.84 c,e	
Area F(Dredged Template)	38.10	0.00	38.10		Deep Water in Dredge Template post-Develop	38.33	
Uplands	**0.80**	**0.80**	**0.00**	0.00 f	**Total Uplands**	**0.00** f	**0.00**
Area C (East Pile Wharf)	0.80	0.80	0.00				
Isolated Freshwater Wetlands	**3.75**	**3.75**	**0.00**	3.75	**Total Freshwater Wetlands**	**0.00**	**-3.75**
TOTAL	**60.34**	12.63	48.44	**59.54**		**45.59** g	**-13.95**

a Includes 0.20 acres of emergent wetland in Area B

b Some subaqueous habitat temporarily impacted will be converted to either forms of subaqueous habitat.

c Includes the proposed stormwater channel(channel considered waters of the Commonwealth)relocation and South Shoreline Stabilization. Note the revetment slopes a 3:1 from developed grade elevation 11.4' NAVD down to existi

d Impacts include 1.08 acres of SAV. Creation of 3.25 acres of SAV will be actively established within the proposed sub-tidal habitat at Jack's Marina to attain a 3:1 compensation ratio.

e Pile construction of Southport wharfs on north and east boundaries and revetment along south shoreline will provide 3.91 acres of deepwater habitat: 0.63 acres at North Wharf (915' x 30'); 2.44 acres at East Wharf (2128' x 50'); and 0.84 acres along southern revetment. Becuase of flushing and refracted light penetration nearest the wharf face, viable habitat exists 30' from riverward the edge of the north wharf and 50' from the edge of the east wharf. (Normandeau 2010)

f No wetland mitigation is required for take of 0.80 acre upland area under East Wharf because this upland habitat is concrete rip-rap (not subaqueous).

g Furthest landward 20 ft under proposed North Wharf and furthest landward 50 ft under East Wharf (approximately 2.84 acres) is NOT counted as retained valuable subaqueous habitat due to the lack of light penetration.

Table 1
Impacts and Mitigation
Southport Marine Terminal and
Jack's Marina

Refer to Figures 2 and 3 for graphic delineation of Areas A through F and impacts at the Southport Site and Figure 5 for graphic delineation of the mitigation areas at Jack's Marina.

Habitat/Location	JACK'S MARINA						
	Mitigation						Total
		Creation , Restoration & Enhancement w/ ratios (acres)					
	Existing Habitat Type (Acres) (C)	Method (Ratio)	Habitat Type Created (Acres)	Mitigation Credit (Acres) (D)	Total Impacts (A)	Total Credits E= (B + D)	Net Gain/ (Loss) (E - A)
Intertidal	**15.28**	**Intertidal Creation, Enhancement & Restoration**	**22.52**	**10.64**	**5.88 a**	**12.24**	**6.36 b**
Area A (North Pile Wharf)		Restoration: Intertidal Wetlands (1:1)	0.09	0.09			
Area B (North Bulkhead Fill)		Creation: Intertidal Wetlands (1:1) d	5.47 c	5.47			
Area C (East Wharf)		Creation: Intertidal Mudflats (1.1) d	3.30 c	1.67			
Area D (Southeast Site Fill)		Enhancement & Invasives Mgmt. (4:1)	13.65	3.41			
Area E (South Shore Stabilization)		* No Credit for 1.63 AC of existing Intertidal Wetlands	1.63 d	0.00			
Intertidal Stormwater Channel		re-graded and retained as intertidal wetlands					
Subtidal	**4.03**	**Subtidal Creation & Enhancement**	**5.53**	**1.65**	**7.10 e**	**3.41**	**-3.69**
Area A (North Pile Wharf)		Enhancement: Shallow Subtidal (-4.0' to -5.0' NGVD) (4:1)	1.29	0.32			
Area B (North Bulkhead Fill)		Creation: SAV planting (< -5.0' to -7.0' NGVD) (3:1)	3.25 e	1.08			
Area C (East Wharf)		Enhancement: Deep Subtidal (-7.0 to 11' NGVD) (4:1)	0.99	0.25			
Area D (Southeast Site Fill)							
Area E (South Shore Stabilization)							
Area F (Dredged Template)							
Deep Water	**No deep water habitat currently exists within the Jack's Marina mitigation area and no deep water mitigation is planned.**		**0.00**	**0.00**	**42.81**	**42.24**	**-0.57**
Area A (North Pile Wharf)							
Area B (North Bulkhead Fill)							
Area C (East Pile Wharf)							
Area D (Southeast Site Fill)							
Area E (South Shore Stabiilization)							
Area F(Dredged Template)							
Uplands	**16.09**	**Upland Enhancement & Restoration (2:1)**	**7.35 f**	**3.68**	**0.00 g**	**3.68**	**3.68 h**
Area C (East Pile Wharf)		Restoration: Buffer Plantings of Native Species	6.00				
		Enhancement: Redbelly turtle nesting habitat	1.35				
Isolated Freshwater Wetlands		**Enhancement: Planting native tree & shrub species in Buffer**	**Varies**	**0.00**	**3.75**	**0.00**	**-3.75**
TOTAL	**35.40**		**35.40**	**15.97**	**59.54**	**61.56**	**2.02**

a Includes 0.20 acres of emergent wetland in Area B

b Net increase and credits of intertidal (wetland and mudflat) habitat with ratios.

c Impacted intertidal wetland and mudflat areas will be mitigated for at a minimum of 1:1 replacement ratio plus enhancements (e.g., redbellied turtle basking platforms and nesting habitat). No credit claimed for exstin

d South Shoreline Revetment is constructed of irregular rip-rap and replicates existing rocky and porous substrate and minimizes impacts to intertidal and subtidal habitat. Revetment converts more existing deep water habitat to intertidal and subtidal and less intertidal and subtidal habitat is converted to deep water.

e Impacts include 1.08 acres of SAV. Creation of 3.25 acres of SAV will be actively established within the proposed sub-tidal habitat at Jack's Marina to attain a 3:1 compensation ratio.

f Furthest landward 20 ft under proposed North Wharf and furthest landward 50 ft under East Wharf (approximately 2.84 acres) is NOT counted as retained valuable subaqueous habitat due to the lack of light penetratio

g No wetland mitigation is required for take of 0.80 acre upland area under East Wharf because this upland habitat is concrete rip-rap (not subaqueous).

h Mitigation for impacts to terrestrial resources and threatened and endangered species include enhancement for state-listed plant species, planting of native species and redbelly turtle nesting.

Additional mitigation not assigned credits could include single log vanes In relocated stormwater channel, turtle basking platforms, shoreline stabilization, and public access at Jack's Marina, possibly including convertin

1.2 SOUTHPORT PROJECT DESCRIPTION

The proposed Southport containerized cargo terminal would be constructed on approximately 116 acres and would have capacity for 1.34 million containers annually, creating thousands of new, family-sustaining jobs and injecting substantial new business and tax revenue into the regional economy. The project would provide the Port of Philadelphia with the necessary capacity to handle increasing container traffic on the East Coast, including growth associated with the Asian shipping market and the widening of the Panama Canal, as well as alleviate congestion and impending capacity constraints at competing East Coast port facilities. The project would also generate substantial employment and economic opportunities. The Commonwealth has already committed funding toward this project; however, obtaining federal permits necessary for proceeding with certain parts of the project is dependent on completing the National Environmental Policy Act (NEPA) process. It is anticipated that the terminal could begin as early as spring 2013 and could be operational in 2015.

The proposed project includes construction of two berthing areas, the container yard, new access roadway and existing roadway improvements, installation of utilities, construction of various buildings to support the operations of the terminal, dredging of the Delaware River from the new bulkhead line to the limits of the federally maintained navigational channel, and the placement of dredged material in the Fort Mifflin confined disposal facility (CDF) or another permitted dredged material disposal facility. Specific components of the proposed project are listed below:

- Construction of a 2,128-foot (ft) marginal wharf, a utility trench, and pile-supported crane rails to provide two 1,064-ft berths for containerized cargo ships.
- Installation of six electric-powered, post-Panamax container cranes.
- Construction of a container yard that provides approximately 116 acres of developed surfaces (paved and permeable) for the loading, offloading, and storage of containers and trailer chassis.
- Construction/installation of the necessary infrastructure and utilities for a fully operational container yard that can accommodate a planned throughput of approximately 1.34 million twenty-foot equivalent units (TEUs) per year.
- Construction of various buildings and structures to include an administration building, maintenance and repair building, yard operations/crane maintenance and road-ability canopy, driver service building, and gate pedestals and guard booth.

- Relocation of approximately 1,000 ft of an existing tidally influenced stormwater channel.
- Extension of Columbus Boulevard to provide dedicated access to the terminal site.
- Dredging of the Delaware River to -42 ft (40 ft + 2-ft optional overdredge) mean lower low water (MLLW) from the new bulkhead line to the limits of the federally maintained navigation channel. Initially, approximately 1,008,000 cubic yards (cy) of material would be removed from the river bottom, and placement would be at the existing Fort Mifflin CDF or another permitted dredged material disposal facility. The surface area for project dredging is approximately 34 acres with existing depths ranging from -0 to -42 ft MLLW.
- The site developer could dredge to -47 ft (45 ft + 2-ft optional overdredge) MLLW if the Delaware River deepening project is completed and deeper vessels call at the Port of Philadelphia in the future. This additional dredging of the berths would require the removal of approximately 298,000 cy of material. The surface area for project dredging to -47 ft is approximately 38.33 acres and mitigation has been calculated to compensate for this deeper target depth.

1.3 OBJECTIVES

The objective of the revised mitigation plan is to demonstrate that the federal and state standards for determining mitigation and compensation for impacts to wetlands and waterways have been met. In addition, a detailed compensation plan is provided that offsets the unavoidable loss of regulated wetlands and waters and sensitive habitats and species. This plan was prepared following the format prescribed by CENAP and following the EPA guidance "Compensatory Mitigation for Losses of Aquatic Resources, Final Rule."

1.4 PROJECT SITE SELECTION

To assure compliance with NEPA, a project alternatives analysis was undertaken during the preparation of an EA to evaluate all practicable alternatives for the siting of Southport (WESTON, 2010a, 2012). This analysis was undertaken during the permit application processes associated with Section 10 of the Rivers and Harbors Act and 404 of the Clean Water Act (CWA). The analysis was based on the overall purpose of the project and ensures that every attempt has been made to avoid and/or minimize environmental impacts.

Over the years, PRPA and the Commonwealth have conducted a series of comprehensive studies to examine the suitability of lands along the Delaware River for future port development. The purpose of these studies was to provide for the necessary expansion of Port facilities and to enhance the Port's ability to respond to economic opportunities present in the international shipping community. These studies have guided PRPA's master planning process through the identification of specific properties for acquisition and subsequent use. The proposed project site was required to be on the Pennsylvania side of the Delaware River and on land either owned or able to be acquired by PRPA. Additionally, the site needed to be located south of the Walt Whitman Bridge because of the vertical clearance restrictions.

The alternatives analyses, which are described in detail in Chapter 2 of the EA (WESTON, 2010a) prepared for the permit application, considered potential locations, project footprints, and terminal layouts before arriving at the preferred option of the proposed site. After evaluating the existing development along this length of the Delaware River shoreline, it was determined that the proposed Southport project site is the only location that meets the size requirements and is suitable for the development of a marine terminal. Furthermore, the proposed site provides the following benefits:

- Easy deep-water access (with limited dredging) to the existing federal navigation channel (-40 MLLW).
- Two- to four-berth capability.
- Highway connectivity (I-95/ I-76).
- National rail connectivity (adjacent to two intermodal rail yards and three Class I rail operators).
- Consistent with adjacent land use, including the Packer Avenue Marine Terminal. Proposed operations would not interfere with the Philadelphia International Airport (PHL).
- Site development is consistent with the Philadelphia Navy Yard Master Plan, "East Yard" area, prepared by the Philadelphia Industrial Development Corporation (PIDC) in 2004 (PIDC, 2004).

1.5 AVOIDANCE AND MINIMIZATION OF IMPACTS

After selection of the proposed project location, a comprehensive planning and formulation process was conducted in an attempt to minimize impacts to sensitive resources and habitats while optimizing the use of the site. Property boundary constraints, wetlands, intertidal and subtidal habitat, open-water fill, dredging, shoreline limits, road access, and access to the nearby interstate highways were among the factors considered in developing the conceptual site plan. Because container terminals are most efficient when the container yard is the same width as the berthing areas and as deep as possible, it was important to maximize the distance from the river and toward the Norfolk Southern property.

The overall planning analysis ultimately concluded that a two-berth terminal layout, rather than a three- or four-berth layout, would meet the project throughput goal of exceeding 1 million TEUs per year and result in significantly fewer in-water environmental impacts.

In 2009, the Commonwealth contracted the services of Weston Solutions, Inc., to further refine the potential alternatives and prepare the necessary environmental documentation and applications required to obtain permits for the construction and operation of the proposed terminal. Early informal consultations with federal, state, and local regulators discussed potential environmental impacts from constructing the then-preferred alternative, including the amount of in-water fill that would adversely impact intertidal/subtidal habitat along the northern end of the proposed project footprint. Because this type of habitat is now less common along the developed shores of the Delaware River, alternatives were reevaluated using different container alignment and berthing configurations to maximize throughput and reduce the amount of in-water fill. A new preferred alternative (Figure 1 in this document) was developed that reduced the number of berths from three to two, changed the stacked container alignment to a diagonal arrangement, and used rail-mounted gantry (RMG) cranes instead of rubber-tire gantry (RTG) cranes during yard operations, which resulted in significantly less in-water fill. The planning process, which was initiated in 2003, resulted in the selection of the two-berth alternative as the final preferred alternative and demonstrates that all efforts were undertaken to avoid and minimize the proposed project's environmental impacts to the maximum extent practicable.

The two-berth preferred alternative reduces impacts to deep water, subtidal, and intertidal areas by approximately 40%. Non-tidal/isolated wetland impacts would be the same regardless of whether the two- or three-berth alternative is selected. Additionally, the construction of the proposed terminal wharves on pilings along the northern and eastern site boundaries would increase the area of deep (>6.6 ft below MLLW or 9.0 ft [North American Vertical Datum (NAVD 1988)]) water habitat when compared to existing conditions.

The proposed action would require the dredging of approximately 1,008,000 cy of material from the Delaware River to a depth of -42 ft (40 ft + 2-ft optional overdredge) MLLW with the potential that an additional 298,000 cy of material could be dredged to attain -45 + 2 ft as discussed in Section 1.1. The dredging surface area is approximately 34 acres (38.33 acres for -45 + 2-ft depth) and extends from the federal navigation channel to the wharf face of the terminal. The larger dredged area would provide sufficient space and depth for maneuvering and berthing Panamax container ships. All reasonable dredged material placement alternatives were considered during the project planning process. This process has included consultation with CENAP and Pennsylvania Department of Environmental Protection (PADEP) to formulate the project alternatives, including dredged material placement at the Fort Mifflin CDF or another permitted dredged material disposal facility.

2. EXISTING SITE CONDITIONS - SOUTHPORT PROJECT LOCATION

All premises on the Southport project site formerly consisted of marshlands or were part of the Delaware River (WESTON, 2010b). The land was created through filling of the site footprint in the 1900s, altering the entire site's topography and drainage pattern. The western portion of the site contains the buildings and infrastructure used at the former Philadelphia Navy Yard for housing, which is now abandoned. The area to the east of the housing area has been filled to elevations of up to 15 ft in some areas with dredged material, construction rubble, and blasting grit. The area west of the interpier area (Piers 122 and 124) includes a former pistol range and was also filled. The intertidal/water area between the north end of the Navy Yard and sheet piling south of Pier 124 was historically deep water and has gradually filled in through a combination of expansion of the Navy Yard and siltation.

The following summarizes information on the areas impacted from the proposed action requiring mitigation. Refer to the JPA, EA, and attachments for more detailed information. **Figure 2** depicts the location and size of regulated areas within the Southport project footprint potentially requiring mitigation, including delineated areas of intertidal wetland and submerged aquatic vegetation (SAV). The impacts by size and type of habitat based on elevation are presented in **Figure 3**. Net impact is calculated in Table 1 and considers some of the open water areas under the proposed pile supported wharf as avoidance and minimization of impacts.

The site is mostly vegetated and has several distinct vegetation communities that contain species compositions common to disturbed areas:

- Areas of both wetland and upland dominated by common reed (Phragmites australis).
- Upland fields.
- Scattered areas of forest that are mostly associated with shoreline areas.
- Once landscaped, and now overgrown areas within the former Navy Yard housing.
- Mostly unvegetated intertidal and shallow water habitat.

The following summarizes existing site conditions for the Southport project site. More detailed information is found in Section 3 and the appendices of the EA.

2.1 SURFACE WATER AND SITE DRAINAGE

The proposed Southport project is located within the Delaware River watershed. The total drainage area for the project (including upgradient lands) is indeterminate because of the very flat unmanaged terrain surrounding the site but is not likely more than approximately 289 acres. The project site does not contain any natural streams or other drainage features associated with the project footprint.

A stormwater channel traverses the property (conveying stormwater from the Norfolk Southern property) to the north of the former Mustin Field runway and discharges into the Delaware River at the north boundary of the Navy Yard property (Figures 2 and 3). The portion of the channel traversing the site is approximately 0.73 acre and tidal, with flows restricted by a rockpile weir located at the eastern end. Two 10- to 12-inch plastic pipes allow flow though the weir during low tide; the weir is overtopped during high tide.

The total 220-acre drainage area that feeds the tidal stormwater channel includes approximately 47 acres that drain toward the channel from the proposed Southport project area. The remaining 173 acres draining to the stormwater channel are from the upgradient properties located north and west of the property boundary.

Based on existing site topography, an additional 69 acres generate surface runoff from undeveloped areas that drain by sheet flow into the Delaware River or infiltrate groundwater within on-site depressions. In the former Navy Yard housing area, sheet flow stormwater collects in a series of stormwater inlets that are a component of the engineered collection and conveyance system. This system discharges to the Delaware River via three outfalls along the southern site boundary. Other sheet flow from positive drainage may discharge directly to the Delaware River to the south of the slip adjacent to Pier 124 to the north.

2.1.1 Deep Water Habitat

Deep water is defined as depths greater than -6.6 ft MLLW (-9.75 NAVD). These areas exist within the project footprint (Figure 2), extending to waters of the Delaware River, both within the inner-berth area and to the east and south along the project site shoreline. The area of deep water within the terminal upland footprint would be dredged or filled; however, the construction

of the proposed terminal wharves on pilings along the northern and eastern site boundaries would increase the area of deep (>6.6 ft below MLLW) water habitat when compared to existing conditions.

In addition, the proposed action would require the dredging of approximately 35.37 acres to a depth of -42 ft (40 ft + 2-ft optional overdredge) MLLW with the potential that an additional 298,000 cy of material could be dredged to obtain operating depths of -45 + 2-ft overdredge (38.33 acres) and extends from the federal navigation channel to the wharf face of the terminal. It should also be noted that a majority of the deep areas within the dredge template will remain deep habitat after dredging. The existing deep, intertidal, and subtidal areas at the new shoreline location will be retained as subaqueous habitat under the pile supported wharves and the rip-rap revetment, both of which provide a unique and desirable habitat for fish and benthic species (Normandeau, 2010b).

2.2 WETLANDS

The on-site wetlands/waters are associated with the Delaware River watershed and are part of a much larger wetland/water complex on the former Navy Yard and Norfolk Southern property. In general, waters from the site (intrastate waters) flow directly into the Delaware River (interstate waters). The boundaries of the project site wetlands were delineated and surveyed, and a jurisdictional determination (JD) of these wetland and water areas was completed by CENAP in April 2010 (Figure 2). In addition to this report, these wetlands are characterized in the *Wetland and Other Waters Investigation Report* (WESTON, 2010b) and the EA (WESTON, 2010a and provided with the project's JPA and Draft Final EA (Weston 2012a).

2.2.1 Nontidal Freshwater Wetlands

The project site is characterized by a history of land use activities that resulted in the creation of isolated depressions where ponded water and vegetation common to disturbed areas (e.g., common reed) are present. These depressions are assumed to have been formed by the fill placement and site grading, which resulted in a perched water table. During site investigations, six isolated depressions totaling 3.75 acres having wetland characteristics were identified and delineated (flagged) (Figure 2). The presence of hydrophytic vegetation and evidence of wetland hydrologic conditions (standing water, water-stained leaves, adventitious roots) indicate that the

areas function as wetlands. All are considered to be the result of historic site disturbance (fill and grading) related to historic land use. None of the nontidal wetland areas are associated with surface water features, including stormwater management systems. These wetlands have no surface or subsurface water connection to the Delaware River and offer no value to fishery resources of the Delaware River and limited value to wildlife. These wetlands are regulated by USACE based on their proximity to the Delaware River. These wetlands are dominated by invasive species (common reed) and have extremely variable and intermittent hydrologic characteristics. Other vegetation consists of soft rush (*Juncus effusus*), silky dogwood (*Cornus amomum*), and black willow (*Salix nigra*) in some areas (particularly Wetland E, see EA Appendix F) where the size and density of common reed is generally less robust.

2.2.2 Emergent Tidal Freshwater Wetland

An area of emergent intertidal wetland, measuring approximately 0.2 acre, was identified between the northern boundary of the Navy Yard property and a sheet pile area south of Pier 124 (EA Appendix F). The dominant vegetation in this low-marsh area was spatterdock (*Nuphar luteum var. advena*). The intertidal area in this portion of the site extends into mudflats.

2.2.3 Other Intertidal Habitat

The mean high water (MHW) elevation (Section 10 Rivers and Harbors Act jurisdiction) is 3.04 ft NAVD88. The spring high water elevation (Section 404 CWA jurisdiction) is 4.48 ft NAVD88. The tide elevations were derived from National Oceanic and Atmospheric Administration (NOAA) data for the gauging station closest to the site (Philadelphia U.S. Coast Guard [USCG] Station, Station ID: 8545240), located approximately 3 miles upstream. Shallow water zones (extending to 6.6 ft below the MLLW water elevation of -3.15 NAVD88) are present along the Delaware River at the north, east, and south edges of the Southport project site.

North of the Navy Yard the shoreline is a combination of bulkheads and narrow, steep areas characterized by minimal vegetation and construction rubble. There is a larger intertidal zone, primarily characterized by mudflats, between the north end of the Navy Yard and an area of sheet piles south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow, consisting of construction rubble and well-graded stone.

The Delaware River along the Southport project site provides a range of habitats for numerous aquatic species, including benthic invertebrates, finfish, and SAV. The substrate within the affected environment of the Southport project site consists mainly of soft sediments, sand, and cobbles depending on location within the project area. A benthic investigation was conducted by Normandeau Associates, Inc., in October 2003 to evaluate the benthic infaunal community in the vicinity of the Southport project site. The study areas consisted of four interpier areas between the Packer Avenue Marine Terminal and the land that was formerly part of the Philadelphia Naval Shipyard. The eastern edge of the study area ended at the pier lines. Most of the macroinvertebrates present were oligochaete worms. Others included fingernail clams (*Musculium transfersium*), aquatic insects, and the Asiatic clam (*Corbicula fluminea*). The benthic macroinvertebrates found in these interpier areas are nearly identical to communities found throughout the freshwater tidal areas of the Delaware River (Normandeau, 2004). WESTON conducted additional benthic studies in late spring 2010; results have been incorporated into the Southport EA as Appendix C.

Fish habitats in the vicinity of the proposed Southport project include the following:

- Subtidal and intertidal zones along the eastern and southern boundary of the Navy Yard.
- Intertidal marsh, and subtidal areas, with shallow to deep water south of existing Pier 124 and immediately north of the east end of the site extending eastward into the Delaware River.
- The intertidal stormwater channel.

The intertidal marsh and subtidal areas in the interpier areas may be considered ecologically important because of the presence of emergent vegetation and SAV along the shoreline, which may be used by macroinvertebrates as a substrate and by small fish for cover, and the plants are a source of dissolved oxygen for the water. In addition to the emergent vegetation and SAV, the manmade embayment in this location provides calm water for fish common to this habitat type. Refer to the Southport project EA for additional information regarding potential finfish in the vicinity of the project site.

Approximately 1.08 acres of SAV have been identified and mapped in the interpier area. The dominant vascular plant species is *Vallisneria americana* (water celery). An algae, *Chara vulgaris* (musk grass) was also common in this location.

2.3 SOIL

The Web Soil Survey (USDA, 2010) shows Urban Land for the entire Southport area. Urban Land, in general, is soil material that has been disturbed, filled over, or otherwise destroyed prior to construction. The disturbed material is fill that consists of river sediments, gravel, ash, concrete, brick, and sandblast grit (WESTON, 2005). The Urban Land was described by Gannett Fleming (2007) as very gravelly medium- to coarse-grained sand with clay, silt loam, and sandy loam. Most of this land was marsh or open water, but filling operations by the Navy extended the original League Island eastward to its present configuration. This fill material is deeper in the northeastern and eastern portions of the site where tidal marsh and muck soils originally existed and in areas that were previously marshlands, back channels, or part of the river. At depth, the predominant soil type (muck) ranges from 40 to 50 ft below ground surface (bgs). A hard pan layer beneath the muck constitutes the upper confining layer of the Potomac Raritan Magothy (PRM)[1] aquifer system. This was confirmed during the 2009 soil boring effort (WESTON, 2009).

The observed soils in both wetland and upland areas illustrate the history of filling and grading at the site. The site has been used for disposal of dredged material, construction debris, and blasting grit (WESTON, 2009, 2010b). Subsequent to this filling, the Navy developed a portion of the area for family housing and its associated infrastructure.

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[1] The proposed Southport project site falls within the source zone of the New Jersey Coastal Aquifer area. The PRM is recognized by EPA as the "sole or principal source of drinking water" (sole source aquifer [SSA]) for much of central and southern New Jersey. EPA has determined that the aquifer, if contaminated, would create a significant hazard to public health. The aquifer is highly susceptible to contamination through its recharge and streamflow source zones.

2.4 UPLAND HABITAT

2.4.1 Wooded Habitat

Upland communities consist of woodlands and old fields. Limited woodland areas consist of thin stands of young trees with varying undercover species. These wooded areas are primarily limited to the river's edge. The more common tree species include box elder (*Acer negundo*), mulberry (*Morus* spp.), black cherry (*Prunus serotina*), tree of heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*), and black locust (*Robinia pseudoacacia*). Common shrub species include blackberry (*Rubus allegheniensis*), false indigo (*Amorpha fruticosa*), and silky dogwood (*Cornus amomum*).

The old field areas are characterized by a diversity of species mixes consisting of both native and invasive species. Some upland areas are dominated by common reed (*Phragmites australis*) in varying density. Common in these areas are dense stands of Asiatic tearthumb (*Polygonum cuspidatum*). There are fields lacking common reed dominated by areas of warm-season grasses with mixtures of native and invasive species. This includes broomsedge (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), common wormwood (*Artemisia vulgaris*), black knapweed (*Centaurea nigra*), camphor weed (*Heterotheca subaxillaris*), and bush clover (*Lespedeza* spp.). It is within one of these recovering areas where two Pennsylvania endangered species were found by Arsenault, velvety panic-grass *(Panicum scoparium)* and forked rush (*Juncus dichotomus)*. For more detailed information, refer to the EA (WESTON, 2010a), JD, and photographs included with the JPA.

2.4.2 Sensitive Species and Habitat

Certain species of plants and animals are protected by federal and state regulations under the Endangered Species Act (ESA) of 1973, and the Pennsylvania Natural Heritage Program. Lists of the federally and state-designated Rare, Threatened, and Endangered (RTE) species potentially present in the project area (Philadelphia County) are presented in the EA (Table 3-11). These species occur in a wide variety of habitats, including habitat types not present within the project area. The following summarizes the results of RTE surveys for the Southport project site. Detailed results of RTE surveys and agency correspondence relating to RTE are presented in Section 3 of the EA and its appendices.

Federally listed species potentially occurring in Philadelphia County include the threatened bog turtle (*Glyptemys muhlenbergii*), endangered shortnose sturgeon (*Acipenser brevirostrum*), endangered dwarf wedgemussel (*Alasmidonta heterodon*), and threatened small-whorled pogonia (*Isotria medeoloides*). The NMFS also expressed concern over the Atlantic sturgeon (*Acipenser oxyrhynchus*), which is a federal species of concern. The bog turtle, shortnose sturgeon, dwarf wedgemussel, and small-whorled pogonia are also listed as endangered in the Commonwealth of Pennsylvania.

A PNDI Environmental Review was used to search for potential impacts to RTE species within the project footprint. The PNDI search (search ID 20090901208135) results indicated that actions within the Southport project site may impact RTE species. The results of the PNDI search as well as the correspondence between WESTON and the agencies are presented in EA Appendix G.

Further consultation with the following agencies was required because of potential impacts to state-listed RTE species within the Southport project area: PGC, DCNR, and PFBC. These agencies were contacted to obtain further information on RTE species potentially present within the project footprint. Aquatic, wetland, and terrestrial surveys have been conducted (and in some instances are ongoing) to assess the Southport project area for RTE species. Based on these surveys and agency coordination, the following federal and state RTE species have been either identified at the Southport project site or are potentially using the site and adjacent waters seasonally: bald eagle (*Haliaeetus leucocephalus* [state threatened]), endangered shortnose sturgeon (*Acipenser brevirostrum* [federal and state endangered]), redbelly turtle (*Pseudemys rubriventris* [threatened]), eastern mudminnow (*Umbra pygmaea* [potential candidate]), field dodder (*Cuscuta pentagona* [proposed threatened]), bugleweed (*Lycopus rubellus* [endangered]), velvety panic-grass (*Panicum scoparium* [endangered]), and forked rush (*Juncus dichotomus* [endangered]). NMFS also expressed concern over the Atlantic sturgeon (*Acipenser oxyrhynchus*), which is a federal species of concern.

2.5 COMPENSATION AND MITIGATION REQUIREMENTS

Pursuant to federal and state regulatory programs and policies, compensatory mitigation is required to offset unavoidable impacts to wetlands and other waters of the United States, and

documented sensitive species and habitats. A compensatory mitigation plan for the filling of wetlands and other waters, and disturbance of upland habitats for sensitive species is required to be submitted with a JPA and would be a component of the project's wetland permit approval process. The determination of compensatory mitigation requirements was made following significant efforts to avoid and minimize impacts to wetlands and other waters (refer to Section 1.4).

Sections 3 and 4 of the EA provide information regarding the Southport project site's environmental resources. Habitats and regulated areas within the Southport project footprint requiring mitigation include the following:

- Nontidal freshwater wetlands, which are primarily dominated by common reed.
- Intertidal wetlands, mudflat, and subtidal habitat that contain some SAV.
- A tidally influenced stormwater channel.
- Deep water habitat.
- Upland fields containing state-listed plant species.
- Sensitive species' habitats, including the bald eagle nest and redbelly turtle breeding habitat.

Consultation with federal and state agencies has provided the mitigation framework needed to compensate for the unavoidable loss of these valuable resources as well as other sensitive habitats and biota. Compensatory mitigation for the Southport project is provided in a variety of methods: establishment, which includes relocation and creation; restoration; enhancement; and preservation. Based on preliminary discussions with federal and state regulatory and resource agencies, compensatory mitigation ratios (replacement to loss) for impacts to designated wetland/water areas have been initially determined.

USACE – USACE has identified acceptable replacement-to-loss mitigation ratios for impacts to waters of the United States (Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act) from the Southport project. This can include the following ratios.

Habitat	Description	Ratio
Deep water	Depths greater than 6.6 ft NAVD88 below MLLW	1:1
Subtidal.	Water depths between mean low water (MLW) and 6.6 ft below MLLW (-9.75 NAVD88)	1:1
Vegetated tidal		1:1
Mudflat		1:1
SAV		1:1
Tidal stormwater channel		1:1
Nontidal emergent	Common reed dominated	1:1

Other methods of mitigation, including enhancement and preservation, would be negotiated during the permit review process. Compensation for the filling of nontidal, isolated wetlands can include enhancements or the creation of desirable upland buffers in the selected mitigation site. Mitigation for impacts to federally protected species (bald eagle, short-nosed sturgeon, and Atlantic sturgeon) would be coordinated with the appropriate federal agency (see below).

PADEP – PADEP has identified acceptable mitigation for impacts to waters of the Commonwealth (Chapter 105). The mitigation requirements are similar to the USACE guidance (see above) with the following additional considerations: Impacts to documented redbelly turtle habitat shall be at a minimum 1:1 creation-to-loss ratio with additional mitigation required, which can consist of basking platforms, nesting areas, and other enhancements to the mitigation site. Impacts to other state-listed species and sensitive habitats need to be mitigated. The determination of suitable mitigation shall be coordinated with the applicable Pennsylvania resource agency (see below).

USFWS and PGC – In efforts to mitigate potential impact to the existing bald eagle nest, DGS has prepared and submitted to the USFWS, an application for the take of the inactive eagle nest in the Southport project footprint under the Bald and Golden Eagle Protection Act. This application includes proposed measures to provide a net benefit to eagles including habitat mitigation at Marshall Island, a separate site from the wetland mitigation site proposed here. A supplement to the application for take of an abandoned bald eagle nest has been developed and is

being provided to the appropriate resource agencies. It should be noted that routine monitoring of the nest has been conducted since the application was submitted, and no nesting activities have been observed.

NMFS – NMFS recommends that the filling of tidal and deep water areas is mitigated at a minimum 1:1 replacement-to-loss ratio. Mitigation for the loss of SAV areas would be required at a higher ratio, which is yet to be determined. The selected mitigation site and plan would include providing suitable habitat for the impacted (or closely related) fish species. Consultation may be required to assess impacts and mitigation for the shortnose sturgeon and Atlantic sturgeon.

PFBC – Fish surveys have been conducted at the Southport project site and adjacent areas; and no state-listed species have been positively identified. PFBC concerns include the presence of striped bass breeding habitat along the Southport project site's southern and eastern shores. The PFBC has indicated that the selected mitigation site should provide suitable habitat for the species impacted from the proposed action or closely related species present in other areas of the Delaware River. Marshall Island was purchased by PRPA in an agreement of sale, which included a deed restriction for the purpose of mitigating for the former bald eagle nest at Southport.

The redbelly turtle has been observed within the intertidal areas at the north end of the Southport site. Compensatory mitigation would provide redbelly turtle habitat, which can include suitable intertidal habitat and additional features such as basking platforms and nesting habitat. A turtle nesting survey conducted during summer 2010 provided no evidence of upland nesting by redbelly turtles.

DCNR – Four state-listed plant species have been identified and mapped on the Southport project site. DCNR has provided input regarding mitigation for impacting these species. The DCNR recommends collecting and preserving available seed from the on-site species for planting at the approved mitigation site. Suitable habitat for these species would need to be provided at the mitigation site.

3. MITIGATION SITE SELECTION

3.1 CRITERIA

To accompany the component of mitigation that is proposed for implementation at the Southport project site, Weston Solutions, Inc., contracted by DGS and PRPA, searched for suitable mitigation sites within the Pennsylvania coastal zone in Delaware, Philadelphia, and Bucks counties, which comprise Pennsylvania's Delaware River shoreline between the Pennsylvania-Delaware state line and the Trenton-Morrisville (Route 1) toll bridge. The search for appropriate mitigation included the identification of sites located along tidally influenced sections of the Delaware and Schuylkill rivers and their tributaries. Large sites that could accommodate all mitigation needs and are primarily undeveloped or vacant with minimal structures and infrastructure were preferred over small and highly developed parcels. To accommodate between 15 and 20 acres of the estimated impacts at that time to a combination of tidal and nontidal wetland and open-water habitat, DGS and PRPA searched for sites between 30 and 40 acres in size, or those where open water, subtidal and intertidal habitat, and nontidal wetlands existed or could be created. Smaller sites were initially cataloged with the precaution that should a large site not be identified, DGS and PRPA could acquire multiple small sites to achieve the required mitigation.

The Federal Aviation Administration (FAA) encourages landowners, communities, and agencies supporting restoration or enhancement efforts for wetland types that do not increase aircraft-wildlife strike potentials to contact the affected airports to develop cooperative programs to prevent the attraction of any hazardous wildlife and to monitor the sites for any hazardous wildlife attraction or activity (FAA, 2010). In accordance with FAA guidance, potential mitigation sites with specific land uses, including wetlands and mitigation areas located within 5 miles of an airport, are discouraged and require evaluation and coordination per FAA Advisory Circular 150/5200-33B (Hazardous Wildlife Attractions on or Near Airports) (FAA, 2007). Consequently, all sites within this radius were removed from consideration.

3.2 MITIGATION SITE IDENTIFICATION

During a comprehensive search of available aerial photography and various resources available in formats compatible with Geographic Information Systems (GIS), a database containing a total of 46 potential mitigation sites were initially identified within the following four areas:

- Schuylkill River shoreline in Philadelphia - 7 sites.
- Delaware River shoreline from the Pennsylvania-Delaware state line to the Betsy Ross Bridge in Philadelphia - 6 sites.
- Delaware River shoreline from the Betsy Ross Bridge in Philadelphia to the Philadelphia-Bucks County line - 26 sites.
- Delaware River shoreline in Bucks County - 7 sites.

Each of the seven sites along the Schuylkill River shoreline was eliminated from the analysis. Three of the sites exist within 5 miles of PHL. Four of the sites exist above the Fairmount Dam and, therefore, are not subject to tidal influence. In addition to being nontidal, two of the nontidal sites are too small to satisfy the project's mitigation requirements.

Each of the six sites along the Delaware River shoreline from the Pennsylvania-Delaware state line to the Betsy Ross Bridge in Philadelphia was also eliminated from the analysis. Three of the sites exist within 5 miles of PHL. Two of the sites are slated for future development by the Delaware River Waterfront Corporation (DRWC) and the Sugar House Casino (Forkin, 2010). The sixth site is privately owned and is not available for consideration.

Twenty-four of the 26 sites located along the Delaware River shoreline from the Betsy Ross Bridge in Philadelphia to the Philadelphia-Bucks County line were eliminated from the analysis. Nine of the sites were too small to be considered individually for the required mitigation needs. Six of the sites are properties owned by various departments of the City of Philadelphia; all city property that could potentially provide opportunities for mitigation are currently being reserved to satisfy the upcoming needs for the anticipated PHL expansion project (Forkin, 2010). Prior to implementing mitigation plans, six of the sites would require significant site clearing or could potentially require site cleanup and, therefore, are less attractive to DGS and PRPA. Two of the sites are slated for future plans and, therefore, are not available to satisfy the mitigation needs for

the Southport project. The last of the 24 sites eliminated contains functional and valuable intertidal wetland habitat that would potentially be lost as a result of constructing Southport's specific mitigation needs; therefore, it too was eliminated.

The two sites located along the Delaware River shoreline from the Betsy Ross Bridge in Philadelphia to the Philadelphia-Bucks County line that were retained for further investigation include the National Grid property, which is in the city's Bridesburg section, and the former Northern Shipping Company property located at 7777 State Road.

Two of the seven sites located along the Delaware River shoreline in Bucks County were eliminated from the analysis. One of the sites is slated for future plans and, therefore, is not available to satisfy the mitigation needs for the Southport project. The second of the sites is too small to achieve Southport's specific mitigation needs. The following five sites located along the Delaware River shoreline in Bucks County were retained for further investigation:

- Dow Chemical (formerly Rohm & Haas) property, which is located in Bristol Township.
- U.S. Steel Property in Falls Township.
- NSP–West located in Bensalem Township.
- NSP-East located in Bristol Township.
- The former Jack's Marina (JM), which is adjacent to the NSP property in Bristol Township and was previously owned by Newport Landing.

3.2.1 National Grid

3.2.2 Site Description

The National Grid property is bounded by Richmond, Orthodox, and Buckius Streets, and the Delaware River. This is the location of the former Philadelphia Coke Company, which ceased operations in 1982. The property has since been rezoned as part of the City of Philadelphia's Waterfront Redevelopment District (WRD).

3.2.2.1.1 Availability

The Pennsylvania Environmental Council (PEC) and its partners (Delaware River City Corporation [DRCC], Philadelphia Water Department [PWD], NOAA, Partnership for the Delaware Estuary [PDE], and EPA) have initiated a project to develop a viable conceptual design for a new wetland, riparian habitat, and restored upland forest habitat on the neighboring parcel, which will also address opportunities to enhance riparian habitat, existing tidal wetlands, and upland forest habitat on the National Grid property.

In addition, the PEC project will provide a working green buffer alongside a future walking and biking trail that will be a part of the future North Delaware River Greenway system, which will eventually connect to additional trail and greenway segments in Bucks County and in the Central Philadelphia riverfront, thus also completing a major segment of the 3,000-mile East Coast Greenway through Pennsylvania.

The National Grid property, or a portion of this site, has sufficient undeveloped land to potentially satisfy all mitigation needs for the Southport project. However, the proposed extension of Delaware Avenue will divide the site close to the Delaware River, at the approximate location of the railroad, thereby requiring the inclusion of one or several culverts or a bridge to facilitate sufficient tidal exchange to support intertidal wetlands north of Delaware Avenue. Based on PEC's plans for this site, mitigation would be primarily located in the area south of the proposed Delaware Avenue extension and consist primarily of restoration and enhancement. Furthermore, at the request of various state, local, and federal agencies and organizations involved with the future restoration plans for the National Grid property, the site was eliminated as a mitigation option to the Southport project.

3.2.3 7777 State Road

3.2.3.1 Site Description

The property located at 7777 State Road consists of 72 acres bounded by State Road, the Delaware River, and Pennypack Park. This is the location of the former Northern Shipping Company; however, in 2005, the property was rezoned as part of the City of Philadelphia's WRD.

3.2.3.2 Availability

The property at 7777 State Road is available for purchase (Gable, 2010). The property, or a portion of this property, has sufficient undeveloped land to satisfy all mitigation needs for the Southport project. Specifically, following the removal of the 180,000-square-foot (ft^2) building, terminal office building, and the remaining rail car storage and marshalling yard, this site could provide sufficient land (40 acres) along the Delaware River to satisfy required mitigation. Consideration could be given to "linking" the site to the abutting Pennypack Park (incorporate into Park, access to shoreline bulkhead for fishing), including assessing the potential to connect the tidal mitigation to the Delaware River at the southwest corner of the park. Similarly, incorporating the site into the planned North Delaware River Greenway could be considered.

Based upon the acquisition, site preparation, and associated costs that would be required prior to the construction of the mitigation, as well as the potential for encountering additional site contamination during excavation, this site was eliminated as a mitigation option for the Southport project.

3.2.4 The Dow Chemical Property

3.2.4.1 Site Description

The Dow Chemical Bristol Complex, formerly Rohm & Haas Chemical Plant, is located in Bristol, PA, and bounded by Bristol Pike, Railroad Avenue, the Delaware River, and NSP. The northern portion of the site is an industrial chemical plant, which is zoned for manufacturing. The south-central portion of the site directly west of the Burlington-Bristol Bridge is a mixture of tidal emergent wetlands and nontidal wetlands consisting of former treatment lagoons and emergent and forested wetlands. A majority of the wetland areas are zoned for manufacturing use. An undeveloped area, known as Maple Beach, is located in the southeastern section of the property. This area is primarily vacant but contains some small areas that are zoned for residential use.

Maple Beach and other portions of the Dow Chemical site are bounded by 10-ft-high levees to separate the shoreline from the remainder of the property. Federal Emergency Management Agency (FEMA) maps identify this area as being protected from the 100-year flood by levees;

however, the maps also note that the levees could be overtopped by a very large flood or fail in other circumstances (Draft Bristol Township Comprehensive Plan, April 2008).

Two creeks with hydrologic connections to the Delaware River are located on-site: Otter Creek (also referred to as Mill Creek) in the east section of the property and Hog Run Creek in the southwest section of the property. Otter Creek flows for approximately 1 mile from the dam at Silver Lake; under Route 13, Otter Street, and Railroad Avenue; through the property; and into the Delaware River. The tributaries of Hog Run Creek emanate in the area between State and River Roads and join to form Hog Run Creek just north of River Road. Hog Run Creek flows southward through the property and discharges into the Delaware River.

The facility has an approximately 111-acre parcel consisting of a system of former treatment lagoons and wetlands (tidal and nontidal) located west of the Burlington-Bristol Bridge. Mitigation in this area would primarily consist of converting (enhancing) the former treatment lagoons to tidal wetlands. The bottom of these lagoons is at elevations close to the upper tidal range of the Delaware River. Enhancement of these wetlands would involve breaching the dikes and excavation to appropriate depths, a potential low-cost solution given existing elevations. However, a portion of the levee protecting the facility from the 100-year flood would need to be relocated.

3.2.4.2 Availability

The property has sufficient undeveloped land to satisfy all mitigation needs for the Southport project; however, the areas adjacent to Hog Run contain closed landfills on both sides and are not considered suitable for mitigation. Additionally, a portion of the levee protecting the facility from the 100-year flood would need to be relocated. Because of the need to reconstruct new levees, and the potential for encountering additional site contamination during excavation, DGS and PRPA will pursue satisfying mitigation needs at another location, or locations, where there is less risk.

3.2.5 The U.S. Steel Property

3.2.5.1 Site Description

U.S. Steel owns property along the Delaware River in Falls Township and seeks to sell it (Keystone Industrial Port Complex [KIPC]). This includes significant areas of undeveloped property adjacent to the Delaware River. Much of the shoreline is forested and appears to be forested wetlands. There are also unknown environmental concerns associated with portions of the property.

3.2.5.2 Availability

The KIPC has sufficient undeveloped land to potentially satisfy most of the mitigation needs for the Southport project inclusive of wetland enhancement, tidal marsh construction, and other required mitigation. Based on unknown environmental concerns and the time it would take to fully investigate for suitable mitigation site(s), this property was eliminated from further consideration. Therefore, DGS and PRPA will not pursue implementing the Southport project mitigation at the U.S. Steel site.

3.2.6 Jack's Marina and Neshaminy State Park

Some mitigation is proposed at the Southport project site as avoidance and minimization and sustainable development (refer to Sections 5,6 and 7); however, initially, the preferred sites for the implementation of a majority of the mitigation components consisted of sections of NSP and an adjacent former marina referred to as Jack's Marina (JM; **Figure 4**).

3.2.6.1 Neshaminy State Park Site Description

NSP is located on both sides of Neshaminy Creek adjacent to the Delaware River. The two parts of the park are designated in this document as NSP-West and NSP-East. NSP-West is bounded to the north by State Road, to the south by the Delaware River, to the west by Dunks Ferry Road, and to the east by Neshaminy Creek. NSP-East is bounded to the north by River Road, to the south by the Delaware River, to the west by Neshaminy Creek, and to the east by a residential area along Minot Avenue. In its entirety, NSP measures 339 acres and contains two picnic pavilions, two swimming pools, a river walk trail, and several fishing locations. Boating access to the Delaware River is provided at the marina, located in NSP-East and managed by a concessionary under an agreement with the DCNR.

3.2.6.2 Availability

It was determined that NSP-East and NSP-West have sufficient land to satisfy the mitigation needs for the Southport project, as stated in the Draft EA Mitigation Plan. However, these areas are already functioning as a park and a natural resource. In the Draft EA, improvement and construction of wetland was considered but it was determined that JM by itself provides adequate available locations to implement mitigation to compensate for all of the impacts to wetlands, waters, and sensitive habitats and species from the project. Use of JM eliminates the necessity of excavating areas at NSP. For these reasons, NSP-East and NSP-West were removed from consideration as mitigation options for the Southport project.

3.2.6.3 Jack's Marina Site Description

JM abuts NSP along the east bank of Neshaminy Creek. It is the former site of a boat yard and marina, which was locally referred to as Jack's Marina. JM is a 35.4-acre parcel that consists of a mixture of land types, including disturbed uplands, tidal wetlands, and open water. State-listed species, several species of vegetation, and redbelly turtle are found at the site.

3.2.6.4 Availability

The JM parcel has sufficient undeveloped land to potentially satisfy all mitigation needs for the Southport project. Because the site encompasses part of the freshwater intertidal zone along the shores of the Delaware River and Neshaminy Creek, mitigation methods shall include establishment (creation), restoration, enhancement, and preservation of wetlands and shallow water areas that are tidally connected to these water bodies. Inclusion of a substantial mitigation project at the JM site complemented by the mitigation proposed at the Southport site would be adequate to satisfy all of the mitigation requirements for the Southport project.

3.3 SELECTION OF JACK'S MARINA AS MITIGATION SITE

Wetlands and other waters regulated under federal and state law will be impacted from the proposed Southport project, requiring compensatory mitigation. Earlier sections of this Revised Mitigation Plan demonstrate that the federal and state standards for determining mitigation (avoidance, minimization and compensation) requirements for impacts to wetlands and other waters are substantively met. This plan was prepared to present the mitigation measures that will be taken to offset unavoidable impact to regulated wetlands, waters, and sensitive habitats and

species resulting from implementation of the Southport project. The proposed mitigation includes two primary components: (1) Design considerations at the Southport site to minimize the loss of deep water habitat and (2) Compensation at the JM site for impacts to Southport's terrestrial, wetland (non-tidal and tidal), and shallow water habitats.

Numerous studies have been conducted and subsequent reports have been were prepared to support mitigation planning efforts, including the JPA and original EA for the Southport Development project and selected mitigation site (JM) submitted in July 2010.

3.4 RESPONSE TO AGENCY COMMENTS

Additional studies were completed to address comments received on the draft EA during fall 2010 and final selection of JM as the sole wetland mitigation site outside of mitigation performed at Southport.

The mitigation planning process and response to comments includes ecological and environmental surveys conducted at both NSP and JM in 2010 (Arsenault, 2010, 2011; Herpetological Associates, Inc., 2011; Normandeau Associates, Inc., 2010a; Weston Solutions, Inc., 2011) to further characterize the preferred wetland mitigation site and in response to a PNDI review. In general, the results of these surveys support previous investigations of these sites. Copies of these reports are provided in Attachment 1, which is presented on the CD accompanying this document. The CD also includes additional supporting documents.

Some of the key comments addressed in this revised mitigation plan include:

- Compensate for the loss of wetland/water resources at a 1:1 creation-to-loss ratio and 3:1 to 4:1 for Preservation and Enhancement.
- Demonstrate that substantial creation of new intertidal and aquatic habitat at JM and Southport Marine Terminal site, not the preservation of existing intertidal and aquatic habitat at JM, is the primary proposed mitigation.
- Maximize intertidal habitat at JM to include mudflat and SAV.
- Enhance existing habitats (upland, intertidal and subtidal) at JM.;
- Address comments related to fish habitat and mitigation at both the Southport site following construction and the JM site (such as demonstrating significant

environmental benefit to fisheries habitat under pile-supported wharves and revetment at Southport).

- Consider potential for site contamination at JM from past use of the property.

It should be noted that subsequent to the submission of the JPA, the applicant recalculated the size of some regulated habitats (intertidal, subtidal, and deep water) at the Southport site using updated topographic survey and bathymetry data. This resulted in some changes to the size of regulated area categories (e.g., tidal, subtidal, and deep water). In addition, impacts to the southern shoreline area that would result from the proposed bank stabilization and south shore revetment were reassessed. These changes are reflected in Table 1.

Site investigations (environmental/soil borings) conducted by Weston Solutions, Inc. (2011) determined that soils sampled at JM and NSP met PADEP clean fill guidelines. Based on these findings, the estimated net cut for proposed mitigation at JM (current estimate of grading materials) can be reused as fill at the Southport site. No soils from NSP will be excavated or graded as part of the mitigation plan. The proposed grading plan for the mitigation measures is shown in **Figure 5**.

In summary, JM will serve as the primary proposed mitigation site in combination with the avoidance and minimization; as well as other mitigation measures at the Southport site. It should be noted that a separate eagle mitigation site has been procured by the Commonwealth as part of the application for take of the abandoned bald eagle nest at the Southport site.

4. EXISTING CONDITIONS AT MITIGATION SITE

4.1 JACK'S MARINA

The JM mitigation site is located at the confluence of the Delaware River and Neshaminy Creek approximately 20 river miles upstream from the Southport site. The JM site consists of 35. acres of land situated on the site of a former private marina (Figure 4). The site is located approximately 2,000 ft north (upstream) of the confluence of the Delaware River with Neshaminy Creek. Located entirely within Bristol Township (Bucks County), JM directly abuts the NSP-East and is located directly across Neshaminy Creek from NSP-West. The site is bounded to the north and east by residential development. The property includes two manmade boat launching and docking lagoons. A large elongated inlet at the south end (Southern Inlet) of the site formerly contained docking, fueling, and restaurant facilities; and a smaller rectangular inlet at the north end (Northern Inlet) was used primarily for boat launching and servicing. The remainder of the ground contained various buildings and large areas that were used for outside boat storage. A large, tidally influenced wetland/marsh exists between the two inlets.

4.1.1 Surface Water and Site Drainage

JM is located in the Delaware River Watershed and drains entirely to the west into Neshaminy Creek. The site contains two boat launching and docking lagoons but it does not contain any isolated bodies of water.

4.1.2 Soils

JM contains three types of soils, based upon the three distinct areas present on-site. The site's upland area, which was previously used for the marina support structures, contains Urban land-Matapeake complex soils (NRCS, 2008). Urban Land is land covered by streets, parking lots, buildings, and other structures that obscure the soils. Matapeake soils are yellowish brown silt loams underlain by gravelly loamy to coarse sands that are dark yellowish brown. Urban Land has rapid runoff rates as a result of highly impermeable surfaces and low levels of erosion (NRCS 1996). The tidal wetland area contains Nanticoke-Hatboro silt loams (NRCS, 2008), which are very deep, very poorly drained soils within floodplains of tidally influenced rivers and creeks in the Mid-Atlantic coastal plain. They form in freshwater estuarine marshes and

depressions (NRCS, 2002). Last, the peninsula of upland area located to the north of the Southern Inlet contains Udorthents, gravelly soils (NRCS, 2008), which are deep and very deep, moderately well to somewhat excessively drained soils in the Mid-Atlantic northern coastal plain. They formed within nearly level to gently sloping broad flats and terraces. This soil consists of areas that have been cut and filled during grading for roads, railroads, building site developments, recreation areas, and other similar uses and now have been converted to lawns, playgrounds, or sedimentation basins for aesthetic, recreational, or stormwater control uses adjacent to large urban areas (NRCS, 2002).

4.1.3 Tidal Freshwater Wetlands

The JM site contains large areas subject to tidal flow, including Neshaminy Creek and two manmade lagoons cut out of the land immediately adjacent to Neshaminy Creek. A 13.65-acre tidal wetland exists in the center of the site and extends to the creek bank. It is complex and likely has a long history of disturbance. Rocks line the edge of the marsh along Neshaminy Creek and three channels cutting through the rocks into the marsh behind. The tidal marsh contains the following three intergrading communities:

- A high-energy intertidal zone along the creek with spatterdock (*Nuphar lutea*) and *Sagittaria spp*.,
- An arc of *Nuphar* toward the inner edges, and
- A more diverse core of *Nuphar* mixed with sweet flag, jewelweed, clearweed, bur-reed, *Polygonum spp*., purple loosestrife, and many other species, often knit together by climbing hempweed.

The shoreline of both lagoons contains eroded banks with some concrete and/or wooden bulkheads on all sides. In November 2007, bathymetric soundings in the northern lagoon recorded average depths of between 4 and 5 ft NAVD88, while recorded depths in the center of the southern lagoon ranged between 4 and 8 ft NAVD88 (Hudson, 2007). Turbid conditions during WESTON's recent site visits have prevented the observation of any SAV that may be present within the lagoon areas; however, many pilings in both lagoons were observed.

4.1.4 Upland Areas

Upland areas dominate the perimeter of the JM site. The southern inlet formerly contained docking, fueling, and restaurant facilities; and the northern inlet was used primarily for boat launching and servicing. The remainder of the ground contained various buildings and large areas were used for outside boat storage. To date, most of the buildings and structures have been demolished; however, some demolition debris, vandalized boats, and pavilion-type structures remain on the property.

The ground is primarily bituminous pavement and gravelly type soils that are laden with weedy growth. Black willow, box elder, indigo bush, and Japanese knotweed shade many of the upland banks. Common herbaceous species in upland areas also include Canada goldenrod, heath aster, horseweed, evening primrose, and purple loosestrife. Massive mounds of Japanese hops cover large stretches of the southern inlet, and mile-a-minute weed is frequent. Common reed (Phragmites Australis) is notable in the margins of the intertidal wetland area. The eastern edge of the property contains a wooded buffer of mostly maple, ash, and mulberry trees and poison ivy.

4.1.5 Sensitive Species and Habitat

Through the PNDI review process conducted in August 2005, and more recently in March 2010, several federal and state-listed threatened and endangered species and species of special concern have been identified as potentially existing in the vicinity of the JM site.

DCNR determined activities on the JM site may pose impacts to 3 threatened, 9 endangered, and 10 plant species of special concern as shown in **Table 2**, and 2 resources of special concern: freshwater intertidal mudflat and wild rice – water-hemp tidal marsh. The redbelly turtle (*Pseudemys rubriventris* [threatened]) was identified by the PFBC. During the August 2005 review, one federally managed species, the endangered shortnose sturgeon (*Acipenser brevirostrum*), was identified as having the potential to be impacted. The Atlantic sturgeon (*Acipenser oxyrhynchus*) was listed as endangered by NMFS on February 6, 2012.

Table 2 Plant Species of Special Concern Identified for the Jack's Marina Site

Common Name	Scientific Name	Pennsylvania Status
Water-hemp ragweed *	*Amaranthus cannabinus*	Special Concern
Bushy bluestem	*Andropogon glomeratus*	Special Concern
Swamp beggar-ticks	*Bidens bidentoides*	Threatened
Beggar-ticks	*Bidens laevis*	Special Concern
Dodder *	*Cuscuta campestris*	Special Concern
Smartweed dodder	*Cuscuta polygonorum*	Special Concern
Walter's barnyard-grass *	*Echinochloa walteri*	Endangered
Wrights Spike Rush *	*Eleocharis obtuse*	Endangered
Little-spike spike-rush *	*Eleocharis parvula*	Endangered
Multiflowered mud-plantain *	*Heteranthera multiflora*	Endangered
American holly	*Ilex opaca*	Threatened
Bugleweed*	*Lycopus rubellus*	Endangered
Eastern jointweed	*Polygonella articulata*	Special Concern
Common Hop-tree	*Ptelea trifoliate*	Threatened
Willow oak	*Quercus phellos*	Endangered
Long-lobed arrowhead	*Sagittaria calycina var spongiosa*	Endangered
Subulate arrowhead *	*Sagittaria subulata*	Special Concern
River bulrush *	*Schoenoplectus fluvuiatilis*	Special Concern
Smith's bulrush *	*Schoenoplectus smithii*	Endangered
Wild bean	*Strophostyles umbellata*	Special Concern
Purple sandgrass	*Triplasis purpurea*	Endangered
Indian wild rice*	*Zizania aquatica*	Special concern

* Species observed on-site during 2006 botanical survey (botanical survey).

4.1.6 Cultural Resources

In a letter dated June 2006, the Pennsylvania Historical and Museum Commission (PHMC), Bureau of Historic Preservation found that the intensive development project proposed at that time for the JM site would have no impact on cultural resources; although, in an October 2003 letter, PHMC did indicate that although there were no recorded archaeological sites within the project boundaries, the soil type, topographic setting, slope direction, and distance to water of the project area are similar to the settings of known archaeological sites in the vicinity. A Phase I archaeological survey was recommended, but not required.

4.1.7 Potential Hazardous Materials

A Phase I/Environmental Condition of Property (ECP), initially conducted for the JM site in March 1999, revealed no evidence of recognized environmental conditions in connection with the property; however, the report did recommend that on-site 500-gallon underground storage tanks (USTs) containing heating fuel oil be tested for potential leaks. Two USTs were tested for leaks in December 2002 and were found to not be leaking. Additionally, a second Phase I/ECP was conducted in December 2002 and resulted in the same findings. Backhoe excavations in the area investigated did not reveal any indication of buried drums containing petroleum products. Soil sample results from sampling conducted in fall 2010 confirmed that soils do not exceed the PADEP medium-specific concentrations for either direct contact or soil to groundwater limits for total lead.

Despite 2002 findings, a 2005 update to the Phase I/ECP report indicates that petroleum-contaminated groundwater was found near the USTs. In April 2006, two USTs and one aboveground storage tank (AST) were removed. Soil and groundwater issues were documented after UST and AST removals, which led to remedial actions. In April 2009, PADEP agreed that four consecutive quarterly sampling events for benzene, toluene, ethylbenzene, xylene, cumene, naphthalene, and methyl tert-butyl ether (MTBE), conducted between February 2008 and November 2008 in monitoring wells, were adequate to characterize recent groundwater quality and demonstrate the attainment of cleanup standard in groundwater at the JM site.

5. IMPACT MINIMIZATION AND COMPENSATORY MITIGATION

Pursuant to federal and state regulatory programs and policies, it has been determined that compensatory mitigation is required to offset unavoidable impacts to wetlands and other waters of the United States, and documented sensitive species and habitats. Implementation of a compensatory mitigation plan at an off-site location (JM) was ultimately required for the filling of wetlands and other waters and disturbance of upland habitats for sensitive species at the Southport site. Both minimization/avoidance and mitigation will be components of the project's wetland permit approval process. The determination of compensatory mitigation requirements was made following significant efforts to avoid and minimize impacts to wetlands and other waters and retain valuable subaqueous habitat by using a more sustainable design and minimizing fill.

5.1 WETLAND HABITAT AT SOUTHPORT

Impacts at Southport were calculated based on the acreages of regulated wetland/water habitat within the footprint that would be either temporarily or permanently affected by construction activities. Figure 2 depicts the regulated wetlands and other waters within the project footprint as defined by elevation and habitat type. Figure 3 shows the extent of the impacts to each wetland/water type and summarizes the acreages of each, broken down by area of the terminal footprint. Wetlands and regulated waters within the Southport project footprint from the wharf edge inland include the following:

- 3.75 acres of isolated, non-tidal freshwater wetlands, which are primarily dominated by common reed.
- 5.15 acres of intertidal area which consists of mostly mudflat at the north end of the project footprint and steep rocky shoreline around the periphery of the Navy Yard. The intertidal area includes 0.20 acre of emergent wetland.
- 0.73 acres of a tidally influenced stormwater channel (serves as habitat for eel).
- 7.10 acres of subtidal habitat predominantly at the North Wharf (Area A, Figure 3) and South Shore Revetment (Area E, Figure 3) perimeter around the footprint and including 1.08 acres of SAV. A small area (0.23 acre) is located within the dredging footprint between the federal navigation channel and east wharf edge.

- 4.71 acres of deep water habitat within the project footprint. The 4.71 acres of deep water habitat excludes the proposed dredging footprint between the federal navigation channel and wharf face. Impacts within the dredged template are temporary and will be discussed later.

- Upland fields containing several individuals of state-listed plant species.

- Sensitive species' habitats include striped bass spawning area located off the southern and eastern portions of the Southport site and an abandoned bald eagle nest located in the north-central portion of the site.

5.2 IMPACTS

Impacts to regulated areas vary and consist of filling, excavation, and backfill to stabilize slopes; the placement of piles for wharf construction; and shading of waters from the proposed wharves along the north and east side of the project footprint. The left side of Table 1 summarizes the impacts (conversion to uplands and either remaining the same habitat type or retained as another wetland/water habitat type) to each regulated wetland/water habitat type. Figure 2 tabulates and provides a graphical clarification of the impacts discussed below. The following summarizes the impacts to regulated areas and resources:

- The 3.75 acres of non-tidal freshwater wetlands would be filled from the proposed action.

- The 5.88 acres of intertidal area would be impacted as follows: (1) Mainly filled at the north and south end; and (2) Excavated, backfilled, and restored with stone bank stabilization under the wharf at the east side. A total of 2.79 acres would be converted to upland or not provide habitat but the remaining 3.09 acres would remain as valuable subaqueous habitat, including the relocation of the existing (0.73 acre) stormwater channel.

    - The 0.73 acres of a tidally influenced stormwater channel (eel habitat) would be relocated to a location parallel to the existing channel and include substrate buffers habitat to replicate the existing eel habitat. In addition, single log vane structures would be placed in the channel to provide additional aquatic habitat structure and turtle basking areas.

- The 7.10 acres of subtidal habitat would be impacted as follows: (1) Mainly filled at the north and south end; (2) Excavated and backfilled with filter and armor stone and located under the wharf at the east side; and (3) Excavated to greater depths within the dredging footprint between the federal navigation channel and the wharf edge. A total of 4.20 acres of impacts would be

permanent - converted to upland and provide subaqueous habitat. A total of 2.90 acres would remain as valuable subaqueous habitat.

- The 42.81 acres of deep water habitat within the project footprint (including the area dredged between the east wharf and federal navigation channel) would be impacted in several ways. To the north, 0.21 acre of fill would be used to create fast land inland of the pile-supported wharf. At the east a total of 2.73 acres of impacts to deep water would consist of creating fast land and a pile supported wharf. Along the south shoreline revetment, 1.77 acres of impacts to existing deep water would result from the south shoreline rip-rap stabilization. Within the dredged template, approximately 33.10 acres of deep water will impacted from dredging, but remain deep water habitat. A total of 1.09 acres of deep water would be permanently converted to upland and not provide habitat. 41.72 acres would remain deep water (38.33 acres within the dredge template area – including 0.23 subtidal habitat converted to deep water). A total of 3.91 acres of deep water habitat will be created or retained (0.63 acres under the north wharf, 2.44 acres under the east wharf, and 0.84 acres along the south revetment).

- There will be impacts to areas used by striped bass, eel, and other fish species along the north and east side of the project footprint. There will be minimal impact to a documented striped bass spawning area located off the southern edge of the Southport site.

- Upland fields containing several individuals of state-listed plant species would be filled and graded for infrastructure construction.

- Impacts to an abandoned bald eagle nest are being handled separately from this wetland mitigation plan.

The permanent impacts to regulated areas and resources identified above will be fully mitigated, minimized/avoided at the Southport site and compensated at JM as presented below. Table 1 summarizes the acreage and location of regulated areas at Southport, the permanent and temporary impacts to these regulated areas, avoidance and minimization of impacts to regulated areas, proposed mitigation at JM, and proposed mitigation credits for each regulated habitat type. Credit determination methodology is discussed in Section 6. Refer to Figures 2 and 3 for graphical delineation. The last column is a summary of the net gain/loss of habitat type when impacts are compared with mitigation. Figure 4 provides grading of the conceptual mitigation plan proposed for JM. The following section summarize the impacts and proposed mitigation for habitats and species requiring mitigation.

5.3 SOUTHPORT SITE IMPACT MINIMIZATION

The following paragraphs provide details regarding methodology for the proposed impact minimization for the Southport site by location. Refer to Table 1 Column B – Total Avoidance and Minimization for acreages credit at Southport.

Tidal Stormwater Channel and Open Water –The existing tidal stormwater channel will be relocated to a parallel location having the same length and width (0.75 acre). Similar habitat would be provided to compensate for this loss, including a rip rap bottom, steep partially vegetated slopes, and redbelly turtle basking platforms. A rock check dam (similar to existing) would be placed at the outlet of the channel to the interpier area to retain water of similar depths as the existing channel. Single log vanes would be installed in the channel to provide fish habitat and turtle basking areas. In addition, intertidal habitat will be excavated in the area of the stormwater outlet to match and grade into the existing water depths in the adjacent interpier area. This will provide additional fish and redbelly turtle habitat.

South Shoreline Stabilization – Shoreline stabilization along the south shore of the Southport project footprint would result in impacts (filling) to 4.33 acres of a combination of intertidal (1.03 acre), subtidal (1.53 acre) and deep water (1.77 acre) habitat. However, the filling would not convert the entire footprint to uplands. Following construction this footprint will create 3.46 acres of a combination of intertidal (0.87 acre), subtidal habitat (1.75 acre), and deep water habitat (0.84 acre), minimizing impacts to these areas.

Deep Water Habitat Under Pile-Supported Wharves – The proposed action includes the dredging/excavation of a template extending from the federal navigation channel to areas under the pile-supported wharf. This includes a combination of deep water, subtidal, intertidal and upland areas to be dredged under the proposed east wharf area. No excavation is necessary for the north wharf and this area will be left undisturbed except for the placement of shore protection stone in some areas, and the installation of piles to support the wharf structure. Figure 3 depicts the proposed pile-supported wharf structures.

Credit for minimization of impacts to deep water habitat should include open water habitat remaining under the pile-supported wharves. Normandeau Associates, Inc. has addressed the concerns of regulatory agencies regarding the impact of shading on aquatic habitat at the proposed project site (Normandeau Associates, Inc., 2010b). A review of research illustrates the value of edge habitat for piers and wharves. Dr. Ken Able and others have conducted research on fish species abundance and diversity under piers compared to other habitat types, including open water (Duffy-Anderson and Able, 1999; Duffy-Anderson et al., 2003; Metzger et al., 2001) and reached the following conclusion regarding the importance of pier structures as fish habitat.

Based on their findings, Duffy-Anderson and Able (1999) state that "the pier edge, the transitional zone between the pier interior and the outside, may be an important ecological zone, providing an abundance of prey items while at the same time offering increased refuge from predation." Pier edges, piles, and shading associated with piers have been demonstrated to increase diversity and numbers of fish relative to open water (Duffy-Anderson et al. 2003). Duffy-Anderson and Able (2001) state that, "invertebrate prey were more abundant under piers than at the edge or outside." Metzger et al. (2001) also found greater prey densities underneath the pier. Given prey organisms at higher densities under piers and lower exploitation rates, piers could serve as refuges for higher productivity of benthic macroinvertebrates that can then be exported to areas outside the pier.

Normandeau Associates, Inc. (2010b) conclude that the shading provided by piers and wharves should be considered ecologically valuable. For example, predator species in the upper tidal Delaware River such as striped bass, largemouth bass, and channel catfish take advantage of current breaks and differentials in light intensity provided by pier edges to ambush prey. The shaded areas under piers could provide slight thermal refuges in areas where current is minimal for species such as striped bass during time periods in which upper thermal tolerances may normally be exceeded. Hudson River studies indicate that a favorable habitat for American eel, a species of increasing concern in the Delaware River, is created by large shaded areas. Species possessing alternative feeding mechanisms may benefit from piers, which are areas that provide refuge for survival and

growth of benthic macroinvertebrates. Examples of these species in the vicinity of the Southport Development site would be channel catfish, brown bullheads, and the aforementioned eels. The pilings of the piers also provide substrate for attached algal growth, which is utilized as food by small fish such as eastern silvery minnow and spottail shiner, which, in turn, can be utilized as prey by predator fish.

The wharves along the northern and eastern edge of the project footprint would be placed on pilings, providing open-water (tidal, subtidal and deep water) habitat. However, it is assumed that the value of aquatic habitat under the wharf structures decreases with distance from open water. Therefore the applicant proposes to take credit for open water remaining under wharves for a distance of 30 ft under the north wharf and 50 ft under the east wharf. In addition, notches will be cut into the existing steel sheet pile located along north edge of wharf to provide fish better access to and from open water areas of the Delaware River. A total 0.63 acres under the north wharf and 2.44 acres under the east wharf of deep water habitat will be created or retained.

Dredging and pile-supported wharf construction for the Southport project may be beneficial to shortnose sturgeon, as dredged anchorage areas may be a preferred habitat of the fish (Personal Communication with Hal Brundage, Environmental Research and Consulting, Inc. on 26 November 2010) because these areas are outside of the stronger river currents. In addition, a ship approaching, docking, and departing from the site will be maneuvered by shallow draft tugboat. Its engines will be on, but the screws will not be turning. Therefore the potential for impacts to sturgeon that may utilize these areas is minimal.

Other Mitigation – Consideration can be given to enhancing deep water habitat along the south shore (striped bass breeding) and under the north wharf by adding artificial reefs consisting of “reef balls” or other suitable structures. Any additional mitigation measures designed to enhance the environment that would be attractive to large birds, such as to tidal mud flats or intertidal wetlands, requires consideration of the FAA guidance related to BASH (bird/animal aircraft strike hazard) (FAA 2007).

5.4 SOUTHPORT MITIGATION BY HABITAT

Intertidal and Subtidal Mitigation –The total creation of intertidal and subtidal habitat is 3.35 (1.60 intertidal and 1.75 subtidal) along the South Shore Revetment.

Deep Water Mitigation – The net area of deep water impacted following construction at the Southport site will be 4.71 acres, not counting the dredge template. A total of 3.91 acres of compensation is proposed, all located at the Southport site. This includes new areas of deep water that can function as viable habitat under the 915' long north wharf (to a distance of 30 ft from the open edge for a total of 0.63 acre) and the 2128' long east wharf (to a distance of 50 ft from the open edge for a total of 2.44 acres) and south shore revetment (0.84 acre).

No mitigation is considered necessary for the dredging of the 38.33 acres within the dredged template (east of the wharf edge) for the following reasons.

- The area is currently 45 ft deep in some locations within the dredged footprint and 38.10 of 38.33 is characterized as deep water (deeper than 9.75 ft NAVD88) and will remain deep water. The remaining 0.23 acre is subtidal habitat and impacts and mitigation is accounted for in subtidal mitigation.
- The area was previously disturbed during the historic expansion of the Naval Yard.
- The impact is temporary since the benthic community will be restored following the completion of dredging.
- The dredged template is a natural scour area which will lead to less frequent maintenance dredging activities. It is estimated that 20,000 to 40,000 cy of dredged material will have to be removed from approximately 5 to 10 acres of the berthing area every 1 to 2 years based on the current maintenance dredging quantities at the adjacent Packer Avenue Marine Terminal.

Isolated Freshwater Wetland Mitigation – Compensation for impacts to isolated, perched wetlands (3.75 acres) will all be done at the JM mitigation site consists of establishing a desirable plant community consisting of native tree and shrub species on the uplands remaining at JM. **Intertidal Stormwater Channel Mitigation** – A total of 0.73 acre of tidal stormwater channel will be relocated on the Southport site. Habitat,

substrate, and geometry similar to the existing stormwater channel would be provided to sustain and maintain its habitat function.

Redbelly Turtle Habitat Mitigation – Mitigation for turtles at the Southport site would consist of the placement of basking structures in the stormwater channel and other habitat appropriate intertidal and subtidal locations at Southport.

State-listed Plant Species Mitigation – Seeds or whole specimens of the state-listed plant species at Southport will be harvested and reestablished at JM as a component of mitigation (upland restoration).

Submerged Aquatic Vegetation (SAV) Mitigation – No SAV mitigation will occur at Southport. All Mitigation of SAV will consist of planting at JM in subtidal areas in the lagoons (3.25 acres).

Other Mitigation Considerations at JM – Additional opportunity exists to increase mitigation at JM. This includes:

- PRPA will be responsible for constructing, operating, monitoring and maintaining the wetland mitigation site at Jack's Marina. Subsequent to the monitoring period, ownership and long-term maintenance of the site may be transferred to DCNR to be included as part of its park assets.
- Uplands within the mitigation areas can include public access trails, observation points, and interpretive signs.
- Rehabilitating a deteriorating dock at JM for public fishing.
- Armoring/stabilizing sections of the JM shoreline to keep the river shoreline stabilized to retain site structure.
- Expand the establishment of SAV in the Delaware River adjacent to NSP.
- Develop and implement an invasive plant species management program in wetland and upland habitats at JM.

6. JACK'S MARINA MITIGATION

Existing conditions at JM have been assessed and are presented in the draft mitigation report provided in Appendix K (Mitigation) of the draft EA in the JPA submitted July 16, 2010, including conceptual mitigation design plans for the site. Numerous studies have been conducted and reports prepared to support mitigation efforts for the Southport Development project and selected mitigation site (JM). This includes ecological and environmental surveys conducted at both NSP and JM in 2010 (Arsenault, 2010, 2011; Herpetological Associates, Inc., 2011; Normandeau Associates, Inc., 2010a; Weston Solutions, Inc., 2011) to further characterize the preferred mitigation site and in response to a PNDI review. In general, the results of these surveys support previous investigations of these sites. Copies of some of these reports are provided in Appendix A on the CD provided with this report.

In response to written comments received from regulatory and resource agencies, and site visits to JM with regulatory and resource agency staff, a revised mitigation plan has been prepared that focuses on the following:

- Maximizing the construction of intertidal and subtidal habitat from existing degraded uplands.
- The enhancement of existing intertidal wetlands.
- Enhancement of existing subtidal habitat through the establishment of SAV.
- Upland enhancements (redbelly turtle nesting areas, planting with native tree and shrub species, establishing areas for the propagation of state-listed species identified at the Southport site), and planting uplands with native species of trees, shrubs and herbaceous vegetation.

The following bullets present some general mitigation strategies used in developing the mitigation plan for JM, followed by additional details for specific locations and habitat types within JM. Figure 4 presents a plan view of the existing site conditions and conceptual proposed mitigation. Table 1 presents information on the impacts to regulated areas from the Southport project and proposed minimization and compensatory mitigation to compensate for impacts.

- Maximize the creation of intertidal and subtidal habitats from existing degraded upland areas.
- Remove the stormwater culvert at the eastern edge of the intertidal wetland area to improve tidal flow and expand the extent of intertidal habitat. The potential for culvert removal resulting in increased tidal flows and flooding of adjacent, upgradient properties needs to be evaluated.
- Lagoon/marina areas – Enhance these subtidal areas to establish SAV.
- Assess the use of concrete/armoring along the JM shoreline to keep the river shoreline stabilized to retain site structure. This can include breaking up concrete slabs already in place along the shoreline. In addition, concrete slabs in other portions of JM can be broken up and used to stabilize the JM shoreline along the east side of Neshaminy Creek and the Delaware River.
- A forested wetland is present on the NSP property, adjacent to the south boundary of JM. The wetland has no apparent outlet (depression system with an assumed perched water table); therefore, to avoid potentially draining the wetland, an upland berm/buffer would be maintained between the forested wetland and intertidal wetland/water mitigation on the JM parcel. The upland buffer would be enhanced with native species plantings for some mitigation credit.
- The design for the intertidal and subtidal areas would not promote shoaling at entrance(s) and impact hydraulics/hydrologic conditions of intertidal and subtidal areas.
- Threatened and endangered plants and redbelly turtle that use the site are addressed in the mitigation plan. PFBC and DCNR have both approved mitigation plans for the formally proposed development of JM (refer to the CD included in back folder of this report). As appropriate components of the approved plans will be incorporated into this project's proposed mitigation design.

The following items present details of the key mitigation components for the JM site. Refer to the Mitigation Design Summary in Figure 4 for the conceptual plan at Jack's marina and corresponding acreages.

Upland Restoration and Enhancement (7.35 acres) – Upland areas at JM consist of highly disturbed areas characterized by impervious surfaces, construction rubble, abandoned boats, and fill piles. These areas have a plant species composition characteristic of highly disturbed areas. A component of the mitigation at JM will be to restore the 7.35 acres of upland areas remaining following mitigation to a more desirable

mix of upland vegetation and to evaluate the use of these areas to mitigate for impacts to state-listed species from the Southport site. It is proposed to plant much of the area with native tree and shrub species. Examples of tree species include willow oak, American holly, hickories, white ash, eastern cottonwood, white ash, sugar and red maple, sweet gum and red and white oak. Trees (4 ft to 6 ft containerized) would be planted on 10-ft centers. Examples of shrub species include sumacs, bayberry, blackhaw, ironwood, and witch hazel. Shrubs (2 ft to 4 ft containerized) would be planted on 10-ft centers. Herbaceous seed mixes should include switchgrass, little bluestem, big bluestem, indiangrass, broomsedge goldenrods and other native species. Herbaceous seed mixes would be planted at 15 lbs/acre. Additional enhancements to uplands are identified below.

Uplands – Maintain Upland Buffer along the South Edge of JM (6.00 acres) – There is a forested wetland on the NSP property adjacent to the south boundary of JM. There is no apparent outlet; therefore, to avoid draining this wetland, ensure that the mitigation plan maintains an upland "berm" on the JM parcel between wetland/water mitigation and the forested wetland. Enhance the buffer with native plantings. Remove the fence between NSP and JM, as the restored JM site would be transferred to DCNR for incorporation into NSP.

Uplands – Redbelly Turtle Nesting Habitat (1.35 acres) – Two upland islands (total of 1.35 acres) would be retained to create nesting areas for redbelly turtles known to frequent the area.

Wetland Restoration/Culvert Removal (0.09 acres) – Removing the stormwater culvert discharging at the eastern edge of the intertidal wetland area would improve tidal flow in this area. The culvert would be removed and the area graded to maximize low marsh intertidal habitat. A bridge would need to be constructed to provide for foot traffic and access for park vehicles. The potential for culvert removal resulting in increased tidal flows into upgradient areas and flooding adjacent properties needs to be evaluated.

Intertidal Mitigation (7.14 acres) – 5.47 acres Wetland and 1.67 acres Mudflat – Mitigation in these designated areas would consist of excavation to depths between 4 ft

NAVD 88 to -4 ft NAVD and connecting to the existing lagoons and intertidal areas. It is proposed to allow the intertidal footprint to revegetate naturally from seed and vegetative growth from plants in adjacent intertidal wetlands. The wetland to upland transition zone would be relatively steep (narrow) and planted with a species mix (herbaceous and woody – refer to item 1 above) designed to provide some level of control of invasive and undesirable plant species (e.g., common reed, mile-a-minute, and stiltgrass). A component of the mitigation plan would be monitoring and maintenance to control vegetation.

Lagoon Preservation/Enhancement (5.53 acres) – The two existing lagoons (4.03 acres) on JM and adjacent open water areas in Neshaminy Creek provide fish habitat and a species composition with many similarities to the Southport site. (Refer to the attached report by Normandeau Associates, Inc. [2010] comparing the fish composition and habitat types). To compensate for the loss of 1.08 acre of SAV habitat at the Southport site, it is proposed to establish 3.25 acres of SAV. This would involve the conversion of existing subtidal areas to elevations considered acceptable to SAV to establish.

Intertidal Wetland Enhancement (13.65 acres) – An approximate 13.7-acre, centrally located intertidal marsh exists on JM property. It is characterized by a diverse, native intertidal marsh community, including several state-listed species. Invasive species (common reed and purple loosestrife) are present in this area. The value of this intertidal wetland would be enhanced by removing JM from potential future development and implementing mitigation in adjacent areas to provide habitat diversity and protection of this sensitive area. An invasive species control program would be implemented (e.g., common red and purple loosestrife control) to further enhance the value of this area. Two areas with historic fill material would be excavated to depths approaching 1 ft to reduce invasive species habitat.

Other Mitigation Considerations at JM – Additional opportunity exists to increase mitigation at JM. This includes:

- Uplands within the mitigation areas can include recreational improvements public access trails, observation points, and interpretive signs.

- A former loading dock located at the southwest corner of the southern lagoon/marina is currently used for public fishing and would be rehabilitated under the proposed mitigation.

- Concrete/armoring could be added along the JM shoreline to keep the river shoreline stabilized to retain site structure. This can include breaking up concrete slabs already in place along the shoreline. In addition, concrete slabs in other portions of JM can be broken up and used to stabilize the JM shoreline along the east side of Neshaminy Creek and the Delaware River.

7. CREDIT DETERMINATION METHODOLOGY

Proposed mitigation for impacts to wetlands and other waters consists of a combination of the following: (1) Environmentally sensitive design at the Southport Development project site to minimize impacts (focus on minimization of impacts to deep water habitats); and (2) A holistic approach to establish a gradient of habitat types to compensate for impacts to intertidal and subtidal habitats, sensitive habitats (SAV) and sensitive species (redbelly turtle and state-listed plants).

Credits for the conversion of the mostly paved and degraded uplands to intertidal and subtidal habitats are proposed at a 1:1 ratio. Mitigation credit for the enhancement and indefinite preservation of a large (13.65 acre) intertidal wetland system at the JM site, which provides habitat for several state-listed plant species, is proposed at a 4:1 ratio and could include a combination of 1) shallow excavation of fill material in existing intertidal wetland areas and 2) an invasive species management program for both common reed and purple loosestrife. The proposed purchase of the JM property, along with implementation of sitewide mitigation will create a larger, more diverse ecosystem. Prior to the downturn in housing market conditions, JM was proposed for development as a townhouse community with an associated marina, which would closely abut the existing wetlands, accelerating a gradual reduction in its ecological value. If JM is not purchased by the Commonwealth at this time, for this purpose, there is a high probability of another developer developing the site into similar high density housing, which would result in the reduction of its ecological value, including the loss of undeveloped (but disturbed) upland buffer areas adjacent to intertidal wetlands, subtidal areas (lagoons), Neshaminy Creek, and undeveloped areas of NSP located at the southern edge of JM.

Mitigation credit for impacts to other regulated areas and resources are presented in Table 1 and the proposed mitigation for the Southport site and JM that follows. Table 1 identifies the impacts at the Southport site requiring mitigation and proposed mitigation types, ratios, size, and location of proposed mitigation by site. Figure 4 provides a revised conceptual mitigation plan for the JM property.

7.1 PROPOSED MITIGATION CREDITS SUMMARY

The following paragraphs provide details regarding the proposed mitigation. Refer to Table 1 Column D – (Mitigation Credit) in Table 1 for the mitigation credit acreages at Jack's Marina and Column B for Avoidance and Minimization Credits a Southport.

Intertidal Creation and Restoration (1:1) – A mitigation ratio of 1:1 was used to compute credit for the creation and restoration of intertidal wetlands and mudflats. Intertidal habitat will be planted to sustain a mixture of vegetated wetland and mudflat. Summing the components of intertidal acreages, the proposed mitigation credit for JM is 7.23 acres.

Intertidal Preservation (1:1) – mitigation ratio of 1:1 was used to compute mitigation credit for the preservation of intertidal habitat retained in the intertidal portion of the south shore revetment at Southport consisting of 0.87 acres.

Intertidal Stormwater Channel Relocation (1:1) – A mitigation ratio of 1:1 will be used for the construction of relocated stormwater channel at the Southport site resulting in a proposed credit of 0.73 acres.

Intertidal Enhancement (4:1) – A mitigation ratio of 4:1 was used for the preservation and enhancement (invasive species control and shallow excavation of historic fill material) of 13.65 acres of intertidal wetland at JM, resulting in a proposed credit at JM of 3.41 acres.

Subtidal SAV Creation (3:1) – A mitigation ratio of 3:1 is proposed to replace the 1.08 acre of SAV take from the Southport Development project. SAV habitat would be created in the existing subtidal lagoon/marina areas at JM. An alternative would be to evaluate the potential to expand areas of existing SAV near the confluence of the Delaware River. The lack of recent SAV mitigation or restoration projects in the Delaware River presents one of the first opportunities to mitigate for the declining populations of SAV. Combined with the subtidal creation and enhancement, the total subtidal credits proposed at JM are 1.65 acres.

Other Subtidal Enhancement (4:1) – A mitigation ratio of 4:1 was used for the creation and restoration of remaining subtidal areas not specifically planted with SAV accounts for a total additional proposed credit at JM of [0.32 + 0.25] =0.57 acres.

Subtidal Preservation (1:1) – A mitigation ratio of 1:1 was used to compute mitigation credit for the preservation of intertidal habitat retained in the subtidal portion created in the south shore revetment at Southport resulting in a total proposed credit of 1.75 acres.

Deep Water Preservation and Creation (1:1) – A ratio of 1:1 is proposed to replace the deep water habitat at Southport, including areas along the south shoreline and under the outward 30 ft of the north pile-supported wharves and outward 50 ft of the east pile-supported wharves resulting in a total credit of 3.91 acres.

Redbelly Turtle Habitat Upland Enhancement and Relocation (2:1) – A mitigation ration of 2:1 is proposed for relocation of 6.00 acres of buffer plantings of native species and the establishment of 1.35 acres of redbelly turtle nesting habitat at JM and the placement of basking structures adjacent to intertidal and subtidal habitat at and JM. These measures will result in a credit at JM of 3.68 acres.

State-Listed Plant Species Upland Enhancement – Proposed upland enhancement would include establishing each of the three state-listed plant species at JM. This is incorporated into the upland enhancement. No acreage credit is claimed for this as this mitigation is part and parcel to the upland restoration at JM.

8. LONG TERM MAINTENANCE, SUSTAINABILITY, AND ADAPTIVE MANAGEMENT

The mitigation report provided with the Southport JPA addresses long term maintenance, sustainability, and adaptive management to ensure that the selected mitigation successfully compensates for impacts to wetlands, other waters, and sensitive species and habitats. The PRPA is committed to funding these tasks and adhering to the approved permit conditions and using these conditions in conjunction with guidelines similar to those contained in the NSP Resource Management Plan (RMP), which provides for management and protection of natural resources.

PRPA will be responsible for constructing, operating, monitoring and maintaining the wetland mitigation site at Jack's Marina. Subsequent to the monitoring period, ownership and long-term maintenance of the site may be transferred to DCNR to be included as part of its park assets.

Maintenance is the work needed to keep the mitigation site in the condition designated in the approved as-built construction plans and specifications. Monitoring and maintenance of the mitigation area for a minimum of 5 years following the completion of mitigation is required for ensuring mitigation performance. An adaptive management approach should be undertaken to achieve the restoration goals and objectives.

It is anticipated that maintenance plans would be developed and implemented in three phases. First, the as-built construction plans and specifications would include maintenance requirements for activities during and following construction. This includes demonstrating that the mitigation designs have been correctly implemented and sites are achieving stated goals and objectives. This could include demonstrating the stabilization of soils and sediments, achieving the appropriate grades and elevations, establishing appropriate water regime (tidal flows, wetland hydrologic conditions, irrigation), sustaining vegetation (planted and recruited from adjacent areas) and controlling invasive species, and sustaining fish and wildlife.

Second, the mitigation sites are owned by the PRPA and would be managed and maintained under a protocol similar to the existing RMP developed for NSP by DCNR. This includes protection of existing wetlands and other waters, sensitive habitats and species, and management

of invasive species as appropriate. DGS and PRPA would be responsible for conducting and funding the maintenance and monitoring.

Third, a separate maintenance plan would be prepared to address the need for continued maintenance of mitigation sites following the demonstration by the construction contractors (including landscape contractors) that the mitigation design goals and objectives for each site have been achieved, the sites stabilized, and vegetation standards met. This plan would be incorporated with the monitoring plan to ensure effective communication among the responsible parties and timely response to identified issues requiring maintenance. Examples include the following:

- **Sustaining Vegetation** – Ensure that the planted vegetation (seed, cuttings, plugs, woody planting) is surviving and, as appropriate, spreading. In areas of natural recruitment from seed and vegetation growth in adjacent similar habitats (e.g., intertidal wetlands), assess the establishment of species (diversity and cover) and need for maintenance. Examples of maintenance measures include replanting, invasive species control, irrigation, regrading soils, controlling erosion, and animal management (e.g., deer, geese).

- **Stabilizing Soils** – Ensure that soils are stabilized throughout the performance period. Maintenance of soils could be in response to unusual weather events, eroding banks, unstable soils, failing erosion and sedimentation control structures, and damage from animals and vandalism. Examples of maintenance activities include regrading and the placement of erosion control blankets, the placement of coir logs along banks of intertidal channels, placement of riprap in eroding areas, and replanting areas of exposed soils.

- **Sustaining Water Regimes** – The predicted hydrologic conditions may not be met by the implemented mitigation design or unanticipated site conditions may also result in not meeting the conditions, requiring proactive maintenance. For example, unpredicted periods of excessive precipitation may require control of water flow and periods of drought may require irrigation of some areas. The timing of plant installation (e.g., early summer versus spring) may result in the need for irrigation to allow plants to survive and grow until normal precipitation patterns return. Other examples include installing riprap to stabilize inlets to intertidal wetland areas or to stabilize eroding banks.

- **Sustaining Wildlife** – Ensure that habitats constructed for specific wildlife retain the design objectives. Habitat for select species of wildlife (e.g., redbelly turtle) may require maintenance for a number of reasons. This can include the need to control the establishment of undesirable plant species in the created habitat or the need to construct barriers to predators (e.g., fox predation of redbelly turtle nests).

The development of a maintenance plan and program to address the approved mitigation program would be an iterative process involving the site owners, regulatory and resource agencies, and contractors selected to provide maintenance and monitoring. These plans would be developed during the review and acceptance of mitigation proposed for the Southport project.

9. ECOLOGICAL PERFORMANCE STANDARDS

The ecological performance standards would be determined by the final approved permit for the Southport project, including the compensatory mitigation plan. In general, performance standards for the mitigation areas should focus on the establishment of self-producing and sustaining native vegetation communities and habitat types.

Performance standards by vegetative community and habitat type are outlined below. The final performance standard details would be developed through coordination with the regulatory and resource agencies.

Intertidal – Construct functional intertidal zones that provide habitat for the diversity of intertidal plant species present in similar wetlands at JM. (Note that the majority of the intertidal zone at the Southport site is unvegetated.) The selected elevations are similar to those in which the most valuable intertidal wetland communities are found at JM. To the extent possible, elevations at which common reed are found in the mitigation area would be avoided.

Subtidal – Provide stabilized subtidal habitat that can be used by the fish and benthic communities present in the JM area. The establishment of SAV is a component. Potential areas to establish SAV include the existing lagoons at JM and expansion of documented SAV areas in the Delaware River. These areas of SAV will be fully characterized to support the development of an SAV mitigation plan as necessary. A lack of SAV mitigation and restoration efforts in the Delaware River will necessitate close coordination with resource agencies to develop a mutually agreeable plan to compensate for impacts to SAV from the Southport project.

Deep Water – The loss of deep-water habitat from the Southport project would be compensated from the open water with adequate sunlight under the wharf area and at the south shore rip-rap revetment at Southport following construction. No performance standards are proposed for this habitat type.

Upland Buffer – This would consist of two components. First, wooded areas with desirable, established woody species would be protected to the extent possible during implementation of mitigation. This would help to reduce the potential for the establishment of invasive species

along the edges of some mitigation areas (such as common reed). Second, planting upland buffers adjacent to existing wetlands (e.g., forested wetland area adjacent to the south edge of JM) and clearings to promote the establishment of an upland buffer zone having a desired native vegetation community.

9.1 THREATENED AND ENDANGERED SPECIES MITIGATION

Redbelly Turtle – In addition to providing intertidal and subtidal habitat for the existing redbelly turtle population in the area, basking platforms would be installed in wetland/water areas and upland nesting areas established at the JM site.

Vegetation – Suitable locations are available to establish habitat for state-listed species proposed to be transplanted (either by seed or vegetative propagule) exist at JM. Threatened and endangered species at the Southport site, as well as willow oak, American Holly, and other species identified within the mitigation project footprint, would be transplanted into designated upland areas.

Performance standards for the mitigation areas will focus on the establishment of a self-producing and sustaining native vegetation community. For herbaceous vegetation (seed or other source), an 85% cover is a recommended goal after 5 years. For planted trees and shrubs, an 85% survival rate for planted individuals after 5 years will be a goal. If these survival rates cannot be achieved, additional planting may be required to achieve the minimum percent cover. The final performance standards may vary depending on the planting design selected.

10. MONITORING

The proposed mitigation for the Southport project consists of the establishment of multiple habitat types, including the following:

- Intertidal wetland/subtidal habitat.
- Freshwater wetlands with limited tidal exchange.
- SAV habitat.
- Uplands to establish threatened and endangered plant species impacted from the Southport project.
- Redbelly turtle nesting habitat.
- Upland buffers.

The conceptual components of the proposed mitigation have been presented in this mitigation report. The final mitigation plans and design details will be determined through the permit review process. Similarly, the development of a detailed monitoring program will be determined through the permit review process. The following is an example of a monitoring program developed for an approved mitigation plan for a project in Pennsylvania involving the construction of an emergent wetland in the Susquehanna River watershed. It is presented as a point for discussion among the applicant, consultants, and regulatory and resource agencies. The final monitoring program for the Southport project will necessarily be broader and more complex, given the size and diversity of the proposed mitigation for the Southport project.

10.1 SAMPLE MITIGATION MONITORING PLAN

Monitoring should consist of two components. First, regular visits (at least monthly during the first growing season following mitigation site construction) should be made to conduct qualitative assessments of the mitigation area (overall site conditions, plant survival, cover, species composition, photographic documentation). Second, quantitative assessments should be conducted toward the end of each growing season (September) at quadrats established in each habitat type, including a reference area in adjacent emergent wetlands. Each vegetation community/habitat type will be monitored to assess performance of the mitigation areas and the

need for institutional controls (e.g., management of invasive species), if necessary. Quantitative assessments will occur annually for a period of 5 years unless it can be demonstrated that the mitigation goals have been met.

For years 2 through 5 qualitative site assessments will occur during the spring and early summer.

The monitoring program will focus on assessing vegetation because the emergent wetland area is assumed to have standing water or saturation to the soil surface year-round. Monitoring hydrologic conditions will consist of measuring water depth (surface water, free water, and saturation in soil borings) adjacent to quadrats during site visits for quantitative monitoring. Characterization of soils is not proposed for this program.

For both qualitative and quantitative monitoring events, general observations on the mitigation and reference wetlands will be documented, and photographs taken at permanent stations and other applicable locations as appropriate. The general health of the mitigation area, observed wildlife, stabilization of soils and sediments, and vegetation cover and diversity will be noted. The location and extent of common reed and other potentially invasive species will be assessed to determine whether these species are encroaching into the mitigation area.

The number and approximate locations for sample stations, including the reference wetland area, will be mutually agreed upon by participating agencies and stakeholders. If required, permanent sample stations will be selected in the field and the location surveyed using Global Positioning System (GPS) hardware. Each sample station, including locations for photographic documentation, will be marked with labeled stakes or other permanent markers.

The following is a proposed monitoring program to be implemented following mitigation. Data would be collected as follows.

10.1.1 Qualitative Assessments

During each monitoring event, and a minimum of twice annually (spring and early summer), qualitative assessments of the mitigation site and adjacent areas will be conducted. The site will be traversed on foot, and site conditions documented using photographs and notes. At a minimum, the following assessments will be included:

- Assessment of the stability of soils and sediments. Observations will be made regarding areas where erosion/scouring, slumping channel banks are occurring and corrective actions may be necessary.
- General assessment of the overall site and each vegetation community type.
- Observations on vegetative cover, invasive species, hydrologic conditions, wildlife use, and functional attributes.
- Photographs of each wetland restoration area will be taken during each site visit at permanent stations. Documentation of the overall site condition, including each habitat type.
- Monitoring will occur in both mitigation and reference areas.

10.1.2 Annual Quantitative Assessments

Quantitative assessments of the mitigation and reference areas will be conducted annually in September for the 5-year monitoring period. These monitoring events will include detailed data collection in established quadrats following the guidelines outlined below. Photographic documentation of select quadrats will be a component of this program. In addition, a qualitative functional assessment of the restoration area will be conducted.

10.1.3 Vegetation

Determine percent cover, using the Braun-Blanquet method, of vegetation species identified within designated 1m x 1m quadrats.

Plants are identified, when feasible, to genus and species using appropriate plant taxonomic keys for the region. Generally, for each monitoring period some species cannot be identified to genus and species because of a lack of flowering structures and the time of year during which the survey was conducted.

10.1.4 Soils/Sediments

Soil and sediment characterization is not proposed. The majority of the mitigation area will consist of emergent wetlands containing standing water or saturation to the soil surface for most of the year.

10.1.5 Hydrologic Conditions

Observations of direct and indirect hydrologic conditions will be made for each monitoring station. Direct observation of hydrologic conditions included documentation of standing water and free water and saturation in soil borings. Indirect observations include features such as water-stained leaves, drainage patterns, and soil characteristics.

The assessment method will be used in annual quantitative assessment monitoring events (September) and incorporated into the annual monitoring report.

10.1.6 Reports

Reports will be prepared following each monitoring event. Representative photographs will be a component of each report. General observations on the restoration wetlands and adjacent areas will be made.

Progress reports will be prepared following each site visit and will, at a minimum, include the following:

- Information describing the function/value of the site at the time of inspection.
- Inventory, as applicable, of the surviving plant species and percent cover.
- Representative photographs of the restoration site and a map indicating the location and direction of photographs.
- If appropriate, inclusion of a written plan to correct any deficiencies identified during the monitoring event.

The annual/quantitative assessment report will provide more detailed information regarding species composition, estimates of percent cover, and estimates of survival of planted tree and shrub individuals. The quantitative assessment results will include data on species composition and percent cover sufficient to determine the approximate cover of herbaceous vegetation. The same reporting format will be followed in subsequent years.

11. LONG-TERM SUSTAINABILITY OF PROPOSED RESTORATION

As demonstrated in this mitigation report, the proposed compensatory mitigation for the Southport project is designed to be self-sustaining and represents the collective input of federal and state regulatory and resource agencies. The design is intended to provide for the establishment of functional, self-maintaining (e.g., wetland and other water hydrologic conditions including tidal/open-water connections to Neshaminy Creek and the Delaware River) vegetative communities and habitats designed to develop and maintain important functions and values that would be lost from the proposed Southport project.

When performance standards have been met, PRPA would ensure long-term sustainability of the mitigation areas following guidelines similar to those outlined in the NSP RMP, which provides for management and protection of natural resources, including wetlands and tidal wetlands, vegetation, water resources, fish and wildlife, and natural areas (DCNR, 2003). The NSP RMP includes goals and objectives for maintaining the diversity and integrity of diverse natural resources. A component of incorporating the long-term sustainability of the mitigation areas would be to, as needed, incorporate guidance for the select mitigation areas into the adopted guidance to comply with federal and state permit conditions.

PRPA will be responsible for constructing, operating, monitoring and maintaining the wetland mitigation site at Jack's Marina. Subsequent to the monitoring period, ownership and long-term maintenance of the site may be transferred to DCNR to be included as part of its park assets.

12. ADAPTIVE MANAGEMENT

As a result of the magnitude and complexity of impacts to wetlands, waters, and sensitive resources from the proposed Southport project, an adaptive management approach to address the compensatory mitigation for unavoidable impacts is appropriate. The program proposed in this mitigation plan provides a mechanism throughout the planning, implementation, and post-construction phases to ensure that the stated goals are developed and met using an adaptive management approach, which is simply defined as "Learning by Doing."

Key characteristics of adaptive management plans include (Nyberg and Taylor, 1995):

- Acknowledgment of uncertainty about what policy is "best."
- Thoughtful selection of policies or practices.
- Careful implementation of a plan.
- Monitoring of the key response indicators.
- Analysis of the outcome in consideration of the original objectives.
- Incorporation of the results into future decisions.

Successful mitigation requires an integrated, iterative approach under which adaptive management principles and "learning by doing" are applied. The implementation, monitoring and management of the approved mitigation plan would incorporate mechanisms to evaluate and modify actions in response to lessons learned from implementing the various components of the mitigation (see below).

PRPA would ensure long-term sustainability of the mitigation areas following guidelines similar to those outlined in the NSP RMP, which provides for management and protection of natural resources, including wetlands and tidal wetlands, vegetation, water resources, fish and wildlife, and natural areas (DCNR, 2003). The NSP RMP includes goals and objectives for maintaining the diversity and integrity of its diverse natural resources. A component of incorporating the long-term sustainability of the mitigation areas would be to, as needed, incorporate guidance for

the select mitigation areas into the adopted guidance to comply with federal and state permit conditions.

PRPA will be responsible for constructing, operating, monitoring and maintaining the wetland mitigation site at Jack's Marina. Subsequent to the monitoring period, ownership and long-term maintenance of the site may be transferred to DCNR to be included as part of its park assets.

13. FINANCIAL ASSURANCES

The PRPA is committed to funding the implementation of the approved, implementable compensatory mitigation plan and is in the process of obtaining the necessary funding, which would be based on the cost estimates developed after the mitigation plan is approved.

14. SOUTHPORT DEVELOPMENT PROJECT MITIGATION SUMMARY

A revised mitigation plan for the Southport Development Project has been prepared in response to agency review comments and questions related to the Mitigation Plan as originally proposed in the JPA and July 2010 EA submitted to various regulatory and resource agencies. The revisions improve its adequacy to compensate for impacts to regulated wetlands, waters, and other sensitive habitats. Table 1 summarizes the impacts and proposed mitigation. Figure 4 provides a conceptual mitigation plan proposed for JM. The following summarizes the impacts and proposed mitigation for habitats and species requiring mitigation.

Intertidal and Subtidal Mitigation – The discussion of impact minimization and mitigation for intertidal and subtidal habitats are combined due to the expressed interest of regulatory agencies to maximize the creation and enhancement of intertidal wetlands. The impact to intertidal and subtidal habitats is 12.98 acres (5.88 acres and 7.10 acres, respectively). Combining the Southport site and JM and accounting for ratios, the total impact minimization and mitigation credit of these habitats is 15.65 acres (12.24 acres of creation and restoration of intertidal habitat and 3.41 acres of subtidal habitat). The mitigation features preservation/enhancement of existing intertidal wetlands at JM (3.41 acres credit) and either the construction of SAV habitat in lagoons at JM or in suitable areas of the Delaware River adjacent to NSP (compensation for the loss of 1.08 acre of SAV at Southport). In total the proposed mitigation exceeds the impacts to both intertidal and subtidal habitat and compensates for the loss of SAV.

Deep Water Mitigation – The total impact to deep water habitat at the Southport site is 4.71 acres. Most of the impact is not due to filling (and reducing the acreage of this habitat type) but rather to a combination of excavation, slope stabilization and pile-supported wharf construction. A total of 3.91 acres of impact minimization is proposed, all located at the Southport site. This includes new deep water areas under the southern shoreline stabilization footprint and viable habitat under the exposed edges of the pile-supported wharves. Additional consideration can be given to enhancing deep water habitat along the south shore (striped bass breeding) and under the northern wharf by

adding artificial reefs by installing "reef balls", lava lamps, or other suitable structures attractive to bass and breeding fish. Any additional mitigation measures designed to enhance the environment, specifically intertidal mudflats attractive to birds. requires consideration of the FAA guidance related to BASH (bird/animal aircraft strike hazard).

Isolated Freshwater Wetland Mitigation – A total of 3.75 acres of freshwater wetlands dominated by invasive species (common reed) exist as depressions on top of historic dredged and fill materials (made land) will be filled under the proposed action. These wetlands have no surface or subsurface water connection to the Delaware River and offer no value to fishery resources of the Delaware River and limited value to wildlife. The proposed mitigation to compensate for these impacts consists of establishing a desirable plant community consisting of native tree and shrub species on the uplands remaining at JM following the implementation of the mitigation plan and invasive species control at Jack's Marina and potentially NSP. Excess credits from intertidal and subtidal mitigation area provide additional offsets for these habitats.

Intertidal Stormwater Channel Mitigation – A total of 0.73 acres of the existing tidal stormwater channel will be relocated to a parallel location. Similar habitat would be provided to compensate for this loss, including a rip rap bottom, steep partially vegetated slopes, and the inclusion of single log vanes which would provide added structure for fish habitat and also serve as redbelly turtle basking platforms. A rock check dam (similar to existing) would be placed at the outlet of the channel to the interpier area to retain standing water of similar depths as the existing channel. In addition, approximately 0.33 acre of open water (tidal, subtidal and deep water) will be included in area of the stormwater channel outlet to match the elevations of existing water depths at the outlet location in the interpier area. This will provide additional fish and redbelly turtle habitat.

Redbelly Turtle Habitat Mitigation – Redbelly turtles have been observed in the area of the Southport site, primarily within the stormwater channel upgradient of the Southport footprint. There is no accessible nesting habitat on the Southport site. Mitigation would consist of the establishment of 1.35 acres of redbelly turtle nesting

habitat at JM and the placement of basking structures in intertidal and subtidal habitat at both Southport and JM.

State-listed Plant Species Mitigation – Several individuals of 3 state listed plant species will be reestablished at JM as a component of mitigation (upland restoration).

Other Mitigation Considerations at JM – Additional opportunity exists to increase mitigation at JM. This includes:

- Ownership of the JM site would be transferred to the DCNR following the completion of mitigation and incorporated into NSP. Uplands within the mitigation areas can include public trails, observation points, and interpretive signs.
- A deteriorating dock located at the southwest corner of the southern lagoon/marina is currently used for public fishing and would be replaced under the proposed mitigation.
- Consider adding concrete/armoring along the JM shoreline to keep the river shoreline stabilized to retain site structure. This can include recycling concrete slabs already in place along the shoreline. In addition, concrete infrastructure in other portions of JM can be recycled as shore protection to stabilize the JM shoreline and potentially the NSP shoreline along the east side of Neshaminy Creek and the Delaware River.
- There are areas of SAV in the Delaware River adjacent to NSP. Mitigation could include planting SAV in adjacent areas with suitable habitat.

Conclusion

Mitigation, including impact minimization at the Southport site, is proposed to compensate for impacts to wetlands, waters, and sensitive species and habitats from the proposed Southport Development project. The proposed actions consist of a combination of 1) environmentally sensitive design at the Southport Development project site to minimize and offset some of the impacts (focus on deep water impacts), and 2) a holistic approach to establish a gradient of habitat types to compensate for impacts to intertidal and subtidal habitats, sensitive habitats (SAV) and sensitive species (redbelly turtle and state-listed plants). Additional mitigation includes invasive species management, removal of historic fill, planting uplands with native woody species, shoreline

stabilization, and providing public access to the JM site following the completion of mitigation. The total acreage in the mitigation package exceeds the take acreage from the proposed Southport Development project, including compensation ratios. The habitat value in the proposed plan is more than adequate compensation for any potentially significant impacts from the Southport Development project.

15. REFERENCES

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FINAL

APPENDIX K

FIGURES

EXISTING PIER 124
REEFER RACK (TYP)
SUBSTATION
EXISTING SHEET PILE BULKHEAD
TUG PARKING
FUELING STATION
CRANE AND RMG SHOP/ MARINE DEPARTMENT
NORTH WHARF
PROPOSED LOT LINE
REMAINING NORFOLK SOUTHERN LOT – PARCEL 8 (INTER MODAL FACILITY)
MAIN ACCESS ROAD
SUBSTATION
STORMWATER CHANNEL
MAIN SUBSTATION
SUBSTATION
GUARD BOOTH
ACCESS ROAD
GATE 1
GATE 2
EMPTY STORAGE
JERSEY BARRIER
ACCESS ROAD TO ADMIN BUILDING
EAST WHARF
DREDGE AREA
EXISTING CHANNEL
QUAY CRANE (TYP)
SOUTH REVETMENT
EMPTY STORAGE
SUBSTATION
ADMIN BUILDING
PARKING AREA
1"=150' 0 150 300 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

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REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY
B	REVISED PER PADEP COMMENTS	11/5/10	SK				
A	ISSUED FOR PERMIT REVIEW	7/16/10	SK				

Halcrow

WESTON SOLUTIONS

DESIGNED BY Z E FG
DRAWN BY
CHECKED BY
PROJECT ENGR

COMMONWEALTH OF PENNSYLVANIA
PHILADELPHIA REGIONAL PORT AUTHORITY
PHILADELPHIA, PA

SOUTHPORT PROJECT

SITE CONCEPT PLAN
FINAL PHASE

SCALE 1"=150'
DATE JULY 15, 2010
REVISION B
DRAWING NO. G–5

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83),
VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

REFERENCE: AERIAL DATA REDUCTION ASSOCIATES, INC.
DATE OF PHOTOGRAPHY: JUNE 22, 1994
DATE OF COMPILATION: NOVEMBER 1994

CONVERSION OF THE NAVD 1988 GROUND ELEVATIONS TO NGVD 1929 IS +0.98'
CONVERSION OF THE NAVD 1988 TIDAL DATA TO NGVD 1929 IS +1.32'

THE EXTENT OF TIDAL JURISDICTION IS BASED UPON TIDAL DATA AS FOLLOWS:
SECTION 10 -- MEAN HIGH WATER -- 3.04' NAVD 1988
SECTION 404 – SPRING HIGH WATER – 4.48' NAVD 1988

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE, STATION 8545240, PHILADELPHIA (USCG STATION), DELAWARE RIVER, PA, BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 IS AS FOLLOWS:

HIGHEST RECORDED TIDE 7.34' (NOV 1950)
MEAN HIGHER HIGH TIDE 3.46'
MEAN HIGH TIDE 3.04'
MEAN TIDE LEVEL 0.04'
MEAN LOW TIDE –2.96'
MEAN LOWER TIDE –3.15'
LOWEST RECORDED TIDE –9.96' (DEC 1962)
100 YEAR FLOOD ELEVATION 9.00' (NAVD 88)

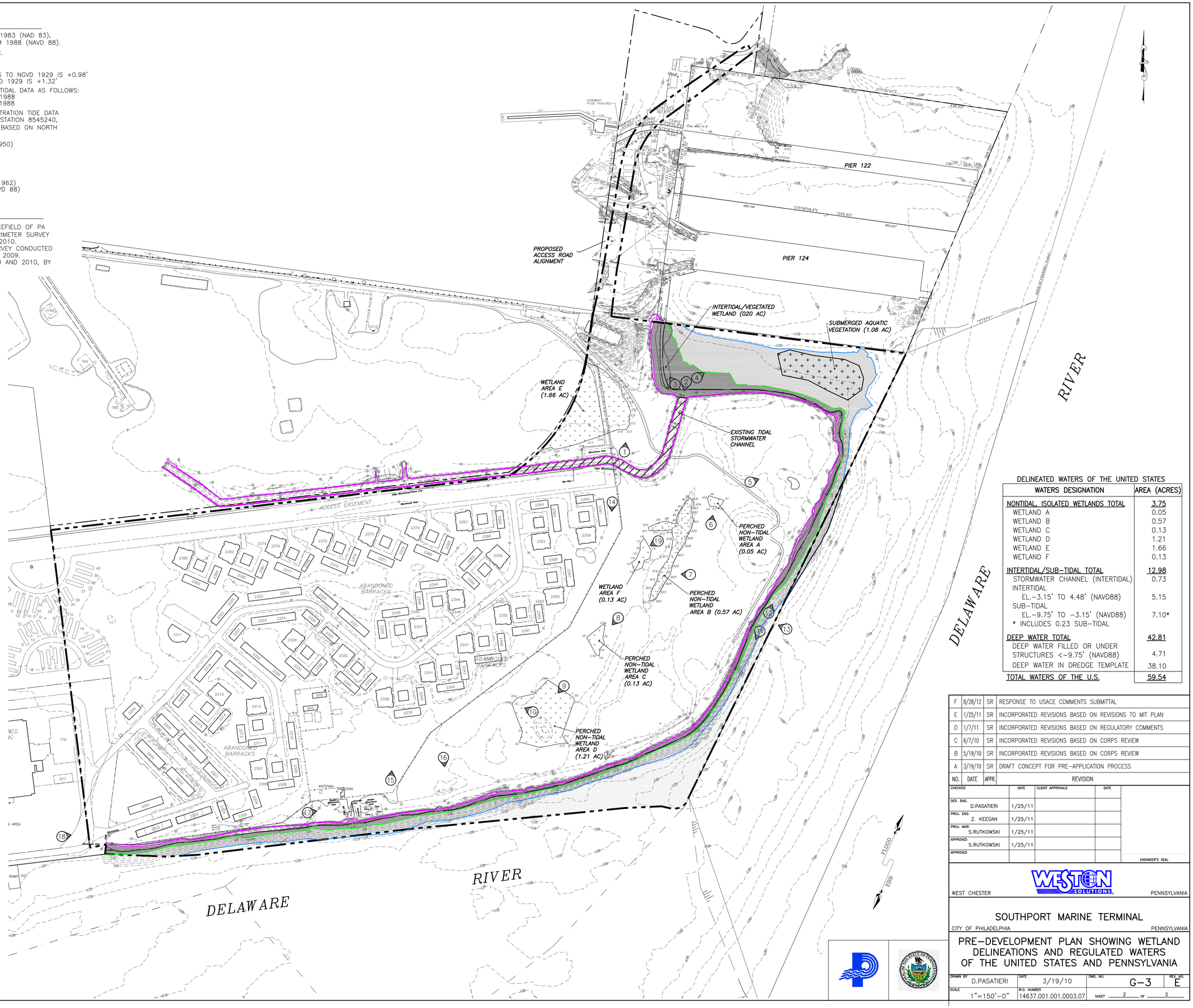
GENERAL NOTES

- TOPOGRAPHY INFORMATION FROM CUSHMAN & WAKEFIELD OF PA (1992) PNBC TOPOGRAPHY MAP, MODIFIED BY PERIMETER SURVEY PERFORMED BY RETTEW ASSOCIATES, INC. MARCH 2010.
- BATHYMETRY INFORMATION FROM FATHOMETRIC SURVEY CONDUCTED BY HYDROGRAPHIC SURVEYS DATED SEPTEMBER 3, 2009.
- WETLAND DELINEATIONS WERE CONDUCTED IN 2009 AND 2010, BY WESTON SOLUTIONS, INC.

LEGEND

- FENCE
- GUIDERAIL
- UTILITY POLE
- DENSE VEGETATION/ SHADOWS (DENSE WOODS)
- BUILDING WITH NUMBER (5432)
- WOODS LINE
- SHRUB/BRUSH AREA
- EXISTING CONTOURS WITH LABELS (10)
- SITE BOUNDARY
- PROPERTY LINE
- PHOTOGRAPH LOCATION AND DIRECTION (11)
- SURVEYED WETLAND BOUNDARY LINES
- SURVEYED WETLAND BOUNDARY POINTS (A2)
- STORMWATER CHANNEL
- ISOLATED FRESHWATER WETLANDS
- INTERTIDAL WATERS (–3.15' TO 3.46' NAVD88)
- SUB–TIDAL WATERS (–9.75' TO –3.15' NAVD88)
- DEEP WATER (<–9.75' NAVD88)
- SPRING HIGH WATER LINE (4.48' NAVD88)
- MEAN HIGHER HIGH WATER LINE (3.46' NAVD88)
- MEAN TIDE LEVEL (0.04' NAVD88)
- MEAN LOW WATER LINE (–3.15' NAVD88)
- SUBTIDAL/DEEP WATER BOUNDARY (–9.75' NAVD88)

150 0 150 300
SCALE: 1"=150'–0"



DELINEATED WATERS OF THE UNITED STATES

WATERS DESIGNATION	AREA (ACRES)
NONTIDAL, ISOLATED WETLANDS TOTAL	3.75
WETLAND A	0.05
WETLAND B	0.57
WETLAND C	0.13
WETLAND D	1.21
WETLAND E	1.66
WETLAND F	0.13
INTERTIDAL/SUB–TIDAL TOTAL	12.98
STORMWATER CHANNEL (INTERTIDAL)	0.73
INTERTIDAL EL.–3.15' TO 4.48' (NAVD88)	5.15
SUB–TIDAL EL.–9.75' TO –3.15' (NAVD88)	7.10*
* INCLUDES 0.23 SUB–TIDAL	
DEEP WATER TOTAL	42.81
DEEP WATER FILLED OR UNDER STRUCTURES <–9.75' (NAVD88)	4.71
DEEP WATER IN DREDGE TEMPLATE	38.10
TOTAL WATERS OF THE U.S.	59.54

NO.	DATE	APPR.	REVISION
F	8/28/12	SR	RESPONSE TO USACE COMMENTS SUBMITTAL
E	1/25/11	SR	INCORPORATED REVISIONS BASED ON REVISIONS TO MIT PLAN
D	1/7/11	SR	INCORPORATED REVISIONS BASED ON REGULATORY COMMENTS
C	6/7/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
B	5/19/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
A	3/19/10	SR	DRAFT CONCEPT FOR PRE–APPLICATION PROCESS

CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG. D.PASATIERI	1/25/11		
PROJ. ENG. Z. KEEGAN	1/25/11		
PROJ. MGR. S.RUTKOWSKI	1/25/11		
APPROVED S.RUTKOWSKI	1/25/11		
APPROVED			

ENGINEER'S SEAL

WESTON SOLUTIONS
WEST CHESTER PENNSYLVANIA

SOUTHPORT MARINE TERMINAL
CITY OF PHILADELPHIA PENNSYLVANIA

PRE–DEVELOPMENT PLAN SHOWING WETLAND DELINEATIONS AND REGULATED WATERS OF THE UNITED STATES AND PENNSYLVANIA

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	3/19/10	G–3	E
SCALE 1"=150'–0"	W.O. NUMBER 14637.001.001.0003.07	SHEET 2 OF 2	

Filename: G:\ACAD\PROJ\12769006003 PRPA Southport\PDC\G-3_G-4_8-28-12.dwg

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83), VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

REFERENCE: AERIAL DATA REDUCTION ASSOCIATES, INC.
DATE OF PHOTOGRAPHY: JUNE 22, 1994
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HIGHEST RECORDED TIDE 7.34' (NOV 1950)
MEAN HIGHER HIGH TIDE 3.46'
MEAN HIGH TIDE 3.04'
MEAN TIDE LEVEL 0.04'
MEAN LOW TIDE –2.96'
MEAN LOWER TIDE –3.15'
LOWEST RECORDED TIDE –9.96' (DEC 1962)
100 YEAR FLOOD ELEVATION 9.00' (NAVD 88)

GENERAL NOTES

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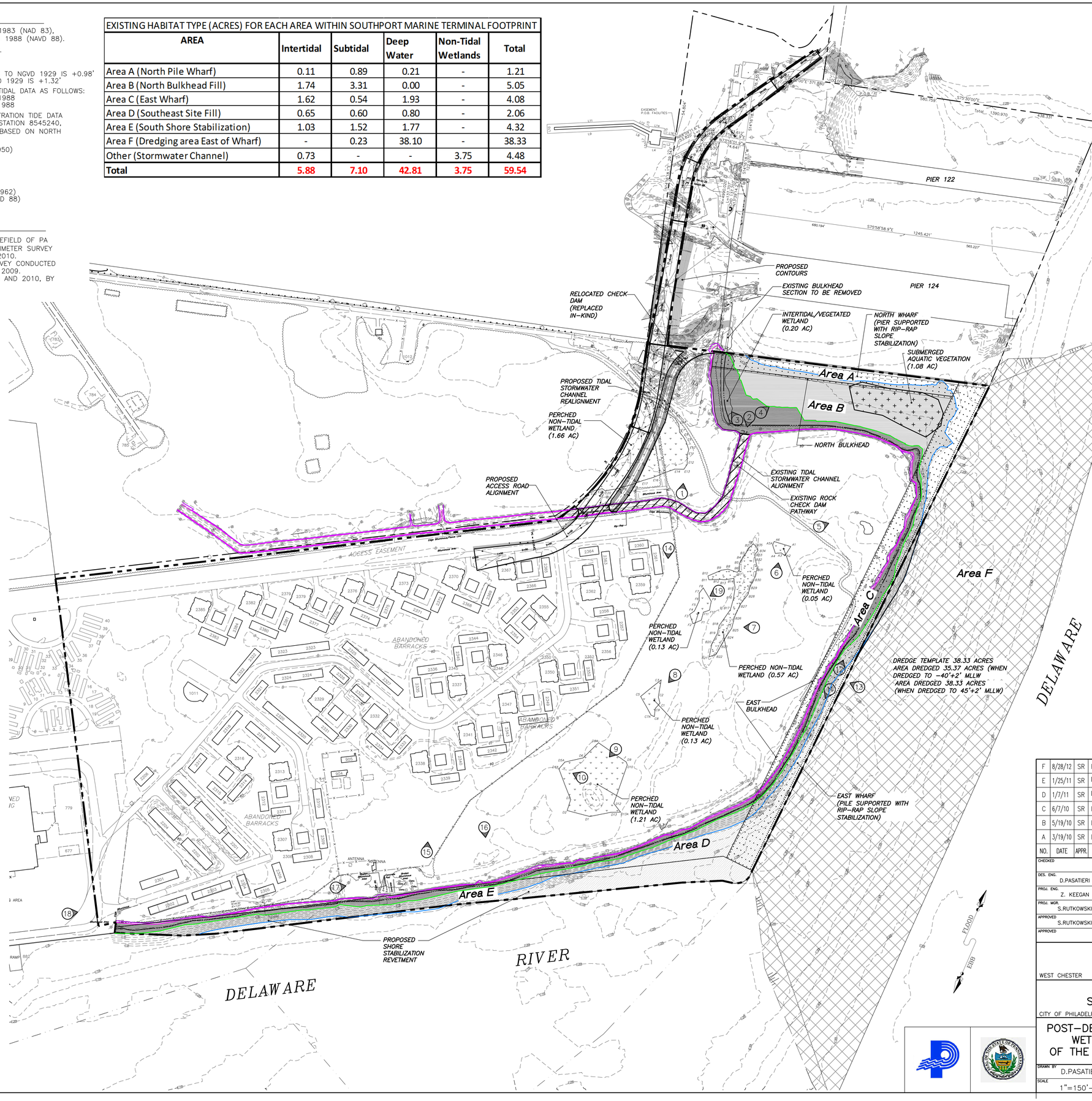
- BATHYMETRY INFORMATION FROM FATHOMETRIC SURVEY CONDUCTED BY HYDROGRAPHIC SURVEYS DATED SEPTEMBER 3, 2009.
- WETLAND DELINEATIONS WERE CONDUCTED IN 2009 AND 2010, BY WESTON SOLUTIONS, INC.

EXISTING HABITAT TYPE (ACRES) FOR EACH AREA WITHIN SOUTHPORT MARINE TERMINAL FOOTPRINT

AREA	Intertidal	Subtidal	Deep Water	Non-Tidal Wetlands	Total
Area A (North Pile Wharf)	0.11	0.89	0.21	-	1.21
Area B (North Bulkhead Fill)	1.74	3.31	0.00	-	5.05
Area C (East Wharf)	1.62	0.54	1.93	-	4.08
Area D (Southeast Site Fill)	0.65	0.60	0.80	-	2.06
Area E (South Shore Stabilization)	1.03	1.52	1.77	-	4.32
Area F (Dredging area East of Wharf)	-	0.23	38.10	-	38.33
Other (Stormwater Channel)	0.73	-	-	3.75	4.48
Total	**5.88**	**7.10**	**42.81**	**3.75**	**59.54**



LEGEND

- FENCE
- GUIDERAIL
- UTILITY POLE
- DENSE VEGETATION/ SHADOWS (DENSE WOODS)
- BUILDING WITH NUMBER (5432)
- WOODS LINE
- SHRUB/BRUSH AREA
- EXISTING CONTOURS WITH LABELS (10)
- SITE BOUNDARY
- PROPERTY LINE
- PHOTOGRAPH LOCATION AND DIRECTION (11)
- SURVEYED WETLAND BOUNDARY LINES
- SURVEYED WETLAND BOUNDARY POINTS (A2)
- STORMWATER CHANNEL
- ISOLATED FRESHWATER WETLANDS
- INTERTIDAL WATERS (–3.15' TO 3.46' NAVD88)
- SUB-TIDAL WATERS (–9.75' TO –3.15' NAVD88)
- DEEP WATER (<–9.75' NAVD88)
- DREDGE TEMPLATE
- SPRING HIGH WATER LINE (4.48' NAVD88)
- MEAN HIGHER HIGH WATER LINE (3.46' NAVD88)
- MEAN TIDE LEVEL (0.04' NAVD88)
- MEAN LOW WATER LINE (–3.15' NAVD88)
- SUBTIDAL/DEEP WATER BOUNDARY (–9.75' NAVD88)

150 0 150 300
SCALE: 1"=150'–0"

DELINEATED WATERS OF THE UNITED STATES

WATERS DESIGNATION	AREA (ACRES)
NONTIDAL, ISOLATED WETLANDS TOTAL	3.75
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WETLAND B	0.57
WETLAND C	0.13
WETLAND D	1.21
WETLAND E	1.66
WETLAND F	0.13
INTERTIDAL/SUB-TIDAL TOTAL	12.98
STORMWATER CHANNEL (INTERTIDAL)	0.73
INTERTIDAL	
EL.–3.15' TO 4.48' (NAVD88)	5.15
SUB-TIDAL	
EL.–9.75' TO –3.15' (NAVD88)	7.10*
* INCLUDES 0.23 SUB-TIDAL	
DEEP WATER TOTAL	42.81
DEEP WATER FILLED OR UNDER STRUCTURES <–9.75' (NAVD88)	4.71
DEEP WATER IN DREDGE TEMPLATE	38.10
TOTAL WATERS OF THE U.S.	59.54

NO.	DATE	APPR.	REVISION
F	8/28/12	SR	RESPONSE TO USACE COMMENTS SUBMITTAL
E	1/25/11	SR	INCORPORATED REVISIONS BASED ON REVISIONS TO MIT PLAN
D	1/7/11	SR	INCORPORATED REVISIONS BASED ON REGULATORY COMMENTS
C	6/7/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
B	5/19/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
A	3/19/10	SR	DRAFT CONCEPT FOR PRE-APPLICATION PROCESS

CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG. D.PASATIERI	1/25/11		
PROJ. ENG. Z. KEEGAN	1/25/11		
PROJ. MGR. S.RUTKOWSKI	1/21/11		
APPROVED S.RUTKOWSKI	1/25/11		
APPROVED			

ENGINEER'S SEAL

WESTON SOLUTIONS
WEST CHESTER PENNSYLVANIA

SOUTHPORT MARINE TERMINAL

CITY OF PHILADELPHIA PENNSYLVANIA

POST–DEVELOPMENT PLAN WITH IMPACTS TO WETLANDS AND REGULATED WATERS OF THE UNITED STATES AND PENNSYLVANIA

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	3/19/10	G–4	E
SCALE 1"=150'–0"	W.O. NUMBER 14637.001.001.0003.07	SHEET 2 OF 2	

Filename: G:\ACADPROJ\12769006003 PRPA Southport\PIDC\G-3_G-4_8-28-12.dwg

Legend

Mitigation Areas - Former Jack's Marina

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0 450 Feet

Figure 4
Wetland/Water Mitigation
Creation and Enhancement Areas
Former Jack's Marina
Bensalem and Bristol, Pa

Y:\Neshaminy State Park\MXD\Former_JacksMarina.mxd - 9/18/2012 curtisf

EXISTING CONDITIONS PLAN

SCALE: 1"=200'-0"

EXISTING AREA CLASSIFICATION SUMMARY

AREA DESIGNATION	WETLAND TYPE	AREA (ACRES)
	INTERTIDAL (LAGOON PERIMETERS) (4.0' TO -4.0' NAVD88)	1.63
	INTERTIDAL (4.0' TO -4.0' NAVD88)	13.65
	SUBTIDAL (-4.0' TO -11.0' NAVD88)	4.03
	UPLAND (> 4.0' NAVD88)	16.09
	TOTAL ACREAGE	35.40

PROPOSED MITIGATION GRADING PLAN

SCALE: 1"=80'-0"

MITIGATION DESIGNATION SUMMARY

	AREA DESIGNATION	HABITAT TYPE	AREA (ACRES)	RATIO	REPLACEMENT CREDIT
INTERTIDAL		WETLAND RESTORATION (4.0' TO 1.0' NAVD88)	0.09	1:1	0.09
		VEGETATED INTERTIDAL WETLAND (4.0' TO 1.0' NAVD88)	5.47	1:1	5.47
		INTERTIDAL MUD FLAT (1.0' TO -4.0' NAVD88)	3.30	1:1	1.67*
		PRESERVATION INTERTIDAL WETLAND (ENHANCEMENT, INVASIVE SPECIES MANAGEMENT)	13.65	4:1	3.41
SUBTIDAL		SHALLOW SUBTIDAL (-4.0' TO -5.0' NAVD88)	1.29	4:1	0.32
		POTENTIAL SUBMERGED AQUATIC VEGETATION (SAV) HABITAT (-5.0' TO -7.0' NAVD88)	3.25	3:1	1.08
		DEEP SUBTIDAL (LAGOON) (-7.0' TO -11.0' NAVD88)	0.99	4:1	0.25
UPLAND		UPLAND RESTORATION/BUFFER (> 4.0' NAVD88)	6.00	2:1	3.68
		REDBELLY TURTLE NESTING (> 4.0' NAVD88)	1.35	2:1	
		TOTAL ACREAGE	35.4		15.97

*NOTE: NO CREDIT FOR 1.63 ACRES OF EXISTING INTERTIDAL WETLAND RE-GRADED AND RETAINED AS INTERTIDAL WETLANDS IN PROPOSED MITIGATION DESIGN.

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83), VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

AERIAL PHOTOGRAMMETRY AND DATA REDUCTION PERFORMED BY AERO2, INC. DURING EARLY APRIL 2010.

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE, STATION 8539094, DELAWARE RIVER AT BURLINGTON, NJ, BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AS FOLLOWS:

HIGHEST RECORDED TIDE 7.16' (OCT 2003)
MEAN HIGHER HIGH TIDE 4.23'
MEAN HIGH TIDE 3.84'
MEAN TIDE LEVEL 0.20'
MEAN LOW TIDE -3.44'
MEAN LOWER TIDE -3.63'
LOWEST RECORDED TIDE -6.30' (JAN 2003)
100 YEAR FLOOD ELEVATION 9.93'

80 0 80 160

SCALE: 1"=80'-0"

LEGEND

EXISTING CONTOUR WITH LABEL (NAVD 88) — 10 — 12.0 —

PROPOSED CONTOUR (NAVD 88) — 0 —

EXISTING PROPERTY LINE — – —

EDGE OF WATER — ··· —

EXISTING ROAD

NO.	DATE	APPR.	REVISION
1	8/28/12	SR	RESPONSE TO USACE COMMENTS SUBMITTAL
0	7/31/11	SR	REVISED PER AGENCY COMMENTS

		DATE	CLIENT APPROVALS	DATE
CHECKED	KTM	8/28/12		
DES. ENG.	DP	8/28/12		
PROJ. ENG.	BD/SR	8/28/12		
PROJ. MGR.	SR	8/28/12		
APPROVED	SR	8/28/12		
APPROVED				

ENGINEER'S SEAL

WESTON SOLUTIONS

WEST CHESTER PENNSYLVANIA

SOUTHPORT
PROPOSED MITIGATION PLAN

CLIENT CITY

FIGURE 5
HABITAT AND GRADING PLAN
JACK'S MARINA

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	12/6/2010		
SCALE: AS SHOWN	W.O. NUMBER: 12769.007.002.0001	SHEET ___ OF ___	

Filename: G:\ACADPROJ\12769006003 PRPA Southport\JacksMarina\SitePlan8-28-12.dwg

ATTACHMENT 1

RECENT MITIGATION PLAN REPORTS

8/16/2010

Submerged Aquatic Vegetation Survey

A Study Completed for the Neshaminy State Park Area, Bucks County, Pennsylvania

Prepared By
Joseph R. Arsenault
Sr. Ecologist

Submerged Aquatic Vegetation Survey

A Study Completed for the Neshaminy State Park Area, Bucks County, Pennsylvania

The Southport Project is a waterfront redevelopment endeavor that proposes to dramatically modify the shoreline of the Delaware River, south of Windy Point within the eastern edge of the Philadelphia Naval Yard. In the redevelopment process, alterations to the littoral and sub-littoral zone will occur. To accomplish this task, environmental permits will be required and mitigation for the loss of sensitive habitats, including sub-tidal habitats and submerged aquatic vegetation (SAV).

The permit requirements for the Southport Project will include mitigation or enhancement for the loss of the wetlands, SAV, additional habitats and sensitive species. The need to find suitable mitigation and enhancement site has led to the Neshaminy State Park and adjacent areas in Bucks County, where suitable land may be available for this activity (Figure 1). A survey to describe the SAV and their habitats in the Park area is needed to determine a plan of action for the mitigation and enhancement proposal.

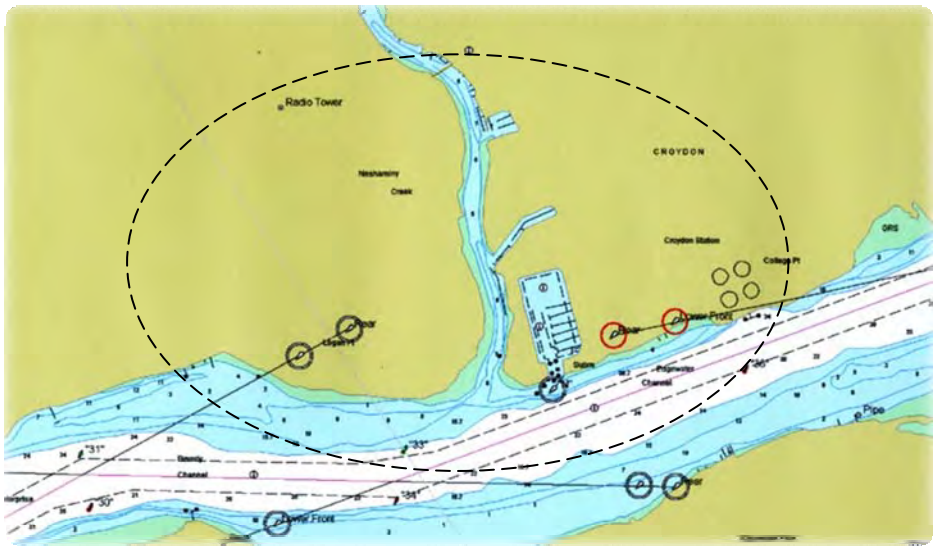

Figure 1: Neshaminy Creek SAV Study Area (oval) shown on Garmin Blue Water Navigation Chart

The Delaware River Estuary Program has defined submerged aquatic vegetation (SAV) as a suite of species composed of vascular plants that grow below the surface of the water on soft sediments in sheltered shallow waters of estuaries, bays, lagoons, and lakes. Tidal SAVs are normally completely inundated throughout the tidal cycle. The Estuary Program describes SAV habitats as a mix of open water and rooted, floating-leaved, and short-emergent vegetation. Cowardin (1979) provides the following classification that is attributed to SAVs: Aquatic Bed, Vascular (E2AB3 and E2AB5 for intertidal; E1AB3 and E1AB5 for sub-tidal.

Little published information is available to the upper tidal Delaware River system. Water quality documents (ANSP, 1998) found a paucity of available data on SAV in the Delaware River. Schuyler (1988) found virtually no efforts to document the extent of SAV in the tidal portions of the freshwater Delaware River. SAV are found in the lower portions of the intertidal zone and have a specific preference for substrates and rooting sediments. Schuyler (1988) described 12 species of SAV have been observed in the tidal Delaware River. Information that was obtained for the river found SAV are potentially important to the quality of the river as well as for fish and wildlife habitat. Neshaminy State Park's tidal waters (Figure 1) occupy a portion of the freshwater tidal Delaware River between the Beverly and Burlington Shipping Channels. The position surrounds the mouth of the Neshaminy Creek, which are many miles above the northern normal seasonal saline isohaline. Similar freshwater tidal habitats in Eastern North America support freshwater tidal environments and have typical representative genera: *Anacharis, Ceratophyllum, Chara, Eleocharis, Hydrilla, Myriophyllum, Najas, Nitella, Potomogeton, Scirpus, Vallisneria, & Zannichellia*. Species in these genera were targeted by this study.

Freshwater tidal and sub-littoral habitats are special for a variety of reasons, many centered on the limited available habitat. The coincidence of human river activities and the tidal portion of the river have influenced the SAV distribution, limiting the resource to small beds associated with the few river shallows. This survey, as documented in this summary report, serves to determine the presence or absence of SAV and to describe its extent within the upper Delaware River intertidal zone.

Study Objective

The SAV survey objective was to determine if submerged aquatic plants occupy any part of the suitable habitat found in the sub-littoral portion of the Neshaminy Creek or Neshaminy Creek State Park's portion of the Delaware River.

Study Goal

The primary study goal was to provide the physical labor and field time necessary to sample the aqueous Neshaminy Creek or the sub-littoral Delaware River for SAV. This study used a standard de novo search protocol to make the presence or absence determination. A second goal of the study was to document the extent of SAV if such species are encountered during the sampling effort. This was accomplished using the evidence collected by the site sample protocol and the best interpretation of the principal scientist.

Methods

The SAV survey followed standard collection protocols. SAV sampling used simple equipment to collect from the sub-littoral area within the Delaware River and Neshaminy Creek:

- 14'gas engine propelled flat bottom boat equipped with an electronic depth sounder, Garmin GPS III *plus*, VHF Com radio, 16' Push pole and standard safety equipment.
- Weighted double sided rake used to collect specimens from river bottom sediments
- 8" Secchi Disk used to document the river's light penetration
- Collection bags, identification tags

Depth recordings and secchi readings assisted the definition of the search area. Each sample point was sampled from an anchored boat. The collection rake was tossed and retrieved three times. The tosses were made 90°s to the two sides and front of the boat, collecting from separate areas at each anchored point. Data on the presence or absence of SAV each throw and the species, if present, was recorded at each station. The boat was motored to slow and drop anchor for samples collected in that environment.

An estimate of the quantity of population size was made from the results of the various collection tosses as well as the corresponding depths. The SAV bed size is estimated based on the presence of collected specimens. Waypoints collected on its perimeter provide an aerial measurement and specific location to the presence or absence determination.

The tidal regime requires special SAV collection consideration. The tidal water fluctuations in this part of the river can exceed 6'. Sampling at high tide can be difficult and may not provide an accurate assessment. Enhanced search conditions are found 1.5 hours on either side of the low tide, so sample timing relied on the tidal predictions provided by NOAA at http://tidesandcurrents.noaa.gov/.

The sampling goal was to observe the Upper Delaware River tidal environment during the peak growing period during a low tide predicted during the mid-morning to early afternoon. This timing is necessary sample when the submerged aquatic vegetation would be most visible while providing safe sampling conditions. The information gathered during this sampling event is presented in the Results section of this summary report.

Results

The SAV survey occurred during a morning low tide (~10:30 AM PLT) on July 16, 2010. The principal scientist and assistant launched the flat bottom boat at 8:00 AM EST and motored into the Delaware River. Sampling began around 8:15AM in the Delaware River sub-littoral zone, downstream of the Park's boat ramp. Thirty-four (34) sample points (#s 88 through 121) were made on the Delaware River and Neshaminy Creek shore lines that resulted in 102 sub-sample collections (Figure 2). These samples resulted in the identification of SAV with a distribution only in the Delaware River portion of the sample area.

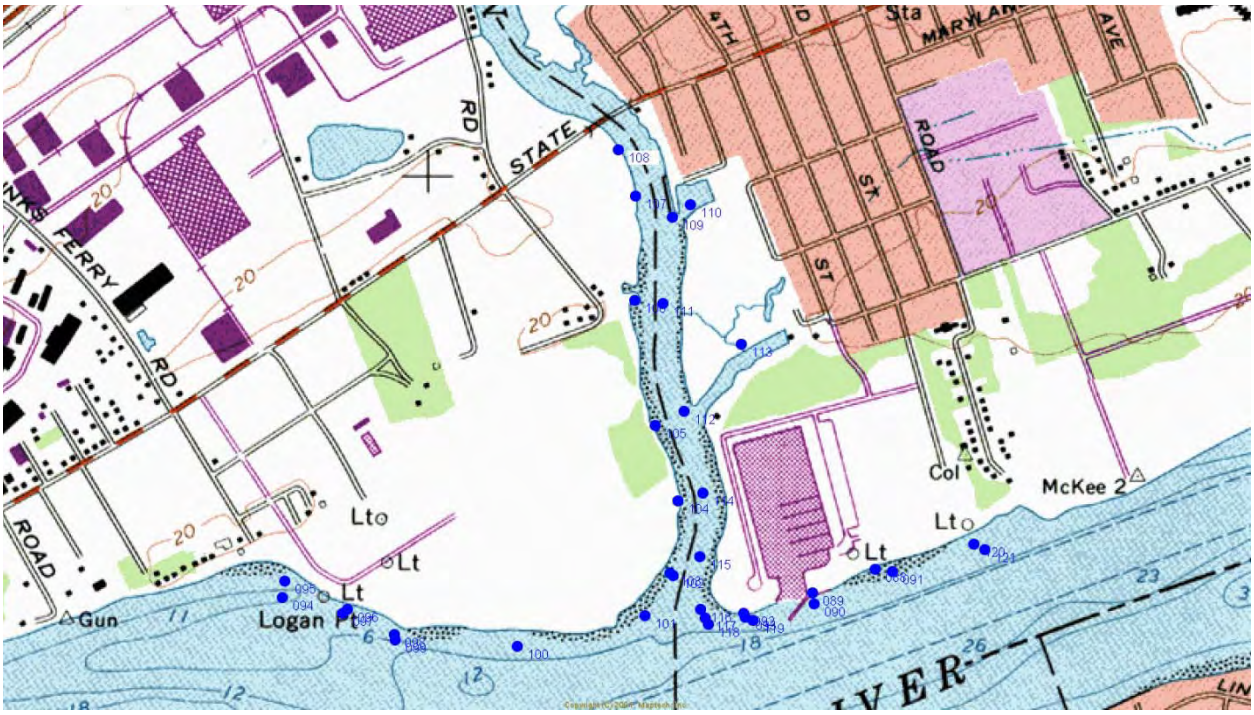

Figure 2: USGS Beverly NJ topographic quadrangle illustrating sample point distribution

The sampling effort resulted in the identification of SAV at 4 of the 34 sub samples. This is 11.8 percent of the anchored stations. It found SAV at 9 percent of the sample tosses where only one SAV species was identified rooted in the river's substrates. Wild celery (*Vallisneria americana*) has representative populations within the near shore aqueous habitat. No SAVs were found in the Neshaminy Creek or its nearby boat slips of the former Jack's Marina. Wild celery was found scattered along the Delaware River's shoreline where the depth of the water at low tide is sufficient to cover the plants yet shallow enough to provide ambient light to provide photosynthesis. Based on the depth readings (Table 1, below) made during the survey, the population is confined to the water with depths between 3 and 6 feet MLW. Secchi readings indicate light penetration is restricted to the upper three to four feet (Approx. 32-44") of the water column. The shallower areas receive light saturation whereas the deeper areas the light reached the upper unfolded leaves of the deepest plants. Table 1 provides the results of the sampling for SAV.

Table 1: Sample Results from July 16, 2010 SAV Study

Sample	GIS Lat/Long	Location	Rake Pull 1	Rake Pull 2	Rake Pull 3	Sediment	Secchi	Depth
88	40.07477760 74.90343877	River	0	0	0	cobble	To bottom	41"
89	40.07426262 74.90523049	River	0	0	0	cobble	-	-
90	40.07402658 74.90519294	River	0	0	0	silt	39"	72"
91	40.07473469 74.90295061	River	0	0	0	silt	38"	84"
92	40.07381201 74.90719386	River	0	0	0	cobble	To bottom	45"
93	40.07372618 74.90716168	River	0	0	0	Silt/clay	49"	89"
94	40.07415533 74.92039570	River	Vallisneria	Vallisneria	Vallisneria	silt	52"	72"
95	40.07452011 74.92032059	River	0	0	0	cobble	To bottom	32"
96	40.07389784	River	0	0	0	cobble	To bottom	32'

	74.91853961							
97	40.07381201 74.91867372	River	Vallisneria	Vallisneria	Vallisneria	silt	46”	60”
98	40.07333994 74.91719850	River	0	0	0	silt	41”	4-5’
99	40.07323265 74.91717705	River	Vallisneria	Vallisneria	0	silt	37.5”	6’
100	40.07308245 74.91367945	River	0	0	0	silt	37”	80”
101	40.07376909 74.91002091	River/creek mouth-west	0	0	0	Silt mud	37”	64”
102	40.07464886 74.90922161	Creek mouth	0	0	0	Silt mud	35”	84”
103	40.07469177 74.90931281	Creek mouth	0	0	0	Silt mud	36”	52”
104	40.07469177 74.90907677	Creek	0	0	0	Silt mud	31”	54”
105	40.07793188 74.90973660	Creek	0	0	0	Silt mud	36.5”	74”
106	40.08072138 74.91031059	Creek	0	0	0	Silt mud	36”	79”
107	40.08301735 74.91028913	Creek	0	0	0	Silt mud	36”	55”
108	40.08402586 74.91080948	Creek	0	0	0	Silt mud	36.5”	72”
109	40.08254528 74.90922698	Creek Lagoon Mouth	0	0	0	Silt mud	53.5”	74”
110	40.08282423 74.90871736	Lagoon	0	0	0	mud	50.5”	68”
111	40.08065701 74.90949520	Creek	0	0	0	Silt mud	37”	57”
112	40.07825375 74.90890511	Creek Lagoon Mouth	0	0	0	Mud leafy	45”	64”
113	40.07975578 74.90725824	Creek	0	0	0	mud	62”	10’
114	40.07645130 74.90836867	Creek	0	0	0	mud	To bottom	42”
115	40.07505655 74.90845450	Creek	0	0	0	mud	To bottom	35”
116	40.07389784 74.90843304	Creek mouth-east	0	0	0	cobble	To bottom	36”
117	40.07370472 74.90828821	Creek mouth-east	0	0	0	cobble	37”	44”
118	40.07357597 74.90820774	Creek Mouth-east	0	0	0	silt	45”	54”
119	40.07366180 74.90693637	River	Vallisneria	0	0	Silt	53”	70”
120	40.07533550 74.90063854	River	0	0	0	Silt	To Bottom	44”
121	40.07520676 74.90031668	River	0	0	0	Silt and Cobble	45”	67”

One additional species was collected in the project area as floating specimens. *Anacharis canadensis* was found floating in the river as well as in the former Jack’s Marina lower boat slip. The providence of these specimens is unknown, but is expected to have been transported from regional populations by the tides and wind.

Population Size

Sample waypoints 94, 97, 99 and 119 (JRA specimens 2275-2311) have been found to support SAV beds Figures 2 and 3). Each site found wild celery on a silt substrate in relatively shallow water with secchi readings less than 4 feet. The beds appear to be discontinuous and scattered along the river’s edge where available silt and light provide suitable rooting environment. It corresponds to the light and depth limits associated with the collected specimens.

Figure 3: SAV bed (red line) surrounds *Vallisneria* habitat. The total area occupied is approximately 1.34 acres (59,659 SF).

The wild celery population is distributed unevenly within the identified habitat. The quantity of vegetation retrieved during each successful sample pull was characterized as moderate to dense at samples 94, 97 and 99. Sample site 119 was characterized a sparse with few weak culms retrieved on one sub-sample retrieval. There appeared to be no discernable gradient, only the presence of healthy species of relative long leaved plants, specifically at sample sites 94, 97 and 99. Sample point 119 found a few ragged culms with robust root stocks at the mouth of the State's marina entrance.

Conclusions

SAV have been discovered in the Neshaminy State Park's tidal waters. One species, **wild celery,** has been discovered rooted in the project area. Wild celery occupies approximately 1.4 acre of suitable habitat, with the bulk of the SAV being located along the lower edge of the Delaware River's sub littoral zone.

Figure 4: Approximate location of SAV bed (red) and possible additional suitable habitat based on depth and substrate, (NJDEP 2002 IRC)

The SAV is restricted to waters between 3 foot and 6 foot mean low water, limited by substrate type and light penetration. Habitat meeting these limitations exists along an extremely narrow area on the Delaware River shoreline on both (east and west) sides of the Neshaminy Creek (Figure 4). Wild celery is restricted to the fine silt substrates and is absent where rocky cobble is the dominant substrate. The shoreline's suitable habitat is compromised by limited suitable substrate as well as depth. Suitable habitat may also be limited by human perturbation. Wave action and propeller wash from the heavy boat actions may also limit the SAV distribution.

References

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1/11/2011

Neshaminy State Park & Jack's Marina Vascular Plant Survey

Prepared By

Joseph R. Arsenault, Sr. Ecologist

Southport Project: Neshaminy State Park & Jacks Marina Vascular Plant Survey: 2010

Project Purpose

The Southport Project is a planned industrial development slated for a portion of the former Philadelphia Navy Yard. This planned activity would impact freshwater wetlands and deepwater habitats to achieve the waterfront development needed for new commercial shipping ventures. The US Army Corps of Engineers permitting process would require mitigation to replace the lost ecological values anticipated by the impacts.

A wetland mitigation solution has been proposed that would use portions of Neshaminy State Park and a nearby private parcel (former Jack's Marina) to achieve the mitigation requirements. The project engineer, Weston Solutions, Inc. has been tasked to provide a due diligence effort to understand the baseline information for the proposed mitigation footprints. This task proceeded with a site selection process and natural resource baseline data collection to determine the existing conditions, plant species associations and the existence of species of concern. Species of concern include threatened or endangered species as well as aggressive invasive species. Both plant characteristics extremes are factors that could influence the site selection and mitigation methods needed to provide the replacement values as required by the proposed wetland permits.

The Southport Project proposed wetland impacts would occur adjacent to the Delaware River edge, within Philadelphia County's Coastal Plain. The Atlantic Coastal Plain's representation within eastern Pennsylvania is limited to the land adjacent to the Delaware River east of the fall line. Most of Pennsylvania Coastal Plain landscapes have been fully utilized for residential, commercial or industrial activities, leaving a select few undeveloped remnant acres north of the city. The selected wetland replacement area is within one of the few remaining undeveloped areas of Coastal Plain in Pennsylvania. Neshaminy State Park and vicinity is one of these remnants.

The Philadelphia Navy Yard is highly disturbed yet supports fragments of naturalized vegetation with native species components. Neshaminy State Park and vicinity is located within a less urban environment, providing space for the proposed mitigation. The Bucks County site was selected for the wetland mitigation because it provided the needed acreage and was located in the same coastal plain physiographic conditions found in the Philadelphia Navy Yard.

To determine the baseline conditions for the proposed mitigation areas a site review for species composition and site circumstance was completed by, Joseph Arsenault. Mr. Arsenault is a field botanist retained by Weston Solutions with experience on the Atlantic Coastal Plain. This investigator made

multiple site visits in the fall of 2010 necessary to provide a comprehensive species list for the anticipated land use. The site review included the identification of protected plants, their locations and presence invasive species problems. The results of this site survey are provided in the text of this report.

Methods

The wetland mitigation may include one or more of the following techniques: creation, enhancement and restoration. Each could be used to achieve the acreage ratios needed to compensate for the Southport wetland impacts. This range of possible mitigation techniques required the review of a variety of natural and manmade environments within the selected park and marina compensation areas. The task was to identify various vegetation community types and document the individual floral components. The effort recorded botanical data (species presence, abundance, nativity, status, vegetation community) for the mitigation evaluation. A flora was developed from the field visits for each of the three study areas within Neshaminy State Park and the available habitats within Jack's Marina. A plant community map is created for each site using 1995 and 2002 aerial photos. The community delineation was made using visible vegetative signatures assisted by ground truth data collected during the field visits.

The field survey proceeded follow standard plant search and survey techniques. A directed random search method was applied to the various study areas. Each plant observed was recorded with a note on the vegetative context in which it was found. A 2010 fall flora was made from the plant and vegetation record. The nomenclature follows one or more of the follow sources: the Flora of North America (1993+), USDA Plants Database (2010), and Kartesz and Meacham (1999). The approximate location of species of special concern (state-listed) was identified within the study area were located using a Garmin III+ GPS. The size of the survey area was estimated using the GPS data. In some areas the numbers of state-listed species were too great to survey individually. In those locations, general information of the density and distribution is provided. Information on state rank codes and definitions for species of special concern identified in this report (e.g. S1, S2, S3 and PE) can be found at the following website: http://www.naturalheritage.state.pa.us/PlantsPage.aspx .

Historic Records and Recent Floristic Surveys:

Pennsylvania's portion of the Delaware River edge and Coastal Plain was never a significant physiographic landscape component. Because of this ecosystem rarity, coastal plain species have historically been limited (Ferren, 1974; Wherry, 1975). Today, due to the pressures of modern development, there are fewer remnants and those that do survive are relics of the once larger contiguous system. Neshaminy State Park surrounds one the larger fragments on the western edge of the Northern Atlantic Coastal Plain.

Two recent botanical surveys have been completed for the land surrounding the Neshaminy Creek, south of State Road. The botanical efforts concentrated field time studying the flora of the natural vegetation within the eastern edge of Neshaminy State Park and the vacated area within Jack's Marina.

Drs. Ann Rhoads and Tim Block completed a site survey in 2002. The Rhoads and Block survey was a botanical review completed for an 8-acre tidal marsh addition to the park's land holdings. Their work was published June 2002. It listed a suite of PNDI listed elements known for the Neshaminy State Park and vicinity. This document identified a variety of plant communities that accompanied a vegetation map. Their combined effort identified 18 listed elements and one listed plant community. The Rhoads and Block survey also identified a suite of invasive species, highlighted with botanical data outlined on fact sheets. Common reed, mile-a-minute, purple loosestrife, garlic mustard and Japanese knotweed are identified as 5 notorious invasive plants found within or adjacent to the proposed 8-acre acquisition.

Ms. Janet Ebert and Mr. Jack Holt: This pair of botanists surveyed Jack's Marina in 2006 for a site specific development proposal. They recorded 232 species, 46% of which are alien to Pennsylvania. They recorded ten plant species of special concern, all associated with the freshwater tidal wetlands.

Results

The 2010 fall field survey completed 4 site visits on October 8, 11, 18 and 23. The field investigations were concentrated on the eastern part of Neshaminy Creek and the lands within the parcel once described as Jack's Marina. The Neshaminy State Park survey included the old field and adjacent sandy dredge spoils; the Soil Factory tract and the river dredge spoils site situated at the intersection of the Delaware River and Neshaminy Creek. Jack's Marina was surveyed in its entirety. The 2010 surveys substantiated the earlier botanical surveys. The 2010 effort provides a vegetation map locating the specific sites of species listed by the State of Pennsylvania.

Physiography and Geology

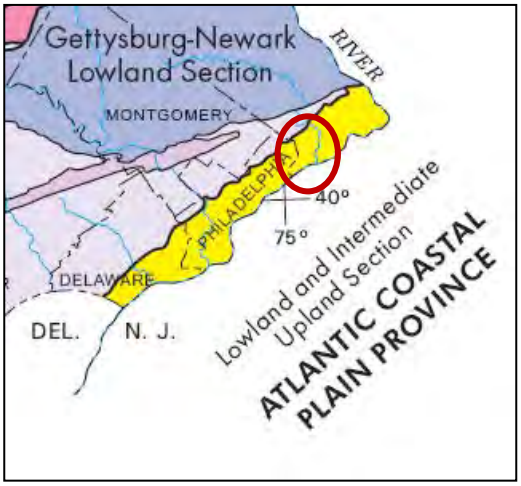

Figure 1: From Physiographic Provinces of PA

Physiographic Province: This part of Pennsylvania is within the **Atlantic Coastal Plain**, on unconsolidated sand and gravel deposits (Figure 1). The Atlantic Coastal Plain is a relative level to gently sloping physiographic province that occupies less than 3% of Pennsylvania's eastern Delaware River Valley. The lower Neshaminy Creek and vicinity is near the northern providence terminus. It developed on a landscape of unconsolidated sand and gravel deposits shaped by the various continental glacier outwash rivers. Only fragments of the native landscape exist today. The Neshaminy State Park and Jack's Marina study sites provide a mix of native and manmade landscapes.

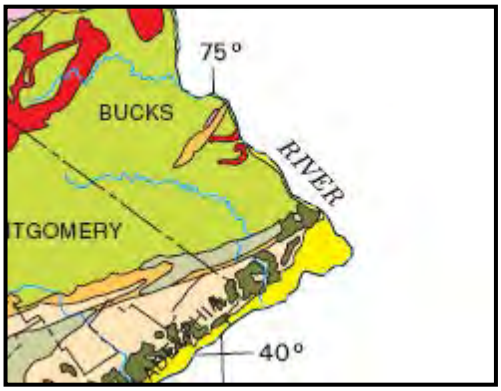

Figure 2 from Surface Geology of Pennsylvania

Geology and Soils: The Pennsylvania Geologic Map identifies a Quaternary aged Coastal Plain (Figure 2). Unlike most Pennsylvania geological sediments, the Coastal Plain deposits are unconsolidated. All hard rock components have been transported by fluvial flows. The surface sand and gravel in this geologic unit were deposited by the proto-Hudson, Raritan and Delaware Rivers. The Pennsylvania Glacial Deposits Map shows the coastal plain under pre-Illinoisan gravel glacial deposits. The exposed sand and gravel has developed into three mapped soil units: Udorthents: gravelly; Udorthents: sandy; and Nanticoke-Hatboro silt loams (Figure 3).

Figure 3: Segment of the Bucks County Soil Survey: Beverly Quadrangle

Udorthent sediments are man altered sand and gravel from parent materials or fill. Neshaminy State Park and Jack's Marina are found on gravelly exposed sediments (Ua). Historic disturbance to the Soil Factory and Delaware River Dredge sites eliminated any original soil profile, replaced with the created landscape created from fill or parent sediments. The Neshaminy Creek sandy dredge fill is mapped as the sandy extreme of this soil unit (UcB). The fill placed before 1956 covered native marsh soils mapped as Nanticoke-Hatboro silt loam (Na). Today, the Nanticoke-Hatboro soil unit is limited to the Neshaminy Creek intertidal marshes and mud flats.

Neshaminy State Park Study Areas

Figure 4: Approximate boundaries for the floral survey in Neshaminy State Park

Site Boundaries: Three Neshaminy State Park study areas are shown on Figure 4 and include the Northern Old Field and Sandy Dredge spoils (blue polygon), the Soil Factory (green polygon), Invasive Dominated Uplands (white polygon) and the river edge dredge spoils (red polygon).

- The old field/sandy dredge spoil study area is an approximate 31 acre patch of herbaceous and woody vegetation. Its boundary is outlined by State Road on the north, Neshaminy Creek on the east, the main park access road on the south and the access drive to the playhouse to the west. This surrounds a remnant of the former plowed agricultural landscape. The former plowed fields and pasture grass hay fields have developed into the vegetation present today. The old field vegetation became established once the farming practices were abandoned. This occurred sometime between 1958 and 1963. The sandy dredge spoils area was a freshwater marsh until fill was placed in a single event between 1953 and 1956. It appears to have received one continuous deposit without any distinct subsequent alterations. It coincidently appears as Jack's Marina northern lagoon was created.
- The Soil Factory site is an approximate 22.1 acre tract within an extensive disturbed site that has undergone 20th Century excavation and filling. The boundary is a subjectively selected irregular polygon between park minor access roads found on all four sides. The landscape was disturbed by a variety of earth moving activities. The disturbance began with a minor wetland fill on the Delaware River marsh shoreline in the late 1920s and excavation and filling continued unabated well into the 1970s.
- The Delaware River Dredge Spoil site is an approximate 19.3 acre subset of the greater Soil Factory disturbance landscape occupied, yet this site was last impacted by a dredge spoils disposal event.

An extensive sandy river dredge deposit filled the study area. This area was last disturbed between 1967 and 1971.

- The Invasive dominated upland area is approximately 1 acre located between the old field study area and the Soil Factory study area. This site is former woodland dominated by invasive trees, shrubs and herbs. Tree of heaven, green ash, and red maple once formed an open canopy under which exist spice bush, wild rose and honeysuckle. Sensitive fern and Nepalese stilt grass are found on the woodland floor along with a suite of opportunistic species. No protected species exist within this site. No further description is provided for this disturbed site within this document.

Northern Neshaminy State Park: Old Fields and Creek Dredge Spoil

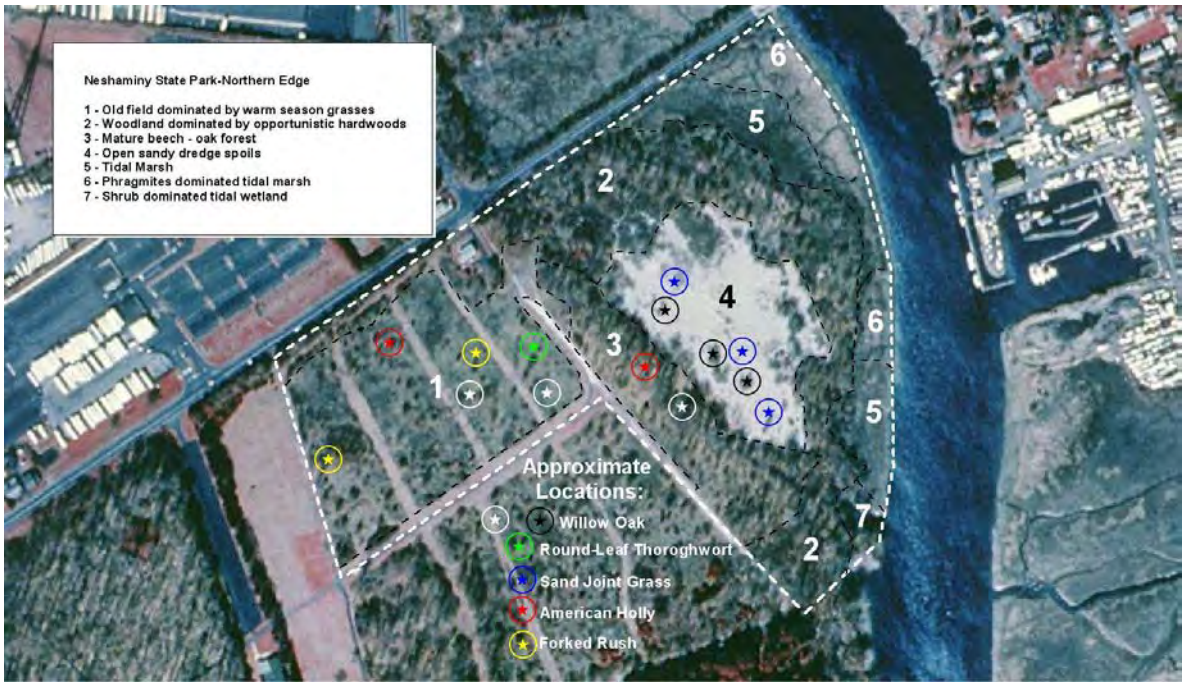

Figure 5: Old Field and Sandy Dredge Spoils Area Vegetation Map and PNDI Listed Elements (1995 Photo)

Woodlands: There are two distinct woodlands within this study site occupying approximately 13.8 acres. The most abundant is recovering seral woodland with 10.33 acres of cover. The second forest type is a red oak-hardwood forest fragment that occupies less than 3.5 acres.

Opportunistic Hardwood Woodland: Within the old field / sandy dredge spoil study area this cover type occupies old field landscape that has matured beyond the herbaceous stage. This cover type occupies most of the woodlands within the Park, specifically south of State Road and west of Neshaminy Creek. Opportunistic hardwood species have occupied space within the old field community, producing a thicket-like woody plant community. This is an un-typed Pennsylvania succession community that will achieve mature stature as a red oak-hardwood upland forest. Tree of heaven (*Alianthus altissima*), Red mulberry (*Morus rubra*), Box elder (*Acer negundo*), Black cherry (*Prunus serotina*), Sassafras (*Sassafras albidum*), Crab apple (*Malus sp*.), Black locust (*Robinia pseudoacacia*), White ash (*Fraxinus americana*), Big tooth aspen (*Populus grandidentata*), Cottonwood (*Populus deltoids*) and Field maple (*Acer campestre*) form an open canopy over a relatively dense understory. Young trees and shrubs form a discontinuous thicket under the tree cover. Multiflora rose (Rosa multiflora), Autumn olive (*Eleagnus umbellata*), Common blackberry (*Rubus sp*., cane), Poison ivy (*Toxiodendron radicans*), Japanese honeysuckle (*Lonicera japonica*) and Spicebush (*Lindera benzoin*) are the most abundant shrubs. This community supports many invasive herbs. This includes Japanese knotweed (*Polygonum cuspidatum*); Garlic mustard (*Alliaria officinalis*), Nepalese stiltgrass (*Microstegium vimineum*) and Field garlic (*Allium vineale*) also exist in this community. This habitat is unlike any native community and its final climax would be assumed to be the red oak-mixed hardwood forest type.

Red oak-Hardwood Forest: This forest is a fragment of Pennsylvania-native climax woodland forest (Fike, 1999) that once occupied most of southern Bucks County. Today, this community type is restricted to the narrow swath of woodland that escaped cutting. This area existed between the former plowed fields and the tidal marsh. Today, it sits between the old field and the sandy dredge spoils. Red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), White oak (*Quercus alba*), red hickory (*Carya glabra*), white ash (*Fraxinus americana*) and Willow oak (*Quercus phellos, 52"dbh photo left*) are the canopy dominants. The understory is less dense that the seral woodland and supports a more native flora. Canopy saplings occur with Southern arrowwood (*Viburnum dentatum*), Bull briar (*Smilax rotundifolia*), and American holly (*Ilex opaca*, S2). Ground cover is limited to patches of Upland sedge (*Carex pennsylvanica*).

Open Sand Dredge Spoil: The open sandy portion of this study site is a 4.8 acre man-made habitat created from Neshaminy Creek dredge spoil. The soils are derived from coarse grain sediment producing an extremely xeric condition in which few plants have occupied. Trees are few and punctuate the open area with individual specimens. Willow oak, black oak *(Quercus velutina*), black cherry, pin oak (*Quercus palustris*), Virginia pine (*Pinus virginiana*) and catalpa (*Caltalpa* sp.) ring the sandy patch. A sparse cover of herbs exists where the sandy soils have not been disturbed. Little blue stem (*Schizachyrium scoparium*), switch grass (*Panicum virgatum*), deer tongue (*Dichanthelium clandestinum*), Columbia Rosette Grass (*Dichanthelium colmbianum*), common crab grass (*Digitaria sanguinalis*), Purple Sand Grass (*Triplasis purpurea*, S1), Fall Witchgrass (*Leptoloma cognatum*), and common reed (*Phragmites australis*) provide less than 10% cover within this drought prone area.

Old Field Community: A Successional Upland Community

Little Blue Stem- dominated old field community: This is an early stage plant community present on Pennsylvania's eastern coastal plain disturbed sites. Warm season grasses, characterized by little blue stem (*Schizachyrium scoparium*) is co-mingled with fall composites and a suite of associated sedges, rushes (Forked Rush, *Juncus dichotomus*, S1) and broadleaf herbs within space once dedicated to farming. Goldenrods and thoroughworts (*Solidago canadensis v. scabra*; *S. juncea; Euthamia graminifolia; Eupaotium hyssopifolium, E. rotundifoilum v. rotundifolium S3, E. serotinum, and E. rugosum*) are common within this community. Shrubs and sapling trees from the succeeding stages of forest recovery are present as scattered individuals. Black cherry, red cedar (*Juniperus virginiana*), sweet gum (*Liquidambar styraciflua*), winged sumac (*Rhus copallina*), arrowwood and blackberries (*Rubus sp*.) are common woody species found in this early stage plant community. Portions of the old field have advance providing more space to woody species than

herbaceous plants. These areas are an early expression of the opportunistic hardwood woodland community, supporting many of the same species (American holly, *Ilex opaca*, S2; Willow Oak, *Quercus phellos*, S2), in lesser coverage than are visible in the true woodlands. There is approximately 7.6 acres of this early succession community that is similar to the persistent Little Blue Stem-Pennsylvania Sedge community described by Fike (1999).

Wetlands: The wetland plant communities exist between the aquatic environments of the creek, river and the terrestrial vegetation found within the uplands. Two distinct wetland types occur within this study area: Tidal influence vegetation and palustrine forest. Tidal areas have been segregated into four sub-communities: high marsh, low marsh, Phragmites marsh and shrub dominated tidal wetland. The high and low marsh components are the characteristic community association found along the tidal Delaware River system. Phragmites dominated areas are part of the high marsh complex that are subjectively segregated for management purposes. Shrub dominated wetlands within tidal influence includes lands with a slightly higher elevation than high marsh. This habitat is commonly a narrow strip along the high marsh / upland boundary.

Tide Marsh: This community occupies approximately 3.3 acres of the study area. The 3.3 acre area consists of a mix of high and low marsh communities located landward of the low tide mark of Neshaminy Creek. The common reed marsh is a 1.8 acre community that is spread along the banks of the Neshaminy Creek. Tidal influenced shrub wetlands occupy 1/3 of an acre between the wetland line and marsh.

- **High Marsh**: This community is identified by irregular tidal flooding and occupies a position mid-way between the tidal shrub community and the low marsh. The community structure is based on a diverse suite of highly productive annual and perennial species. Giant ragweed *(Ambrosia trifida*), Purple-stem aster (*Aster puniceus*), Tide marsh beggar's tick (*Bidens laevis*, S1), Sweet flag (*Acorus calamus*), Yellow iris (*Iris pseudoacorus*), Purple loosestrife (*Lithrum salacaria*), River bull rush (*Schoenoplectus fluviatilis*, S3), Broad-leaf cattail (*Typha latifolia*), Water hemp (*Amaranthus cannabinus*, S3), Wild rice (*Zizania aquaitica*, S3), Climbing boneset (*Mikania scandens*) and Water smartweed (*Polygonum punctatum*) are found in this marsh.
- **Low Marsh**: Low marsh conditions are flooded at each high tide and are dominated by non-persistent perennials and small weak annuals. Tidal yellow spatter dock (*Nuphar lutea* ssp. *advena)* is the dominant species; Arrow Arum (*Peltandra virginica*), Subulate arrowhead *(Sagittaria subulata,* S3); Long-lobed arrowhead (*Sagittaria calycina* v. *spongiosa,* S3); Mud-plantain (*Heterantha* sp.) are common associates.
- ***Phragmites* Dominated Tide Marsh**: This high marsh variant is dominated by common reed to the exclusion of most other species. Water smartweed, touch-me-not (*Impatiens capensis*) and other wet herbs can be found within this cover type.
- **Shrub Dominated Tidal Wetland**: Approximately 0.37 acres of this woody tidal habitat exists in this study area. Black willow (*Salix nigra*), buttonbush (*Cephalanthus occidentalis*), smooth alder (*Alnus serrulata*) and box elder maple (*Acer negundo*) are community dominants.

State listed elements and restoration capabilities

The 2010 survey found 5 listed species in the uplands. American holly (*Ilex opaca*), Willow oak (*Quercus phellos*), Round leaf thoroughwort (*Eupatorium rotundifolium v. rotundifolium*), and Forked rush (*Juncus dichotomus*) are found scattered throughout the old fields south of State Road. Willow oak and Purple sandgrass (*Triplasis purpurea*) are found in the open sand in the dredge spoil area. Willow oak is found as scattered seedling and saplings scattered around the opening periphery, while Purple Sandgrass is roughly distributed as three clusters. Willow oak and American holly are found in the mature woodland. A possible State record 52.4" DBH Willow oak is located on the old upland bank.

The tidal wetlands support habitat suitable for 5 listed species. Subulate leaf arrowhead was found just outside the study area on the low tide banks of the Neshaminy Creek and is expected to occupy similar low tide mud that was inaccessible during the site inspections. Long-lobed arrowhead was found on the marsh directly across the creek for this site and its presence is expected. A similar observation can be made for Wild rice, Tide marsh beggars tick, River bull rush and Water hemp.

Restoration opportunities are found for old field and woodland enhancements; common reed removal.

Soil Factory Field

Figure 6: Soil Factory Study Area (2002 Photo)

The Soil Factory study site is approximately 22 acres, located within a severely disturbed corner of the Park. The approximate boundary of the search conducted for this survey is illustrated on Figure 6. An old field community occupies approximately ½ of the study area. Young woodland, contiguous with the woodland described for the North Park study site, occupies the remaining area.

An old field community designation is assigned to approximately 11 acres of herbaceous dominated vegetation. The old field is divided nearly equally into a northern and southern components. The northern ½ is common reed and Canada thistle dominated while the southern half is dominated by other grass species.

Common Reed: The *Phragmites* dominated end of the site is maintained by periodic mowing that reduces the Common reed's biomass thus providing space for a few other species. The flora of the site can be characterized as composed of weedy non-native, aggressive and opportunistic plants. Canada thistle (*Cirsium arvense*) occupies a significant part of the Common reed habitat. Japanese bristle grass (*Setaria faberi*), Pilewort (*Erechtites hieracerifolium*) and Orchard grass (*Dactylis glomerata*) are common and abundant where mowing has reduced the common reed completion.

Warm and Cool Season Grass: The southern ½ of the old field is a grass dominated old field. Warm and cool season grasses are also maintained by periodic mowing. Warm season grasses form dense patches broken by the lower cool season species. Giant broom grass (*Andropogon gerardii*), Little blue stem and Purple top grass are three main species where warm season species dominate.

Opportunistic Hardwood Woodland: The woodland surrounding the old field is similar to the woodland found in the North Park study site. This portion, however, is on a highly disturbed soil, not the farming impacted area. The resulting landscape has a slightly different structure. Box elder, Black locust, Tree of heaven, Princess tree, Catalpa and Mulberry form a canopy with an understory dominated by alien herbs and shrubs. Nepalese stilt grass (*Microstegium vimineum*) is pervasive under the light canopy of this recovering woodland. Japanese bristle grass, Common reed, Garlic mustard, Wild rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*) occupy space to the exclusion of native species.

State listed elements and restoration capabilities

This study area support no state listed species. The site is occupied by a suite of common invasive plants to the exclusion of desired native trees, shrubs or herbs. The study site offers all 22 acres for restoration opportunities such as species removal, community creation or enhancement.

River Dredge Spoils

Figure 7: Delaware River Dredge Spoils Study Area with PNDI species notated (2002 Photo)

The River Dredge Spoil Study Site is an approximate 19 acre tract separated from the Soil Factory site by a narrow dirt lane yet the origin of the landscape is quite different (Figure 7). Although part of the same greater excavation and fill land use, this area was last disturbed by a massive dredge spoil deposition event that occurred between 1963 and 1967. Young woodland covers most of the site. Palustrine wetland forest occupies the eastern and western corners of the site (approximate 3.2 acres). The upland supports similar woodland, half of which has a common reed dominated understory.

Upland Woodlands: This 15.1 acre woodland has a canopy composed of invasive an opportunistic species. Black locust, tree of heaven, black cherry and box elder form an open canopy and provide a sub-canopy suitable for Common reed, Switch grass, Deer tongue and Nepalese stilt grass. Wild rose, Autumn olive and Arrowwood are also found in this upland dredge spoil habitat. American holly (S2) and Willow oak (S2) are small components of this woodland sub canopy.

Common reed occupies a 2.5 acre portion of the upland woodland. The reed has few associates, such as Nepalese stilt grass, pokeweed, Ladies thumb smartweed (*Polygonum caespitosa*), Garlic mustard and Canada goldenrod.

Wetland Woodlands: Wet woodlands occupy two depressions at opposite ends of the study area. The trees for a palustrine deciduous canopy composed of coastal plain palustrine and riverine wetland species. The canopy is formed by an even aged stand of Red maple, Sweet gum, River birch (*Betula nigra*), Black willow (*Salix nigra*) and Silver maple. Spice bush (*Lindera benzoin*), and Arrowwood (*Viburnum dentatum*) provide shrub cover over a mat of Nepalese stilt grass, Ladies thumb smartweed, and Japanese honeysuckle. American holly has 4 stations within the palustrine wetland.

River Edge tidal shoreline: The shoreline of the Delaware River supports a distinct vegetative gradient influenced by the periodicity of tidal flooding. The riverine habitat begins on the walking path created on the dredge spoils retaining berm.

The riverside edge of the berm supports a forest composed of species similar found within the spoils area, only along the path the trees are mature and probably represent the edge of the original river shoreline canopy. Sycamore (*Platanus occidentalis*), River birch, sSilver maple, Box elder maple, Black cherry and Green ash are limited only by the tidal flooding found at the bottom of the berm's slope.

The bottom of the slope is a gathering spot for driftwood and debris carried in from the river flood stages. Few plants occur here. The occasional scour and dense canopy overhang reduces the suitability for most species. One species of notability that does persist in this edge condition is Japanese knotweed.

Beyond the racks of logs and canopy overhang is the intertidal shoreline of the Delaware

River. There are three distinct substrates along this study area's shoreline. The shoreline textures include sandy beach, rocky cobble, and muddy substrates. The vegetation on the intertidal shore is limited to aquatic perennial plants.

The sandy intertidal shoreline supports few vascular species. Only Small fruited spike rush (*Eleocharis parviflora*, S1) and Three square (*Schoenoplectus pungens*) were found on this shoreline substrate. The zone appears to be swept at high tide by swift currents, reducing suitability for species only tolerant of quite waters. Wild celery (*Vallisneria americana*) is found in the sub-tidal areas beyond the beach in water up to 6'.

The rocky and muddy shoreline supports tidal Yellow spatter dock (*Nuphar lutea spp. advena*), Small fruited spike rush, Three square, Chinese lobelia (*Lobelia chinensis*), Arrow arum (*Peltandra virginica*) and Water purse lane (*Ludwigia palustris*). Colonies of Subulate arrowhead (S3) are scattered under the spatter dock.

State listed elements and restoration capabilities

The river dredge spoils support at least four clusters of American holly (S2) and two of Willow oak (S1). Both are associated with the woodland found within the spoils pile berm. Subulate-leaf arrowhead (S2) is found on the river's intertidal mud.

All Dredge Spoil community components, with the exception of the tidal river edge, are dominated or influenced by invasive alien trees, shrubs and herbs. This non-native assemblage provides opportunities for habitat modification, species control and forest restoration.

Chinese Lobelia (right) on Delaware shoreline

Jacks Marina Study Site

Figure 8: Location of Jack's Marina, Croydon, Pennsylvania

Located east of Neshaminy Creek, Jack's Marina was selected as a possible wetland mitigation site (Figure 8, 9 and10). Its creek side location immediately adjacent to the State Park made this a choice location for habitat creation, restoration or enhancement. The habitat similarity to the proposed Southport project site provides a reasonable site if habitat replacement is required.

The Jack's Marina study site is defined by the parcel boundaries. The boundary is clearly outlined by the impact caused by the former marina use. Upland areas are filled and paved. Non-paved land is limited to the freshwater tidal marsh and discrete piles of fill. Jack's Marina has a site history that predates aerial photography. It was a fully functioning marina for more than 50 years, providing ample time to fill and disturb a significant part of the parcel's 35.4 acres. The marina's original foot print was created before 1940. The marina expansion began in 1956 when the southern lagoon was started and the landscape visible today was created by 1963. Asphalt concrete and gravel form a complete surface, topping a manmade footprint created as the marina expanded.

The plant survey found the parcel supports two major community distinctions: Filled uplands and tidal marshes. The filled upland occupies 16 acres on the northern, eastern and southern property borders. This area is punctuated with boat carcasses and a variety of boating trash. The filled area is outlined by property fences, bulkheads and retaining walls. The remaining land within the Jack's Marina is tidal wetlands or open water. Approximately 13.1 acres of marsh and 5.7 acres of open water exist within the property boundaries, east of the Neshaminy Creek.

Jack's Marina Vegetation Maps: North and South Property Areas

Figure 9: North End of Jack's Marina Study Site. PNDI species are mapped on tidal marsh; 1995 photo.

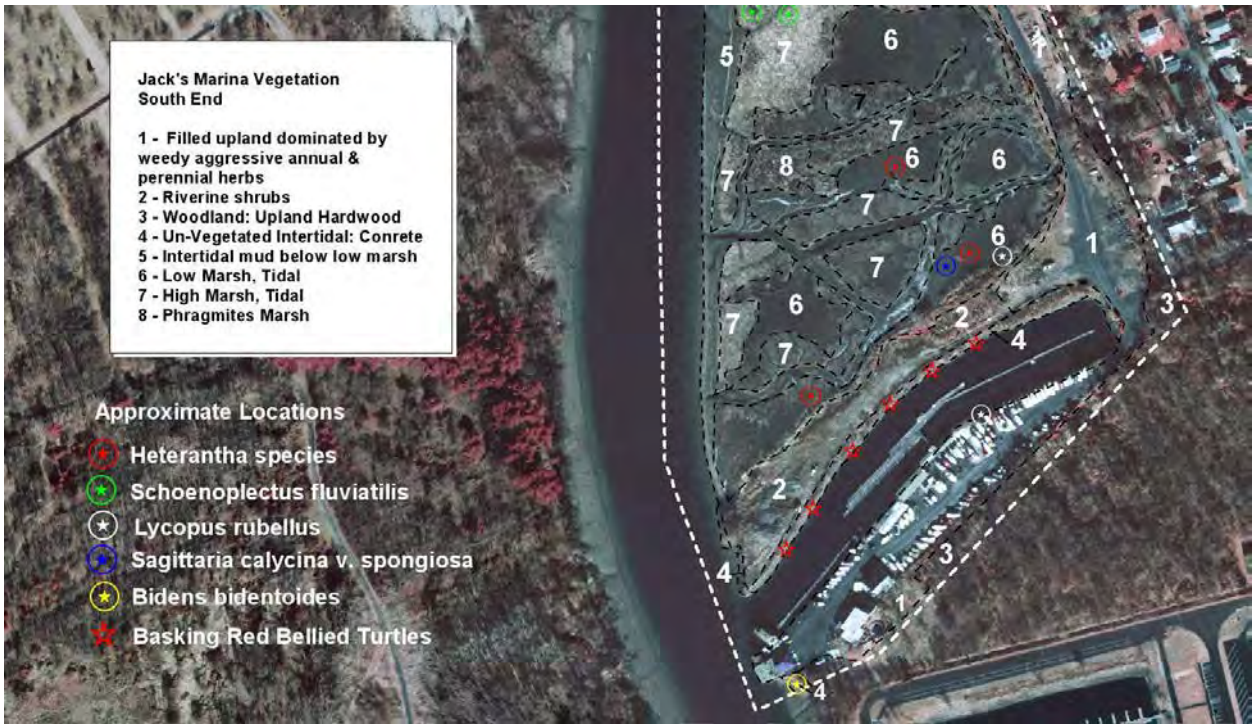

Figure 10: South End of Jack's Marina Study Site. 5 PNDI plants & 1 reptile (red belly turtle); 2002 photo.

Filled Parking and Storage Areas: The former parking and storage areas have taken on vegetation resembling an urban roadside setting since being abandoned during the closure of the marina. The flora that has colonized the cracks and gravel is dominated by common weedy species associated with similar disturbed habitats. The flora is predominantly annuals and weedy perennials. Mugwort (*Artemisia vulgaris*), Annual wormwood (*Artermisia annua*), Calico aster (*Symphyotrichum pilosus*), Common ragweed (*Ambrosia artemsiifolia*), Canada goldenrod (*Solidago canadensis v. scabra*), Yellow bush clover (*Melilotis officinalis*), and Thoroughworts (*Eupatorium rugosum, E. serotinum*), cover open land. Developing woodlands are present along the southern and eastern property boundaries. Where trees have become establish, the species include Box elder maple, Tree of heaven, Black locust, White mulberry, Black cherry, and Black walnut. Stag-horn sumac (*Rhus typhina*), Wild rose, Common blackberry and Poison ivy can be found under this woodland canopy. There are no species of special consideration within this vegetation cover type.

Tidal Marsh: The remaining land within the former Jack's Marina boundaries is wetlands. All of the wetlands are associated with the tidal Neshaminy Creek and its small tributaries. This investigation found high marsh, low marsh, and sub-tidal mud. A narrow palustrine edge follows the banks of a small tributary on the eastern boundary. This wetland supports Green ash, Red maple, Box elder maple and Pin oak. It occupies less than ½ acre of the marina property.

High Marsh: This community is identical to the plant community described for the Neshaminy State Park. The habitat is identified by irregular tidal flooding. It occupies a position mid-way between filled waters edge's shrub community and the low marsh. The community structure is based on a diverse suite of highly productive annual and perennial non-persistent emergent species. Giant ragweed (*Ambrosia trifida*), Purple-stem aster (*Aster puniceus*), Tide marsh Beggar's tick (*Bidens laevis*, S1), Sweet flag, Acorus calamus), Yellow iris (*Iris pseudoacorus*), Purple loosestrife (*Lithrum salacaria*), River bull rush (*Schoenoplectus fluviatilis*, S3), Broad-leaf cattail (*Typha latifolia*), Water hemp (*Amaranthus cannabinus*, S3), Wild rice (*Zizania aquaitica*, S3), Climbing boneset (*Mikania scandens*) and Wwater smartweed (*Polygonum punctatum*) are but a few of the plants found in this marsh. Ebert and Holt (2006) found Walter's Barnyard Grass (*Echinochloa walterii*, S1) and Field dodder (*Cuscuta campestris*, S2) within this community. Fragments of the Barnyard grass were found during the 2010 inspection.

Low Marsh: Low marsh exists below high tide and is dominated by non-persistent perennials and small weak annuals. Within Jack's Marina, low marsh forms a complex mosaic with high marsh. It is also found as a band of non-persistent perennial emergent species along the edge of Neshaminy Creek. Tidal yellow spatter dock (*Nuphar lutea* ssp. *advena)* is the dominant species within this community. Arrow arum (*Peltandra virginica*), Subulate arrowhead *(Sagittaria subulata,* S3); Long-lobed arrowhead (*Sagittaria calycina* v. *spongiosa,* S3); Mud-plantain (*Heterantha* sp.) and Pickerelweed (*Pontedaria cordata*)are common associates. Earlier studies found suitable habitat in this community for other lists vascular plants such as Dwarf spike-rush (*Eleocharis parvula*, S1), and Wright's spike rush (*Eleocharis obtusa v. peasii*, S1).

Manmade Lagoon/Open Water: Two manmade lagoons were excavated into the marsh sediments providing safe harbor for the former marina clientele boats. Open water within these two basins is relatively shallow with only depths to 6'. Most of the open water becomes exposed mud at the lowest tides, reducing suitability for most submerged aquatic species. The available muddy bottom provides limited space for sub-littoral communities. Waterweed (*Elodea canadensis)* is the only identified vascular plant utilizing limited portions of this tidal water habitat. Open water habitat is also found on the property boundary along Neshaminy Creek and in a limited area on the stream bottoms of the tidal marsh drainage guts.

Filled Waters Edge: This manmade habitat supports the tidal/terrestrial boundary. The upper slope of the fill is shrub dominated whereas the lower slope is occupied by non persistent emergent species. The edge of tidal gradient is occupied by at least three PNDI listed plants: Subulate leaf arrowhead, Red stemmed bugleweed (*Lycopus rubellus*, S1) and Swamp beggar tick (*Biden bidentoides*, S1).

Sub Tidal Mud: The tidally inundate mud shore line of Neshaminy Creek and the edges of the tidal guts support an ephemeral community similar to the conditions found on the Delaware River Dredge Spoil study site. Scattered specimens of Three square, Subulate leaf arrowhead and Yellow flat sedge (*Cyperus flavescens*) are sparsely represented in this lowest non-aquatic habitat.

Conclusions

The 2010 field survey found both Neshaminy State Park and Jack's Marina's are fragments of the coastal plain ecological region. The 2010 survey found 249 species within nine separate plant communities: old field, mowed field, young woodlands, red oak-hardwood forest, open sandy dredge spoils, tide marsh, filled uplands and riverine sub-tidal mud. Only the State Park's northern old field, mature red oak-hardwood forest and tidal marshes within the Park and Jack's Marina reflect native Pennsylvania plant communities. The other plant communities are elements of various manmade landscapes (created and abandoned) that now support a recovering suite of herbaceous and woody plant communities.

The old field habitat and red oak forest remnant are supported by native upland soils whereas the Neshaminy State Park Soil Factory and Delaware River Dredge Spoils are colonizing manmade substrates that are reforming soil characteristics on filled and excavated substrates. Jack's Marina uplands are also created from manmade landscape alterations, notability filling tide marsh. The marsh, creek and river edge substrates are continually replenished, providing newly deposited sand and silt for plant colonization.

Sixteen (16) PNDI Listed Species were found during this season's flora inspection. Six (6) are found within the Neshaminy State Park northern old field, Red oak forest remnant, sandy dredge spoil, and Delaware River Dredge Spoils. The remaining listed species are associated with the tidal wetlands. No listed species were found in the seral woodlands or Soil Factory maintained field. Jack's Marina tidal communities each support one or more listed taxa.

The four study sites provide opportunities to for a variety of ecosystem mitigation efforts. The native habitats are suitable for enhancement and restoration. Upland ecosystem communities are suitable for invasive species removal and native species enhancement. The young woodlands provide opportunities for invasive species removal and species enhancement as well. Tidal influenced communities provide invasive species removal opportunities as well as condition suitable for inter tidal and sub tidal habitat creation opportunities.

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Appendices

- Protected Species Descriptions
  - *Amaranthus cannabinus*
  - *Bidens bidentoides*
  - *Bidens laevis*
  - *Echinochloa walteri*
  - *Eupatorium rotundifolium v. rotundifolium*
  - *Gratiola (aurea)*
  - *Ilex opaca*
  - *Juncus dichotomus*
  - *Lycopus rubellus*
  - *Quercus falcata*
  - *Quercus phellos*
  - *Sagittaria subulata*
  - *Sagittaria calycina v. spongiosa*
  - *Schoenoplectus fluviatilis*
  - *Triplasis purpurea*
  - *Zizania aquatic*

- Species List: Compilation of 2010 Visits

Amaranthus cannabinus, Water-hemp, S3, PR

Community: Tidal marshes and tidal edges in Neshaminy State Park and Jack's Marina.

Neshaminy State Park: Confined to the west bank of the creek, immediately above yellow spatter dock low marsh.

Jacks Marina: Found on filled edge and high marsh; common; dispersed with Wild rice, Purple Loosestrife and Purple-stemmed Aster

End of Lagoon:	40°04.7959/074°54.3697
Center of Marsh Population:	40°04.8767/074°54.4716
Neshaminy State Park:	40°04.9823/074°54.6433

Bidens bidentoides, Swamp Beggar Ticks, S1, PT/E

Gratiola aurea: Golden hedge hyssop, S1, TU

Community: Tidal mud, exposed rubble shoreline along Jack's Marina southern rubble lined lagoon and creek edge. Golden hedge hyssop located 10' west of beggar tick,

East Side Creek by Bulkhead: 40°04.678/074°54.530

Bidens laevis, Tide Marsh Beggar Tick, S1, PE

Community: High Marsh of tidal wetland on east and west side of Neshaminy Creek.

Neshaminy State Park: A population is found with Water-hemp and Purple Loosestrife on the west bank of the creek.

Jack's Marina: Throughout the mosaic of high and low marsh between the north and south lagoons. Identified locations same as Amaranthus cannabinus.

Center of Jack's Marina Population: 40°04.8767/074°54.4716
Neshaminy State Park: 40°04.9823/074°54.6433

The Tide marsh beggar tick is found throughout the Jack's Marina high tide marsh and sparingly in Neshaminy State Park above the spatter dock low tide zone

Echinochloa walteri, Walter's Barnyard Grass, S1, PE

Community: High Marsh of tidal wetland on east side of Neshaminy Creek.

Jack's Marina: One fragmented colony of an *Echinochloa* was located on the banks immediately adjacent to Neshaminy Creek at/or near the same location described by Ebert and Holt (2006).

Jack's Marina Population: 40°04.9025/074°54.5494

Eupatorium rotundifolium v. rotundifolium, Round-leaf Thoroughwort, S3, TU

Community: Dry sandy old field community in Neshaminy State Park.

Neshaminy State Park – A colony was discovered in the North Old Field with *Eupatorium hyssopifolium v. laciniatum*, *Schizachyrium scoparium* and *Solidago rugosum*.

Neshaminy State Park: Cluster of plants: 40°04.9160/074°54.8041

Ilex opaca, American Holly, S2, PT

Community: Uplands throughout Neshaminy State Park. Specifically found as seedlings, saplings and mature specimens in old fields and woodlands.

Neshaminy State Park – Species exist in the North Old Field, Red oak-hardwood forest, and seral woodland (North Study Area and River Dredge Spoil Study Area).

Neshaminy State Park Sites: Individuals or Cluster at:

40°04.929/74°54.914	40°04.557/74°54.611	40°04.433/74°54.725
40°04.924/74°54.781	40°04.577/74°54.605	40°04.457/74°54.752
40°04.534/74°54.608	40°04.467/74°54.699	
40°04.546/74°54.626	40°04.461/74°54.683	

Juncus dichotomus,

Forked Rush, S1, PE

Community: Dry upland old fields

Neshaminy State Park: Edge of old field on western edge of study area

Park Locations: 40°04.9822/74°54.761; 40°04.867/74°54.906

Lycopus rubellus, Red-stemmed Horehound, S1, PE

Community: Tidal shores of the Neshaminy Creek and adjacent marsh, specifically at the upper edge of the tide on bare mud and rubble (photo left: habitat).

Jack's Marina: This species is found as scattered individual plants along the rock rubble near the southern lagoon. *Lycopus amplextens, L. americanus*, and *Pilea pumila* has been found with *L. rubellus*.

Jack's Marina Locations: Centered on: 40°04.7164/74°54.4937

Quercus falcata, Southern Red Oak, S1, PE

Community: Upland forest of north end Neshaminy State Park

Neshaminy State Park: Found in mature Red Oak-Hardwood forest fragment located between the sandy dredge spoil and old fields. Found with red oak, white oak, willow oak and American beech.

Park Locations: 40°04.9529/74°54.7696 (White Star)

Quercus phellos, Willow Oak, S1, PE

Community: Forest and woodlands on the eastern edge of Neshaminy State Park

Neshaminy State Park: Found in old field , mature Red Oak-Hardwood forest fragment (52.4" dbh), sandy dredge spoil (photo) and fill of the Delaware River Dredge Spoil sites as seedlings and scattered mature specimens.

Park Locations: 40°04.9674/74°54.7079; 40°04.9094/74°54.7160; 40°04.9166/74°54.8219; ; 40°04.4610/74°54.6663

Sagittaria subulata, Subulate Leaf Arrowhead, S1, PE

Community: Low marsh and low portions of tidal shores along the Neshaminy Creek and Delaware River.

Neshaminy Tide Marsh: Associated with *Nuphar lutea, Peltandra virginica* and *Heterantha* sp.

Jack's Maria Location: Found with Sagittaria calycina: 40°04.8259/74°54.4251

Park Locations: 40°04.4309/74°54.6395

Sagittaria calycina, S1, PE

Community: Low marsh on east side of Neshaminy Creek

Jack's Marina: Found on low marsh that occupies southern 1/3rd of tide marsh complex.

Marina Location: 40°04.8259/74°54.4251

Schoenoplectus fluviatilis, S3, PR

Community: High marsh on east side of Neshaminy Creek

Jack's Marina: Found on high marsh, specifically along creek and on northern 1/3rd of tide marsh complex.

Marina Location: Middle of population (photo, left): 40°04.918/74°54.491 (Red Star)

Zizania aquatica, Wild Rice S3, PR

Community: High Marshes along Neshaminy Creek

Jack's Marina: Found throughout the high marsh complex on both sides of the Neshaminy Creek.

Marina Location: 40°04.8887/74°54.4557 (White Star)

Triplasis purpurea, Purple Sandgrass, S1, PE

Community: Open drought prone sand

Neshaminy State Park: Found scattered (single stem to dozens of pants) throughout the creek dredge spoil near the northeastern corner of the Park. Associated with switch grass, little blue stem and deer tongue.

Spoils Locations:

40°04.888/74°54.689
40°04.954/74°54.701
40°04.944/74°54.734

2010 Flora: Selected Areas in Neshaminy State Park and Jack's Marina: 5/25/26; 10/8, 11, 17, 23/2010

Species Names	**Old Field North Area**	**Old Field Soil Factory**	**Sandy Dredge Spoil**	**Woodland North Area**	**Woodland Soil Factory**	**Woodland River Dredge**	**North Area Mature Forest**	**Tide Marsh North**	**Tide Marsh River Dredge**	**Tide Marsh Jacks**	**Jacks Upland**
Acalypha rhomboides	x										
Acer campestre				x							
Acer negundo				x	x						x
Acer rubrum	x			x		x	x				x
Acer saccharinium					x	x					x
Achillea millefolium	x										
Acorus calamus								x		x	
Agrostis gigantea	x	x									x
Agrostis perennans			x								
Alianthus altissima		x		x	x	x					x
Alliaria petiolata		x		x	x						x
Allium vineale	x	x		x							x
Alnus glutinosa											x
Alnus serrulata								x		x	
Amaranthus cannabinum, S3								x		x	
Ambrosia artemsiifolia											x
Ambrosia trifida										x	
Amorpha fruticosa						x				x	x
Amplelopsis brevipedunculata											x
Andropogon gerardii		x									
Andropogon virginicus						x					

Anthoxanthum odoratum	x	x				x					x
Apios americana			x					x		x	
Apocynum cannabinum	x	x									x
Arctium lappa											x
Aristida dichotoma											x
Artemisa annua											x
Artemisia vulgaris	x			x							
Arthraxon hispidus											x
Asclepias syriaca	x	x									x
Aster pilosus	x										x
Aster puniceus										x	x
Aster simplex										x	
Barbera vulgaris											x
Betula nigra				x		x					
Betula papyrifera				x		x					
Betula populifolia	x					x					
Bidens bidentoides, S1										x	
Bidens bipinnata											x
Bidens frondosa										x	
Bidens laevis, S1										x	
Boehmeria cylindrica										x	
Bromus japonicus		x									
Bulbostylis capillaris			x								
Campsis radicans											x
Carex crinita						x					
Carex longii	x										
Carex lurida						x				x	
Carex pensylvanica				x			x				

Carex scoparia						x				x	
Carex sp 3 {coll.}				X							
Carex sp. 1				x							
Carex sp. 2	x										
Carex sp. 4 (rosea?)							x				x
Carex stricta						x					
Carex vulpinoidea		x									x
Carya glabra				x			x				
Carya ovata				x							
Catalpa sp.			x		X	x					
Celastris orbiculata			x	x							
Chamaeyce maculata											x
Chelone glabra										x	
Cichorium intybus	x										
Cirsium arvense											x
Cirsium sp.											x
Clematis terniflora											x
Commelina communis						x					x
Conzya canadensis						x					x
Cornus amomum								x		x	x
Cornus florida				x							
Coronilla varia	x	x									x
Cuscuta sp.1 "campestris"											x
Cuscuta sp. 2										X	
Cyperus flavescens									x	x	
Cyperus grayii			x								
Dactylis glomerata		x				x					x
Danthonia spicata	x		x								
Datura struminea		x			x						

Dichanthelium acuminatum vars.	X					x					x
Dichanthelium clandestinum	x	x	x			x					x
Dichanthelium columbianum			x								
Dichanthelium sphearocarpon	x		x								
Digitaria ischaemum						x					
Digitaria sanguinalis	x		x								
Diodea teres						x					
Diospyros virginiana	x										
Duchesnea indica											x
Echinochloa muricata											x
Echinochloa sp. (walterii?, S1)										x	
Echinocistus lobata										x	
Eclipta alba										x	
Eleagnus umbellata						x					
Elodea canadensis										x	
Elymus virginiana											x
Eragrostis cilianensis											x
Eragrostis pectinacea											x
Eragrostis spectabilis	x	x				x					
Erechtites hieracifolia										x	
Euonymus alata				x							
Eupatorim rotundifolium v. ovatum S2	x										

Eupatorium hyssopifolim vars.	X					x	x				
Eupatorium rugosum		x		x							
Eupatorium serotinum		x									x
Euthamia graminifolia	x		x	x		x					
Fagus grandifolia				x		x	x				
Festuca pratense		x									x
Fraxinus americana	x			x		x	x				
Fraxinus pensylvanica		x			x						x
Froelichia gracilis						x					
Gallium aparine											x
Geum sp.											x
Glecoma hederacea					x						
Gratiola sp. (aurea? S1)										x	
Helenium autumnale										X	
Helenium flexuosum											x
Heterantha sp. (reniflora?)										x	
Hibiscus palustris										x	
Holcus lanatus	x										
Humilus japonica					x						
Ilex opaca, S3	x			x		x					
Impatiens capensis								x		x	
Ipomoea hederacea											x
Iris pseudoacorus								x		x	
Juglans nigra											x
Juncus dichotomus,	x										

S1											
Juncus effusus						x					
Juncus tenuis	x		x								x
Juniperus virginiana	x			x		x					
Krigia virginica			x								
Krilliga brevifolia									x	x	
Leptoloma cognatum	x		x			x					
Ligustrum vulgare				x							
Lindera benzoin						x					
Liquidambar styraciflua	x					x					
Liriodendron tulipifera	x										x
Lolium multiflorum		x									
Lonicera japonica	x	x		x	x	x					x
Ludwigia palustris										x	
Lycopodium digitatum	x										
Lycopus americanus										x	
Lycopus amplectens										x	
Lycopus rubellus, S1										x	
Lythrum salicaria								x		x	x
Malus sp.				x		X					x
Melilotus officinalis											x
Mentha arvense										x	
Microstegium vimineum		x			x	x					x
Mikania scandens								x		x	
Morus alba						x					
Morus rubra		x									x
Muhlenbergia schreberi		x									x

Nuphar lutea v. advena								x		x	
Nyssa sylvatica	x						x				
Oenothera biennis											x
Onoclea sensibilis						x					
Panicum anceps	x										
Panicum virgatum	x		x			x					
Parthenocissus quinquefolia	x										x
Paulonia tomentosa					x						x
Peltandra virginica								x			x
Phalaris arundinacea											x
Phragmites australis		x	x			x				x	x
Phytolacca americana	x	x		x		x					
Pilea pumila										x	
Pinus strobus	x			x							
Pinus virginiana			x								
Plantago lanceolata	x	x									
Plantago major										x	
Platanus occidentalis						x					x
Poa annua						x					
Poa compressa											x
Polygonum arifolium										x	
Polygonum caespitosum	x										x
Polygonum cuspidatum				x		x					x
Polygonum lapathifolium											x

Polygonum perfoliatum	x	x			x					x	x
Polygonum punctatum								x		x	
Polygonum sagittatum											x
Polygonum scandens											x
Polygonum virginianum											x
Pontederia cordata										x	
Populus deltoides				x		x					x
Populus grandidentata	x			x							
Potentila recta											x
Potentilla norvegica											x
Potentilla simplex											x
Prunus serotina	x				x	x					x
Quercus falcata, S1				x			x				
Quercus alba	x			x			x				
Quercus palustris	x					x					x
Quercus phellos, S2	x		x	x		x	x				
Quercus robar	x										
Quercus rubra				x			x				
Quercus velutina	x		x	x			x				
Rhus copallina	x					x					
Rhus typhina						x					x
Robinia pseudoacacia		x		x	x	x					x
Rorippa sylvestris								x		x	
Rosa multiflora						x					x
Rubus flagellaris	x	x									
Rubus laciniata		x			x						

Rubus occidentalis											X
Rubus phoenicoiasius				x							
Rubus sp. Cane		x		x		x					
Rumex crispus		x									X
Rumex obtusifolia	x										x
Sagittaria calycina, S1										x	
Sagittaria latifolia										x	
Sagittaria sp. (rigida ?)										x	
Sagittaria subulata, S2						x				x	
Salix fragilis											x
Salix nigra		x			x	x					x
Sassafras albidum	x										
Schizachyrium scoparium	x	x	x								
Schoenoplectus fluviatilus, S3										x	
Schoenoplectus pungens										x	
Scutellaria latifolia										x	
Sedum											x
Sedum acre											x
Setaria faberii		x									
Setaria pumila	x										x
Setaria viridis (?)		x									
Smilax rotundifolia				x			x				
Solanum carolinianum		x									
Solidago canadensis	x	x					x				x
Solidago juncea	x		x				x				

Solidago rugosa	x										
Sorgastrum nutans		x									
Spiraea latifolia						x					
Stellaria media						x					
Taraxacum officinalis	x										x
Teucerum canadense											x
Thalictrum dioicum										x	
Toxicodendron radicans	x			x	x	x					x
Tradescantia virginiana						x					
Trichostema dichotomum			x								
Triodea flavus	x	x									x
Triplasis purpurea, S1			x								
Typha angustifolia										x	
Typha latifolia								x		x	
Ulmus rubrum											x
Urtica dioica											x
Vaccinium caesariense	x										
Vallisneria americana									x		
Verbascum blattaria											x
Verbascum thapsus		x		x							
Verbena urticifolia											x
Viburnum dentatum				x		x	x				
Vitis vulpina											x
Zizania aquatica, S1								x		x	

HA File # PA10.25

Phase I Habitat Assessment for Redbelly Turtle, Southern Leopard Frog, New Jersey Chorus Frog, and Northern Cricket Frog, and Phase II Nest Surveys for Redbelly Turtle at the Southport Wetland Mitigation Project, Neshaminy State Park, Berwyn Township, Bucks County, Pennsylvania

Submitted January 12, 2011

to

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INTRODUCTION

Herpetological Associates, Inc. (HA) was contracted by Weston Solutions, Inc. to conduct Phase I Habitat Assessments for Southern (Coastal Plain) Leopard Frog (*Lithobates sphenocephala*), New Jersey Chorus Frog (*Pseudacris kalmi*), Northern Cricket Frog (*Acris crepitans*), and Redbelly Turtle (*Pseudemys r. rubriventris*), as well as Phase II Nest Surveys for Redbelly Turtle for the Southport Wetland Mitigation Project at Neshaminy State Park (NSP) in Bucks County, Pennsylvania (PNDI # 20100331236617).

HA's 2010 surveys included three proposed wetland mitigation areas (Areas A, B, and C) along the western banks of Neshaminy Creek within NSP. An alternate proposed mitigation site, which is a privately owed former marina (Jack's Marina) located directly across Neshaminy Creek to the east and north of NSP was not included in HA's 2010 surveys, but was given a cursory assessment. Previous studies for Redbelly Turtles conducted in 2006 at this location by another consultant documented the presence of Redbelly Turtles in the Creek and adjacent lagoons (Species Impact Review (SIR) #20510), therefore Redbelly Turtles are assumed present in the Creek and all associated permanent water bodies in the vicinity of NSP. The focus of HA's 2010 surveys was to identify critical habitat for Redbelly Turtles and the three frog species at proposed mitigation areas A, B, and C for the Southport Wetland Mitigation Project.

MATERIALS AND METHODS

LOCATION OF THE STUDY SITE

The primary study area is located within NSP, within the Atlantic Coastal Plain Province at the confluence of Neshaminy Creek and the Delaware River in Bristol Township, Bucks County Pennsylvania (40.07540°N; -74.90994°W; **Figure 1**). The site can be found on the Beverly USGS 7.5-minute quadrangle map.

SURVEYORS

The following HA staff were present during the surveys: Michael E. Torocco (Qualified Redbelly Turtle Biologist), Tessa M. Bickhart (Staff Herpetologist), and D. Quillyn Bickley (Field Assistant).

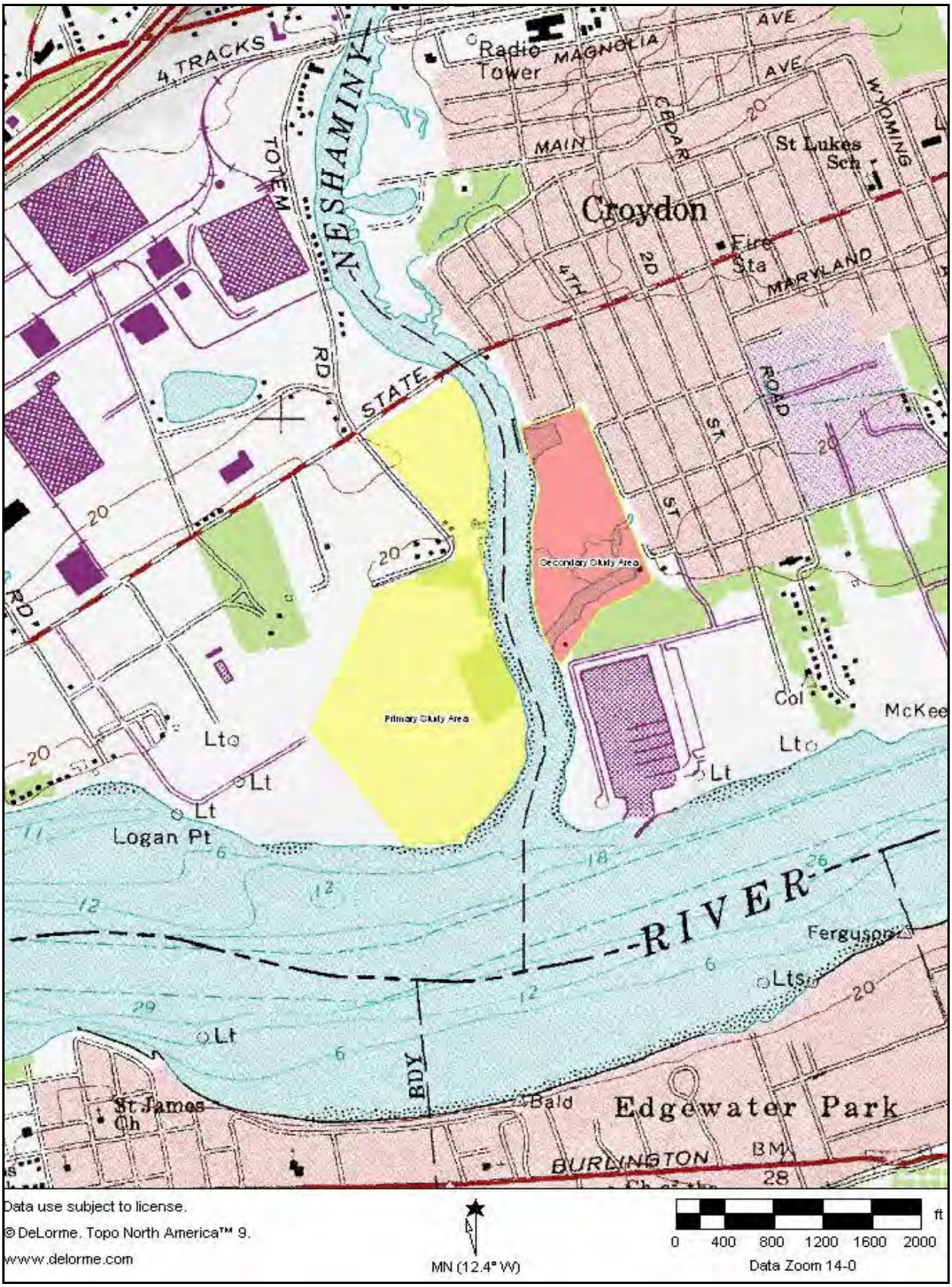

Figure 1. Topographic map showing the primary study area for the Southport Wetland Mitigation Project at NSP.

AMPHIBIAN BREEDING HABITAT SURVEY METHODS

Habitat evaluations for Southern (Coastal Plain) Leopard Frog, New Jersey Chorus Frog, and Northern Cricket Frog are conducted by identifying potential aquatic breeding sites. The structure of potential breeding and foraging habitats, which includes variables such as wetland type, water depth, flow rate, substrate type, plant community, and surrounding upland characteristics, are examined during the habitat evaluation. These characteristics are then compared to known breeding sites for each species. The general habitat conditions used by each target species are as follows:

- **Southern leopard frog** habitat is variable, but tends to include larger emergent wetlands and/or bodies of water such as marshes, ponds, and the fringes of lakes and slow-flowing streams and rivers (especially in back water areas). Small, isolated, woodland vernal ponds are typically not used, as this frog is semiaquatic and may move into adjacent wet meadows outside of the breeding season. This species prefers coastal plain habitat.

- **Northern cricket frogs** prefer permanent water rather than ephemeral wetlands, and are typically associated with ponds, lakes, marshes and back water areas of slow-flowing streams and rivers. They will breed and lay eggs in permanent water but will also utilize temporary water such as road-side ditches, vernal pools, and puddles, especially in open rather than heavily wooded conditions. After breeding, the frogs remain near water throughout the active season.

- **New Jersey chorus frogs**, in stark contrast to the cricket frog, use wetland habitats that are heavily wooded. They breed in temporary water bodies such as vernal pools, but may use road-side ditches, puddles, and retention basins in high quality habitat, or backwater areas of permanent water. New Jersey chorus frogs have an abbreviated breeding period in late winter/early spring, and then quickly disperse from wetlands to wooded habitat. This species also prefers coastal plain habitat.

REDBELLY TURTLE HABITAT EVALUATION METHODS

The Redbelly Turtle is a large, aquatic species that inhabits large ponds, lakes, and slow-flowing, deep-water streams. They are usually found in deep water with numerous basking sites and muddy or sandy substrate. Ample aquatic vegetation is important, as Redbelly Turtles are primarily herbivorous. The suitability of the site for Redbelly Turtles was determined by evaluating the existing habitat components. Vegetative communities, hydrological conditions, topography, soil characteristics, and the surrounding upland habitat were investigated to evaluate the habitat for the Redbelly Turtle. HA has three criteria for judging the value of the existing conditions for turtle species.

1. **Structure of Available Habitat:** Habitat potential for Redbelly Turtles may be determined by evaluating the size and depth of open water habitats, quantity of aquatic vegetation, and substrate type. The presence of basking sites, as well as their location are also noted. Nesting habitat requires evaluating upland areas surrounding aquatic habitat. A sunny location with sandy or loamy soil is required for nesting Redbelly Turtles (Ernst, Lovich, and Barbour, 1994; and Heyer et al, 1994).

2. **Historic Evidence:** The overall range of the Redbelly Turtle and historic records on or near a water body site are important to the overall evaluation of a site.

3. **Connectivity of Habitats:** The proximity of confirmed or highly potential Redbelly Turtle habitat to potential habitat on a study site, and the type and extent of their hydrologic connectivity are evaluated. Overland routes for migration between aquatic habitats and to nesting sites are also examined.

Surveys for nesting habitat and turtle nests are conducted by first identifying all potential aquatic turtle habitat (ponds, lakes, and large, slow-moving streams). Once each aquatic habitat is evaluated for Redbelly Turtle potential, the areas surrounding the open water habitat are examined for potential nesting habitat. Areas within 1,000 ft of the aquatic habitat with ample sun exposure and well-drained soils are considered potential nesting habitat. Conversely, habitat that surrounds the open water habitat but has heavy canopy cover, has poorly drained (wetland) soils, or contains impervious surfaces (e.g., concrete, asphalt) is not considered potential Redbelly Turtle nesting habitat.

All potential Redbelly Turtle nesting habitat is carefully examined by a team of experienced biologists using systematic visual searches. Beginning at the upland edge of a waterbody, searches are conducted by walking parallel transects around the open water habitat. The search radius is expanded up to 1,000 ft from each waterbody to the point that habitat becomes unsuitable for nesting.

All signs of turtle nesting are recorded. This evidence includes attempted nests, destroyed nests, and viable nests. These features are defined as:

1. *Attempted nests* are those which a nest cavity was started, but the nest was abandoned and no eggs were laid. Attempted nests are identified by noting the well defined nest cavity which has been dug by the female, with a lack of egg shell fragments and associated mammal digging (denoting predation).

2. *Destroyed nests* are successfully created nests in which eggs were laid, but a predator found the site, excavated the eggs, and consumed them. These sites are identified by the presence of egg shell fragments on the ground, which surround an excavated nest chamber. The observed differences between a destroyed nest/mammal digging and an attempted/abandoned nest cavity are typically distinctive.

3. *Viable nests* are successfully created nest cavities in which eggs have been deposited, and predation has not occurred. Viable nests are not easily found due to the nesting female's ability to camouflage her nest, but they may be found either by finding a turtle in the act of nesting, or by finding the subtle signs of recent nesting.

Egg shell fragments are examined to determine overall size and shape of each egg, which can help to determine if a destroyed nest is potentially that of a Redbelly Turtle. However, positive identification of egg shell fragments is often not possible without observing the turtle creating a nest. For this reason, the location of all destroyed nests are noted, which identifies particular areas as suitable for turtle nesting. All nest locations are documented by photographs, and by GPS using a Trimble GeoXT GPS receiver. All nest locations recorded via GPS are processed and plotted using GPS Pathfinder Office (ver. 4.1) and ArcMap (ver 9.1).

SOUTHPORT WETLAND MITIGATION PROJECT AND SITE DESCRIPTION

OVERVIEW

The Southport Wetland Mitigation Project is being proposed to offset environmental impacts from the construction of a new marine terminal (Southport Terminal Project) on the eastern end of the former Philadelphia Naval Shipyard. The Southport Terminal Project would encompass approximately 116 acres of currently vacant land. The project would include the construction of a marginal wharf measuring 2,128 linear feet along the shoreline of the Delaware River, which would provide for two ship berthing areas. The project would also include construction of various support facilities and structures on the adjacent upland areas for storage and handling of containerized cargo.

WETLAND MITIGATION SITES

In conjunction with the proposed dredge and fill activities associated with the project, the applicant has proposed mitigation plans to compensate for the loss of wetlands and other shallow water habitats. The proposed alternative mitigation sites are located upstream of Philadelphia within the freshwater tidal reaches of the Delaware River at the confluence with Neshaminy Creek (**Appendix A**).

The preferred mitigation site is an abandoned marina facility known as Jack's Marina encompassing a total of 33.8 acres of land and water. After preliminary discussions with the federal and state resource agencies, the applicant has prepared mitigation plans. As part of the mitigation plans, this property would be conveyed to the Commonwealth of Pennsylvania and incorporated into NSP.

As an alternative to the mitigation work at the Jack's Marina site, the applicant has prepared conception mitigation plans for three potential sites located on the west bank of Neshaminy Creek within the existing NSP property near the confluence with the Delaware River. This portion of NSP adjacent to the Creek contains tidally-influenced, freshwater wetlands, a fragment of riparian floodplain forest, and upland fields. The banks of the Creek are rock and silt with dense colonies of spatterdock (*Nuphar lutea*). The adjacent floodplain forest is dominated by ash (*Fraxinus* sp.), hickory (*Carya* sp.), and tulip poplar (*Liriodendron tulipifera*). The areas that have been altered by sandy dredge spoil are dominated by river birch (*Betula nigra*), black locust (*Robinia psuedoacacaia*), and sweet gum (*Liquidambar styraciflua*). The proposed mitigation sites are identified as NSP Mitigation Areas A, B and C:

Area A – Wetland Enhancement – Intertidal Wetland

Within this area is approximately 2.4 acres of intertidal area dominated by common reed (*Phragmites australis*). Eradication of common reed from this area would be achieved through 1) soil excavation to depths approximately 1 ft lower in elevation to provide habitat for more desirable intertidal species in adjacent intertidal wetlands, or 2) treatment of common reed with herbicide. The enhancement footprint will be allowed to revegetate naturally from seed and vegetative growth from plants in adjacent intertidal wetlands.

Directly adjacent to the western edge of Area A within NSP is an open canopy, dredge spoil deposition site. Sand is the dominant component of the soil and vegetation is sparse in this area, but includes switch grass (*Panicum virgatum*), common reed, and oaks (*Quercus* sp.), including the state endangered willow oak (*Quercus phellos*).

Area B – Creation – Nontidal Wetland Mitigation

This mitigation location consists of an upland area recently cleared of invasive woody species. Dominant vegetation within the cleared area includes sensitive fern, Asiatic tearthumb (*Polygonum perfoliatum*), blackberry (*Rubus* sp.), and Japanese stilt grass (*Microstegium vimineum*). Some adjacent areas still have invasive woody species, including tree of heaven (*Ailanthus altissima*). The cleared area and some adjacent areas with invasive trees are proposed to be excavated to depths designed to intercept groundwater, allowing a connection with the mapped wetland to the south and provide for some tidal exchange with Neshaminy Creek. The adjacent wetland currently has a tidal connection to the Creek via a culvert, which is located under the trail that is parallel to the river. Portions of the wetland flood during high tide and drain with each tidal cycle.

The proposed mitigation would include the removal of the culvert and part of the trail to promote greater tidal exchange of the wetland area, and include flooding and flushing of the mitigation wetland footprint. A footbridge would be constructed across the new channel to maintain the river walk.

A planting plan would be developed based on the observed species in the adjacent wetland area. The wetland to upland transition zone would be planted with a species mix (herbaceous and woody) that provides some level of control of invasive and undesirable plant species (e.g., common reed, Asiatic tearthumb, and Japanese stilt grass). A component of the mitigation plan would be monitoring and maintenance to control vegetation.

Area C – Creation – Intertidal Wetland Construction

This mitigation location is a former dredged material disposal area (berms are still present). An isolated freshwater wetland dominated by river birch and sweet gum is located in a depression at the southwest end of the mitigation footprint. Sensitive fern (*Onoclea sensibilis*) and sedges (*Carex* spp.) are also present within the wetland core, but invasive species including black locust, tree of heaven, common reed, and Japanese stilt grass are also present in most of the proposed mitigation footprint. Site elevation increases from west to east in this area.

The mitigation goal is to excavate to elevations that are suitable for the establishment of intertidal and subtidal habitats. The area would connect via a channel to the Delaware River. The channel and inlet would be designed to avoid shoaling and erosion. A footbridge would be constructed across the new channel to maintain the river walk. The mitigation plan proposes to allow the intertidal footprint to revegetate naturally from seed and vegetative growth from plants in adjacent intertidal wetlands. The wetland to upland transition zone would be planted with a species mix (herbaceous and woody) designed to provide some level of control of invasive and undesirable plant species (e.g., common reed, Asiatic tearthumb, and Japanese stilt grass). A component of the mitigation plan would be monitoring and maintenance to control vegetation.

North of Area C is an open field commonly called the "Soil Factory". The Neshaminy Soil Factory Project occurred between 1981 and 1994, during which time a 5 to 10 acre site within NSP served as an experimental and monitoring stage with the 18 Philadelphia Water Department. The NSP marina basin was dredged in 1981 and 1987. Under permits from the Department of Environmental Resources (DER), infertile hydraulic dredge spoil and sludge, a by-product of wastewater management, were combined to produce well draining, high-fertility topsoil for use in landscaping the nonproductive areas of Neshaminy. Dredged material areas have been colonized naturally and consist of combinations of old fields and early succession wooded areas. Currently the fields are dominated by grasses, common reed, motherwort (*Leonurus cardiaca*) and golden rod (*Solidago* sp.), and is surrounded by a mowed or paved paths/roads.

RESULTS

PHASE I HABITAT ASSESSMENT

The Phase I survey was conducted on July 2, 2010 by Michael Torocco and Tessa Bickhart of HA. The focus of the survey was to identify potential Redbelly Turtle nesting habitat and potential amphibian breeding habitat at the proposed wetland mitigation areas (Areas A, B, and C) along the western shore of Neshaminy Creek within NSP (**Appendix A**). For the assessment of Redbelly Turtle nesting habitat, all areas within 1,000 ft of the proposed mitigation areas were also investigated. A disjunct portion of NSP on the east side of the Creek was not included in the study. An adjacent property known as Jack's Marina, located directly across the Creek from NSP, was also included in the initial survey, but not thoroughly investigated. Habitat photos are presented in **Appendix B**.

AMPHIBIAN BREEDING HABITAT EVALUATION

Area A – Wetland Enhancement – Intertidal Wetland: Because this wetland is intertidal, dominated by common reed, and does not contain pools, it is unlikely to provide breeding habitat for the amphibian species of interest.

Area B – Creation – Nontidal Wetland Mitigation: Area B is an upland area, which is proposed to be excavated and connected to an existing tidally influenced wetland. The existing wetland was dry at the time of the investigation, but had evidence of pooling and is expected to hold water during the early spring months. However, due to the tidal influence and connection to the Creek via a culvert, there are daily fluctuations in water level. Due to the tidal nature of the existing wetland and the potential for daily innundation and drainage, it is not expected to serve as important amphibian breeding habitat.

Area C – Creation – Intertidal Wetland Construction: Although dry at the time of the Phase I habitat assessment, the wet depression within Area C may provide amphibian breeding habitat during the early spring season. Evidence of recent water retention was noted during the initial investigation, but repeated visits did not document water retention during July. It does not provide typical or ideal habitat for any of the target amphibians, but may potentially provide breeding habitat for eastern spadefoot toad (*Scaphiopus holbrooki*). Phase II surveys were not conducted primarily due to the timing of the surveys, but also the drought conditions during 2010.

Area D – Jack's Marina: This area was not assessed for the presence of amphibian breeding habitat by HA. This location has been subject to previous Phase I and Phase II surveys (SIR #20510).

REDBELLY TURTLE HABITAT EVALUATION

The general area provides highly suitable aquatic habitat for turtles, and Redbelly Turtles in particular. The Delaware River, Neshaminy Creek, smaller tributaries, and the lagoons associated with Jack's Marina all provide important aquatic habitat for the local population. The diversity of aquatic habitats, from deep, swift moving areas in the larger waterways, to the calm waters of the lagoons provide important resources for both juvenile and adult turtles.

Area A – Wetland Enhancement – Intertidal Wetland: This common reed dominated wetland along the banks of the Creek provides only marginal aquatic habitat for Redbelly Turtles. The site is an unlikely hibernating area due to dense stand of common reed, but should be considered potentially occupied during the active season (April 15-October 15).

The dredge spoil deposition site adjacent to Area A provides ideal turtle nesting habitat with an open canopy, sandy soils and location above the floodplain. Beyond the deposition site are scattered, open canopy mowed areas along paths and picnic areas which provide suitable nesting habitat as well within 1000 ft of the Creek's edge.

Area B – Creation – Nontidal Wetland Mitigation: Area B is within the riparian floodplain of the Creek and although recently cleared of woody vegetation was under a full canopy. Inland from Area B the canopy opens at a compost area along a Park path/road. The area contains piles of lawn clipping, straw, soil, brush, and charcoal and is dominated by motherwort and goldenrod. The existing wetland area does not provide suitable aquatic habitat, but the adjacent compost area does provide suitable nesting habitat for Redbelly Turtles.

Area C – Creation – Intertidal Wetland Construction: This area is becoming canopied by a young stand of black locust, but past deposition of dredge spoil (sand) has created suitable turtle nesting habitat. North and inland of Area C is the area known as the "Soil Factory", which also provides potential nesting habitat along the open canopy mowed edged and grassy interior.

Area D – Jack's Marina: The aquatic habitat in this area is suitable for Redbelly Turtles, and upland areas with exposed soil provide suitable nesting habitat. Basking opportunity is limited within the NPS property, but is present within the inlets and lagoons at Jack's Marina.

Table 1. Phase I Habitat Assessment Survey Summary

Mitigation Area	Size (Acres)	Potential Frog Breeding Habitat?	Potential Turtle Nesting Habitat*?	Included in 2010 Nest Survey
A		No	Yes	Yes
B		No	Yes	Yes
C		Yes	Yes	Yes
Jack's Marina		Not Assessed	Yes	No

*Potential determination for nesting habitat also includes up to a 1,000' outside the mitigation areas.

PHASE II TURTLE NEST SURVEYS

Figure 2. A turtle nest that was excavated by a mammal predator in the sandy dredge spoil area adjacent to Mitigation Area A.

The primary emphasis of the Phase II Nest Surveys was to document the location of suitable turtle nesting habitat associated with the proposed Mitigation Areas A, B and C. Surveys were initiated following the habitat assessment on July 2, 2010 and continued until July 15, when there was an unanticipated hold placed on the project. A total of three visits were made to the site in 2010. However, the number of new nests discovered after the initial visit was minimal. This probably reflects the earlier occurrence of turtle nesting in 2010 due to the hot spring, and most nests were discovered by HA during the initial visit. Although Jack's Marina was only visited once on July 2, 2010, three destroyed turtle nests were documented and 3 Redbelly Turtles were observed basking in the lagoons along Neshaminy Creek.

The open, sandy area that lies adjacent to Mitigation Area A was the primary turtle nesting area discovered on site with 28 destroyed by predator nests documented. Open areas associated with the Mitigation Areas B and C were also documented to be used by nesting turtles, but at a much lower frequency. **Appendix C** shows the location of all discovered turtle nests. **Table 2** provides a summary of Phase II Nest Surveys.

Table 2. Phase II Nest Survey Summary.

Date	Time In-Out	Surveyors	Total Person Hours	Mitigation Area	Number of Nests Observed
7/02/10	1000-1400	MT TB QB	12.0	A B C Jack's Marina	28 3 3 3
7/08/10	0930-1400	MT TB QB	13.5	A B C	no new no new no new
7/15/10	0900-1300	TB QB	8.0	A B C	no new 1 new (snapper) no new

REPTILES AND AMPHIBIANS OBSERVED

Table 3 provides a list of individual reptiles species observed within NSP and the adjacent water ways. The presence of brown snakes was documented by the observation of two dead on the road, and the common snapping turtle was documented by the observation of destroyed nests. All other animals represent observations of living individuals. Aquatic turtles were observed swimming or basking in the lagoons of Jack's Marina and in the Delaware River.

Table 3. Reptiles and Amphibians Observed on the Study Site.

Common Name	Scientific Name
Reptiles	
N. Redbelly Turtle	*Pseudemys rubriventris*
E. Map Turtle	*Graptemys geographica*
E. Painted Turtle	*Chrysemys p. picta*
Red-eared Slider	*Trachemys scripta elegans*
E. Box Turtle	*Terrapene c. carolina*
Common Snapping Turtle	*Chelydra s. serpentina*
E. Garter Snake	*Thamnophis s. sirtalis*
N. Brown Snake	*Storeria d. dekayi*

Figure 3. Two adult Redbelly Turtles, a red-eared slider, and an eastern map turtle are basking together on this old piling in a lagoon of Jack's Marina.

RECOMMENDATIONS

The project proposes to enhance the existing habitat by the removal of invasive plant species and the creation of additional wetland. This provides the opportunity to improve aquatic and terrestrial nesting habitat for the state threatened Redbelly Turtle, which is confirmed present at the site, as well as create additional breeding habitat for amphibians. However, there is the potential for some negative impacts to existing habitat. Several recommendations are suggested for enhancing or creating habitat for these sensitive species. Depending on which mitigation sites are selected, not all of the following recommendations may apply.

1. Turtle Nesting Habitat

- **a.** In upland areas, especially where turtle nests were documented, conduct mitigation activities during the cool season months (October 15-April 15) to avoid disturbance to turtle nesting or egg incubation.
- **b.** The large, open, sandy area adjacent to Mitigation Area A provides highly suitable and important nesting habitat for turtles. HA recommends that this area not be disturbed or modified, especially during the nesting and incubation period (May 15-September 30).
- **c.** Currently, there are small patches of common reed within the nesting area adjacent to Mitigation Area A. Common reed should be eradicated from this area as well, but treated with herbicide or manually removed by hand to avoid impacts to the nesting habitat.
- **d.** Create additional open, sandy nesting habitat in upland areas throughout NSP.

2. Turtle Aquatic Habitat

- **a.** Conduct in-stream work during the active (warm) season so turtles can move out of work areas (April 15-October 15).
- **b.** Create basking platforms in deep waters of the lagoons or backwater areas using logs or wood structures to provide additional basking areas for turtles.

3. Amphibian Breeding Habitat

- **a.** Removal of the small wetland in Mitigation Area C should be conducted when it is dry in case amphibian breeding has occurred and eggs or tadpoles are present (October 15-February 28, which also coincides with turtle egg incubation period and avoids impacts to the nearby nesting area).
- **b.** All of the currently proposed wetland creation or enhancement at NSP includes a connection to Neshaminy Creek, and is therefore tidal. HA recommend the creation of non-tidal wetlands and vernal pools of at least 0.25 acres in size or greater to provide amphibian breeding habitat.

SUMMARY AND CONCLUSIONS

Herpetological Associates, Inc. (HA) was contracted by Weston Solutions, Inc. to conduct Phase I Habitat Assessments for Southern (Coastal Plain) Leopard Frog (*Lithobates sphenocephala*), New Jersey Chorus Frog (*Pseudacris kalmi*), Northern Cricket Frog (*Acris crepitans*), and Redbelly Turtle (*Pseudemys r. rubriventris*), as well as a Phase II Nest Survey for the Redbelly Turtle for the Southport Wetland Mitigation Project at Neshaminy State Park in Bucks County, Pennsylvania (PNDI # 20100331236617).

HA's 2010 surveys included the three proposed wetland mitigation areas (Areas A, B, and C) along the western banks of Neshaminy Creek within NSP. An alternate proposed mitigation site, which is a privately owed former marina (Jack's Marina) located directly across Neshaminy Creek to the east of NSP was not included in HA's 2010 surveys, but was given a cursory assessment. Previous studies for Redbelly Turtles conducted in 2006 at this location by another consultant documented the presence of Redbelly Turtles in the Creek and adjacent lagoons (SIR #20510), therefore Redbelly Turtles are assumed present in the Creek and all associated permanent waterbodies in the vicinity of NSP. The focus of HA's 2010 investigations were to identify suitable nesting habitat for Redbelly Turtles and suitable habitat for the three frog species at proposed mitigation areas A, B, and C.

Highly suitable turtle nesting habitat was observed at a former dredge spoil deposition site adjacent to proposed Mitigation Area A. Confirmation of turtle nesting in this area was documented by the presence of 28 turtle nests that had been destroyed by predators during Phase II Nest Surveys. Although significantly fewer nests were discovered at or adjacent to the remaining mitigation sites (Mitigation Areas B and C), destroyed by predator turtle nests were documented at these sites. Three destroyed by predator turtle nests and adult, basking Redbelly Turtles were documented at the Jack's Marina mitigation area during the cursory examination.

Amphibian breeding habitat is not abundant within the study area (NSP), although one potential site was discovered within proposed Mitigation Area C. This small depression in sandy soil shows evidence of water retention, but was dry at the time of surveys. Phase II surveys for breeding amphibians were not conducted because the initiation of HA's work was beyond the breeding period, as well as the dry weather conditions of 2010.

HA recommends protecting the existing critical turtle nesting habitat documented during the 2010 Phase II Nest Survey as part of the Southport Wetland Mitigation Project. The creation of additional wetlands (including non-tidal vernal pools) and upland nesting habitat, as well as enhancement of existing habitats within NSP will provide the best opportunities for the resident population of these species of interest.

THE ECOLOGY OF THE REDBELLY TURTLE

Description

The Redbelly Turtle (*Pseudemys rubriventris*; Leconte, 1830; **Figures 4-5**) is a large basking turtle averaging 10-12 inches (254-305 mm) in carapace length when mature (Conant and Collins, 1991). Coloration and pattern are highly variable, but in general, the carapace is mahogany to black, with light chestnut to reddish vertical bars on the laminae. The name *rubriventris* is from the Latin words *rubidus* or reddish, and *venter* for belly, referring to the reddish plastron (Graham, 1991). The common name follows Collins and Tagart (2002).

Figure 4. Hatchling Redbelly Turtle.

Considerable sexual dimorphism exists in body size and scute proportions (Graham, 1991). Female Redbelly Turtles are larger and have a longer plastron, higher shell and wider bridges, and plastral scutes are relatively longer at the midline, except the femoral scute, which is slightly longer in males. Redbelly Turtles, especially males, tend to become melanistic with age. Background color of the male plastron is pale pink overlaid with dark vermicular mottling; in females, it is coral red with grey figures narrowly bordering the plates (Graham, 1971b). The front of the upper jaw has a terminal notch flanked on each side by a distinct maxillary cusp. The presence of maxillary cusps distinguishes the Redbelly group, which also includes the Florida Redbelly Turtle *(P. nelsoni*) and the Alabama Redbelly Turtle *(P. alabamensis*).

Status

Pennsylvania Status - Threatened
Federal Status - None

Range

The Redbelly Turtle has a relatively continuous coastal plain distribution across seven mid-Atlantic states from eastern North Carolina to central New Jersey, and a disjunct population in southeastern Massachusetts (Ernst and Barbour,1989). Waters (1962) suggests that the Massachusetts population may be a relic from a once continuous, prehistoric distribution across the eastern coastal United States. *P. rubriventris* could have expanded its range when the continental shelf was emergent during the post-Wisconsin glacial period, which became isolated as the shelf submerged with the retreat of the glaciers. South of New England, the northernmost redbelly population known occurs in Middlesex County, New Jersey. Redbelly Turtles are also known historically from New York (Babcock, 1938; Carr, 1952), and an introduced population apparently became established in Charleston, Staten Island, New York, R. Zappalorti, in Litt. 1992).

Habitat and Life History

Although most of their time is spent in fresh water ponds, Pennsylvania Redbelly Turtles may also be found on land. In late spring and early summer, females select nesting sites in sandy soil, usually within 100 yards (90 m) of the pond. Females occasionally travel greater distances from the ponds in search of suitable nesting sites (J.D. Lazell, Conservation Agency, Conanicut Island, Rhode Island, in Litt. 1980). In each nest, an average of 12 eggs (range 5-17) are deposited (Zappalorti, personal observations; Haskell, 1993). Incubation takes 73-80 days at 25°C (Graham, 1971b). Hatchlings average about 1.25 inches (32 mm) in length (range 25.8-40.8 mm). Under certain conditions, hatchlings do not emerge from nests to enter ponds and instead overwinter in the nest chamber. Sexual maturity in Redbelly Turtles is probably reached at 15 years by females and sooner by males.

Figure 5. Adult Redbelly Turtle.

Redbelly Turtles are usually active from late March to November. During the winter, they rest on the bottom of ponds under the ice, in a state of relative inactivity known as brumation. Current data gathered suggests that aquatic vegetation is the primary diet for all ages classes (Graham, 1969; 1981).

Factors Contributing to the Threatened Status in Pennsylvania

The Pennsylvania Fish and Boat Commission, with the advice of a team of herpetologists, generally considered the following factors that may adversely affect the Redbelly Turtle and its habitat: adverse modification of water quality, such as siltation from land clearing adjacent to ponds; pollution and eutrophication of ponds; pollution of groundwater or reduction in the levels of ponds from groundwater pumping; any draining or filling of wetlands adjacent to occupied ponds; and shoreline modification such as filling, dredging for beaches, dikes, real estate development or similar types of activity (Graham, 1984; U.S. Fish and Wildlife Service, 1994). Other factors include:

1. Predation of eggs by raccoons and striped skunks, whose population tend to increase with residential development and habitat fragmentation;
2. Predation on hatchlings and young turtles from introduced and natural predators, such as largemouth bass, herons, bullfrogs, etc.;
3. Loss of nesting and basking sites to development, recreation, and forest canopy closure;
4. Manipulation of aquatic vegetation, including herbicide use, which may impact quality and quantity of food resources;
5. Collection and harassment by humans;
6. Incidental mortality from highway traffic and shooting;
7. Isolation of populations resulting in inbreeding and genetic drift, which can reduce genetic variability and potentially decrease survivorship.

THE ECOLOGY OF THE SOUTHERN LEOPARD FROG

Description

The southern leopard frog (*Lithobates sphenocephalus*) belongs to a group known as the true frogs, Family Ranidae. Southern leopard frogs are similar in appearance to the northern leopard frogs, but differ in having a more pointed snout, a light spot in the center of the tympanum, and fewer spots on the sides of the body (**Figure 6**). Body length is generally 2.5 to 3 inches. Coloration is variable across the range of the species, and ranges from a brown to vivid green background with irregular dark spots on the back and sides. The belly and throat are white. Males are smaller than females, but have enlarged forearms and paired vocal sacs. Like all members of the Family Ranidae, southern leopard frogs have long hind legs and are strong jumpers.

Figure 6. Southern leopard frog from Burlington County, New Jersey. Photo by Robert T. Zappalorti.

Taxonomy

The southern leopard frog is also known as the Coastal Plain leopard frog. The scientific name was recently changed from *Rana utricularia* to *Rana sphenocephala* (Crother et al., 2000). Further evidence has separated the North American members of the genus *Rana* to *Lithobates*. Two subspecies are recognized: *Lithobates sphenocephalus sphenocephalus*, which occurs in Florida, and *Rana sphenocephalus utricularius* which occurs in the rest of the range.

Status

State Status: Endangered
Federal Status: None

Range

The Southern leopard frog ranges from Long Island and extreme southern New York to Florida, and west to eastern Texas and Kansas. In Pennsylvania, *L. sphenocephalus* has an extremely restricted range, occurring only in the southeastern part of the state. It has been verified only in one location since 1980, but historic locations exist within Coastal Plain habitat along the Delaware River in Pennsylvania.

Life History

Southern leopard frogs are semiaquatic. Although they are often found near ponds, lakes, and slow-moving streams, they also require open fields and wet meadows in which they forage for invertebrate prey. Freshwater marshes are the preferred habitat. These frogs become active and breed fairly early in the spring, with the earliest activity reported as March 20 in Pennsylvania (Hulse et al., 2001). Little research has been performed on *L. sphenocephalus* in the Northeast, and it is believed that activity probably begins as early as February and may extend through November.

Breeding occurs primarily in April. Egg masses may contain over 1,000 eggs, and masses are often laid communally. Transformation from tadpole to frog appears to take 50-75 days, but this is not well documented in Pennsylvania.

Factors Contributing to the Endangered Status in Pennsylvania

The southern leopard frog has an extremely restricted range in Pennsylvania. The current and historic range of the species occurs in a heavily developed and altered area of the state, and as such habitat loss and pollution are the primary causes for population reduction. Preserving suitable wetland and upland habitat is necessary to protect the remaining populations.

THE ECOLOGY OF THE NEW JERSEY CHORUS FROG

Description

The New Jersey chorus frog (*Pseudacris kalmi*) is a member of the treefrog family (Hylidae), measuring 0.75-1.5 inches in length (Schwartz and Golden, 2002). Chorus frogs possess toepads, but unlike other members of the treefrog family, they are not arboreal. Chorus frogs generally have a light gray, pale green, or light brown dorsal coloration with three longitudinal stripes (**Figure 7**). The skin has a granular appearance. The ventral surface is white or cream colored, and sometimes speckled. The New Jersey chorus frog is distinguishable from similar species by broad, well defined, dark brown longitudinal dorsal stripes. Females and males are sexually dimorphic with female being significantly larger then males. Males are also distinguishable during the breeding season when their dark yellow vocal sacs are noticeable.

Figure 7. A New Jersey chorus frog from Atlantic County, New Jersey. Photo by M. McGraw, HA.

Phylogenetics and Taxonomy

The phylogenetic relationship of the chorus frogs continues to be debated, although recent genetic work has shed considerable light on the situation. As a consequence of the phylogenetic debate, the taxonomy has also changed significantly over the years (Cocroft and Ryan, 1995; Da Silva, 1997). Both the upland chorus frog (*feriarum*) and the New Jersey chorus frog (*kalmi*) were once considered subspecies of *P. triseriata*. Most current field guides place the upland chorus frog as the nominate species (*P. f. feriarum*) and the New Jersey chorus frog as a subspecies of *P. feriarum*. However, recent data from Moriarty and Cannatella (2003) has indicated that the New Jersey chorus frog should be considered a distinct species (*Pseudacris kalmi*). This taxonomy is also supported by Collins and Taggart (2002) and Crother (2008), but has not gained widespread acceptance among chorus frog experts yet. It does appear likely that this name will be accepted.

Status

State Status: Endangered
Federal Status: None

Range

The New Jersey chorus frog is restricted to the coastal plain region from Staten Island, New York, to the southern tip of the Delmarva Peninsula. In Pennsylvania, the New Jersey chorus frog is restricted to the coastal plain region within the southeast, which includes, Bucks, Philadelphia, and Delaware Counties.

Life History

The natural history of chorus frogs is largely understood from the work conducted on western chorus frogs (*P. triseriata*; Kramer, 1973; 1974; Whitaker, 1971) and southern chorus frogs (*P. nigrita*; Gartside, 1980). Little attention has been paid to the natural history of the New Jersey chorus frog, and even the authoritative guide by Conant and Collins (1998) only briefly mentions *P. kalmi*. Therefore, much of our knowledge of the New Jersey chorus frog must be gleaned from the available data on other *Pseudacris* species.

In general, chorus frogs emerge from hibernation in mid-March, but depending on ambient temperature they may emerge as early as mid-February or as late as the end of March or early April. Hibernating habitat is unknown, but is believed to be terrestrial since chorus frogs are freeze tolerant. During the reproductive season, March through the end of April, chorus frogs are active during the day as well as at night. Activity peaks in early April when chorus frogs congregate at breeding ponds. Mating occurs in shallow bodies of water including temporary pools, flooded wetlands, and even road-side ditches. Egg masses are approximately 2.5 cm (1 in) in diameter and contain between 12 and 245 eggs, although multiple egg masses may be laid by one female, totaling 500-1500 eggs (Collins, 1982; Wright and Wright, 1949). The tadpoles transform into froglets within 35 to 55 days.

The New Jersey chorus frog is extremely secretive and little is known about habitat requirements and behavior after the breeding season. It is commonly believed chorus frogs are primarily terrestrial after the reproductive season, and may inhabit dense vegetation in forests, old fields, and wetland edges. They may stray considerable distances from water, and home ranges of the western chorus frog were shown to vary from 0.16 - 1.49 acres in one study (Kramer, 1974).

Factors Contributing to the Endangered Status in Pennsylvania

Habitat destruction due to industrial development and wetland filling is the primary cause for the decline of New Jersey chorus frogs. Pollution associated with development may also have a significant impact on the survival of adults and tadpoles. This species is vulnerable to extirpation in Pennsylvania due to its extremely restricted range.

THE ECOLOGY OF THE NORTHERN CRICKET FROG

Description

The northern cricket frog (*Acris crepitans*) is a member of the treefrog family (Hylidae), but are the least arboreal (tree-dwelling) members of the group. They are the smallest frogs in Pennsylvania, ranging in size from 5/8 - 1 inch (1.6 - 2.5 cm). The skin is warty, and can be variable in color. Two common color phases are found, which include either a green or red middorsal stripe (running down the length of the spine), and the stripe may form a 'Y'. However, coloration may include combinations of bright green, yellow, red, brown, or gray. A well-defined triangular spot can be found between the eyes. The toes have extensive webbing. This species may be confused with the chorus frog, but is distinguished by the presence of a dark, ragged stripe on the rear of each thigh. Tadpoles of the northern cricket frog can be distinguished from the spring peeper by a black tail tip.

Figure 8. Examples of red and green phase northern cricket frogs. Photo by Michael Torocco, HA, 2010.

Taxonomy

The taxonomy of the northen cricket frog has remained fairly stable, despite changes in many other species names in recent years. Two subspecies have been recognized: *A. c. crepitans* and *A. c. paludicola*, although these are infrequently used and the validity of these names is unclear. The only putative subspecies found in Pennsylvania is *Acris c. crepitans*, which will be referred to by the preferred name *Acris crepitans* (northern cricket frog). The other species in the genus, the southern cricket frog (*Acris gryllus*), is not found in Pennsylvania.

Status

State Status: Species of Special Concern
Federal Status: None

Range

Northern cricket frogs occur from southeastern New York to the panhandle of Florida and west to Texas. They are absent from the eastern portion of the states from North Carolina to Florida, and are replaced there by the southern cricket frog. In Pennsylvania, they occur in the southeastern counties in the Coastal Plain, Piedmont, and Valley and Ridge Provinces.

Life History

Northern cricket frogs, like all reptiles and amphibians, overwinter or "hibernate" during the cold winter months. Activity becomes reduced in October, and they remain relatively inactive until late March. They have been found active during warm periods throughout the year, especially if their habitat remains unfrozen. Evidence suggests that they overwinter in upland settings rather than aquatic locations.

The onset of spring brings increased activity to this species, but breeding does not peak until May-June. Males have a prolonged calling period, which usually lasts from May through July and into August. Breeding (and male calling) usually takes place from floating vegetation or along the edges of permanent waterbodies such as ponds, lakes, and streams. Up to 250 eggs are laid singly or in small masses, and are attached to vegetation or laid on the bottom. Metamorphosis of tadpoles to frogs usually peaks in August. Frogs become mature by the following spring, and data suggests that few of their parents survive to breed a second year.

Northern cricket frogs are not shy, and can be found active in day or night. They are wary, however, and will escape by making long jumps with powerful hind legs.

Figure 9. A green spotted male northern cricket frog. Coloration is highly variable in this species. Photo by Michael Torocco, HA, 2010.

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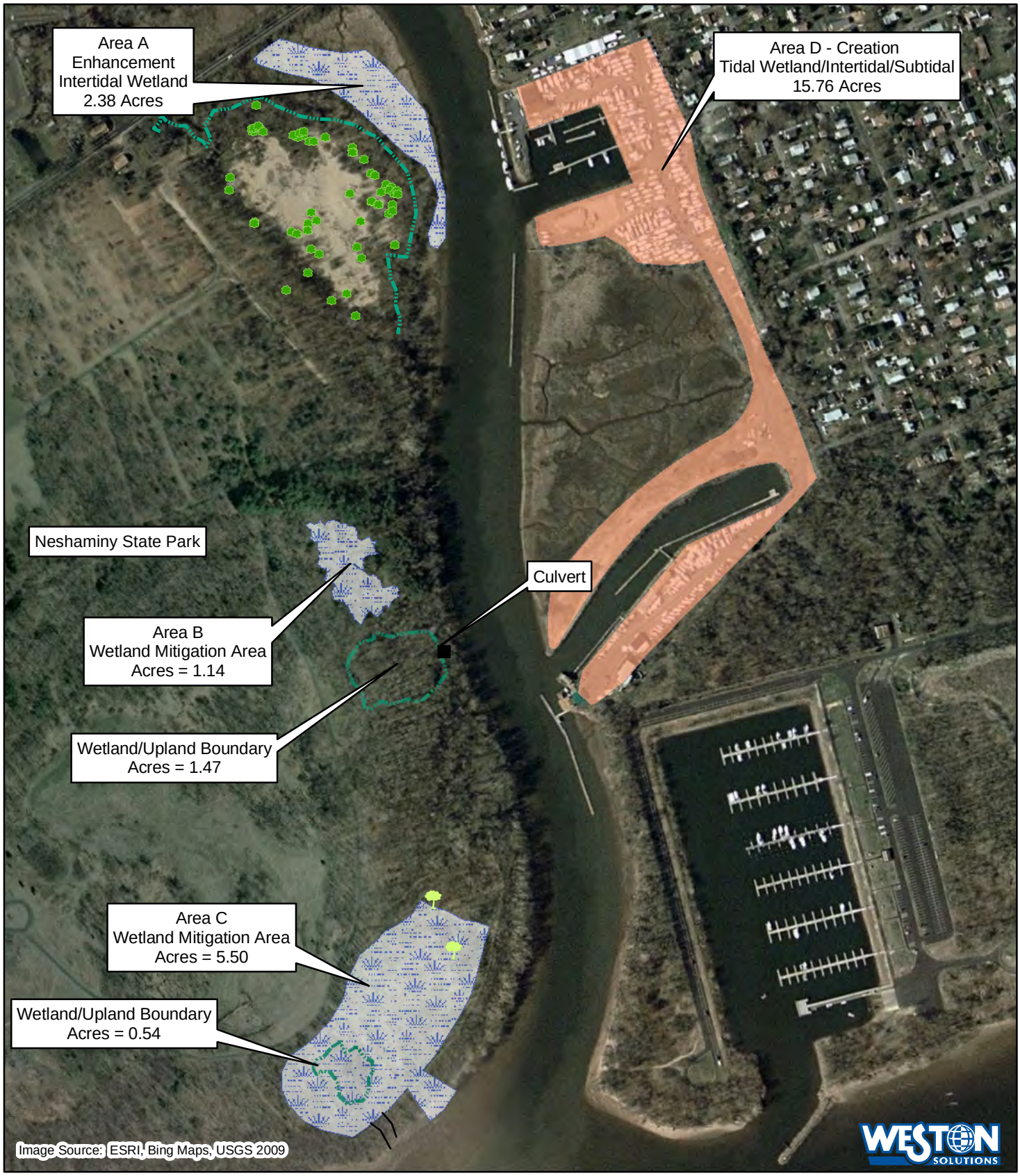
APPENDIX A:

Map Showing the Location of Proposed Mitigation Areas Provided by Weston Solutions, Inc.



Legend

- Willow Oak
- American Holly
- Wetland/Upland Boundary
- Mitigation Areas - Jack's Marina
- Wetland Mitigation Areas - Neshaminy State Park

N
W E
S

0 450 Feet

Figure 3
Wetland/Water Mitigation
Creation and Enhancement Areas
Neshaminy State Park and Jack's Marina
Bensalem and Bristol, Pa

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APPENDIX B:

Habitat Photographs

Appendix B-1. Northerly view of the confluence of Neshaminy Creek and the Delaware River from the NSP during low tide (July 15, 2010).

Appendix B-2: Suitable nesting habitat within the soil deposit site adjacent to Area A (July 2, 2010).

Appendix B-3. Wetland area within Mitigation Area B. This wetland was dry at the time of the habitat assessment on July 2, 2010.

Appendix B-4. Northerly view of the open canopy compost/refuse area adjacent to Area B (July 8, 2010).

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Appendix B-6. Southerly view from within the ephemeral wetland within Area C (July 15, 2010).

Appendix B-7. Southeasterly view of the old field within the site that is known as the "Soil Factory" outside Area C (July 8, 2010).

Appendix B-8. Lagoon at Jack's Marina (July 2, 2010).

APPENDIX C:

Map Showing Turtle Nest Locations

Legend

- Turtle Nests

N

0 75150 300 450 600 Feet

Appendix C

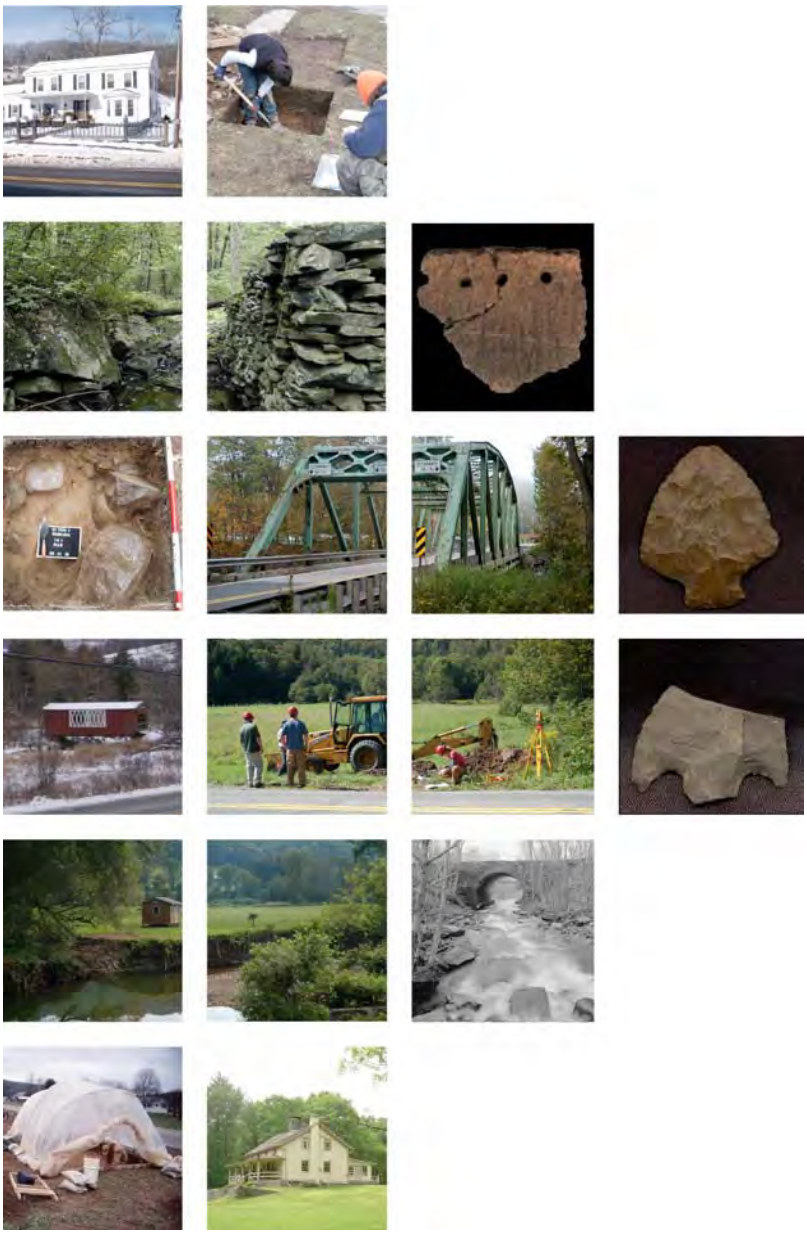
Turtle Nest Locations at Neshaminy State Park and Jack's Marina

Herpetological Associates, Inc.

Southport Development Project
Neshaminy State Park and Jack's Marina
Wetland Mitigation

Bensalem and Bristol Townships,
Bucks County, Pennsylvania

Phase IA Cultural Resources Assessment



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October 2010

Southport Development Project
Neshaminy State Park and Jack's Marina Wetland Mitigation

Bensalem and Bristol Townships, Bucks County, Pennsylvania

Phase IA Cultural Resources Assessment

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October 2010

EXECUTIVE SUMMARY

The Louis Berger Group, Inc. (Berger), of Morristown, New Jersey, conducted a Phase IA cultural resources assessment for the proposed creation of wetlands within the Neshaminy State Park and Jack's Marina in Bucks County, Pennsylvania as part of the required wetland mitigation associated with the proposed Southport Development Project in the City of Philadelphia. The proposed wetland mitigation consists of four discontinuous areas (Areas A, B, C, and D) (Project Area). Areas A through C are located within the Neshaminy State Park in Bensalem Township and Area D is located within Bristol Township. The Project will be funded by the Commonwealth of PA Department of General Services (DGS).

The proposed wetland mitigation project requires extensive ground disturbance to create the new wetland areas. The Phase IA cultural resources assessment, conducted in October 2010, is designed to investigate the potential for previously undocumented archaeological resources within the Project Area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP)and within the Project Area.

Although Area A, located to the south of State Road in Bensalem Township, is located within Neshaminy State Park, which contains the seventeenth century site of Dunk's Ferry and Inn and which was the location of the site of William Penn's first land purchase from the Lenape Native Americans in 1682, this area was never historically developed and is therefore not considered to have historic archaeological potential. Additionally, Area A was historically tidal marshland along the western bank of the Neshaminy Creek and approximately 0.43 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Although higher elevations overlooking marshlands and floodplains are considered to have a high potential to contain prehistoric archaeological deposits, marshlands themselves were not habitable by prehistoric populations. Pedestrian reconnaissance of Area A confirmed the absence of land with higher (dry) elevations and as a result, Area A is considered to have no potential for containing significant prehistoric archaeological deposits. No further archaeological investigations are recommended for Area A.

Area B, located immediately south of the terminus of Totem Road in Bensalem Township, is located within Neshaminy State Park, which contains the seventeenth century site of Dunk's Ferry and Inn and which was part of William Penn's first land purchase from the Lenape Native Americans in 1682. Area B was never historically developed and is therefore not considered to have historic archaeological potential. Area B was also historically depicted as tidal marshland along the western bank of the Neshaminy Creek and approximately 0.35 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Aerial photographs from 1938 and 1958 indicate, however, that Area B was agricultural farmland. Pedestrian reconnaissance of Area B indicated that although a designated wetland exists to the south of Area B, Area B is higher (dry) in elevation and as a result of its proximity to the Neshaminy Creek, Area B is considered to have a high potential to contain prehistoric archaeological deposits. Additionally, given the close proximity of previously documented *Neshaminy State Park Site* (36BU0211) approximately 250 feet to the north of Area B, a Phase IB archaeological survey is recommended to determine the presence or absence archaeological deposits within Area B.

Although Area C, located immediately west of the confluence of Neshaminy Creek and the Delaware River in Bensalem Township is located within Neshaminy State Park, which contains the seventeenth century site of Dunk's Ferry and Inn and which was part of William Penn's first land purchase from the Lenape Native Americans in 1682, Area C was never historically developed and is therefore not considered to have historic archaeological potential. Area C was also historically depicted as undeveloped or tidal marshland along the western bank of the Neshaminy Creek. Again, although marshlands

themselves were not habitable by prehistoric populations, pedestrian reconnaissance of Area C indicated that although a designated wetland exists within the southern portion of Area C, the majority of Area C is higher (dry) in elevation. However, the location of Area C was depicted as a "Diked Hydraulic Fill Settling Basin" on the 1971 Neshaminy State Park Existing Facilities Map. As Area C was modified in the recent past to create a settling basin, Area C is considered to have no potential to contain prehistoric archaeological deposits. No further archaeological investigations are recommended for Area C of the current Project.

Area D, located within tidal wetlands immediately west of 5th Avenue in Bristol Township, was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER2003-2767-017-A) in 2003 for the, then proposed, Newport Landing residential development project. Although the PHMC/BHP indicated that the permit area for that project (Area D of the currently proposed project) possessed a "high probability that archaeological resources may occur within the proposed permit area" and indicated that "a Phase I archaeological survey of the project area is recommended but not required [as part of that review], additional documentation was presented to the PHMC/BHP by the applicant (T.H. Properties, Inc.) in 2007. That documentation indicated that the permit area (current Area D) "has been repeatedly disturbed over the last 50 years" and "was further excavated in the 1980s as a wetlands mitigation measure for placement of a roadway culvert" (T. H. Properties 2007). Further, the additional documentation indicated that "test borings indicate that fill comprised of dredge and demolition materials has been placed to depths of six to nine feet" (T. H. Properties 2007). As a result, the PHMC/BHP indicated that the Newport landing Project which encompassed current Area D, would "have no effect on significant cultural resources" in its letter dated June 6, 2007.

Portions of Area D contain imported fill to create land on which 5th Avenue and marina structures associated with the former location of Jack's Marina (formerly Bradley's Boat Basin; currently the Three Seasons Marina) were built circa 1971. Other portions were never historically developed. Therefore, as the PHMC/BHP previously indicated, Area D is not considered to have historic archaeological potential. Additionally, Area D was historically tidal marshland along the eastern bank of the Neshaminy Creek and its extent ranges from approximately 0.25 to 0.65 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Although higher elevations overlooking marshlands and floodplains are considered to have a high potential to contain prehistoric archaeological deposits marshlands themselves were not habitable by prehistoric populations. Pedestrian reconnaissance of Area D confirmed the absence of natural land with higher (dry) elevations and as a result and as the PHMC/BHP previously indicated, Area D is considered to have no potential for containing significant prehistoric archaeological deposits. No further archaeological investigations are recommended for Area D of the current Project.

Berger has conducted a survey of historic architectural resources greater than 50 years of age within the four areas of the Project Area and immediate vicinity. This survey was based on the pedestrian reconnaissance conducted within the Project Area on October 13, 2010, as well as the historic and background research conducted for the Project. No historic architectural resources greater than 50 years of age were identified within Areas A, B or C of the Project Area. No further historic architectural survey is recommended for Areas A, B or C of the Project Area.

Although the boat basin associated with the former location of Jack's Marina in Bristol Township, was created circa 1938, the structures currently located within Area D were built circa 1971 and were not surveyed as part of this project because Area D was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER# 2003-2767-017-A) in 2003 for the then proposed, Newport Landing residential development project and because the PHMC/BHP indicated that "no evaluation of historic structures [would] be necessary for [that] project" in

its letter dated October 3, 2003 (ER# 2003-2767-017-A). As the Newport Landing project contained the location of Area D of the current Project, no further historic architectural survey is recommended for Area D of the Project Area.

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1.0 INTRODUCTION

1.1 DESCRIPTION OF PROJECT

This report presents the results of Phase I cultural resource investigations conducted by The Louis Berger Group, Inc. (Berger) for the proposed creation of new wetlands in Bensalem and Bristol Townships, associated with the Southport Development Project in the City of Philadelphia, Pennsylvania. The proposed wetland mitigation project will be located within Neshaminy State Park and Jack's Marina, approximately 20 miles upstream from the Southport location (Figures 1 and 2). As the proposed wetland mitigation project requires extensive ground disturbance to create the new wetland areas, a Phase IA Cultural Resource Assessment is required to determine if the areas proposed for wetland creation possesses the potential to contain previously undocumented archaeological resource or are within view of previously undocumented historic architectural resources. The Project will be funded by the Commonwealth of PA Department of General Services (DGS).

The Phase I cultural resource assessment was conducted with the objective of investigating the potential for previously undocumented archaeological resources to exist within the Project Area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP) within the Project Area and immediate vicinity.

These cultural resource investigations have been conducted in accordance with the instructions and intent of the National Historic Preservation Act of 1966, as amended; Public Law 93-291; 36 CFR 800 (Preservation of Historic Properties; the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (Federal Register, 1983, Volume 18, Number 1990, pp. 44716-44742; and the Pennsylvania Historical and Museum Commission/Bureau for Historic Preservation (PHMC/BHP) Guidelines for Archaeological Investigations (November 2008). The cultural resource specialists who performed the investigations meet the standards specified in 36 CFR 66.3(b)(2) and 36 CFR 61.

1.2 PROJECT SETTING

The Project consists of four areas located on the western and eastern banks of the Neshaminy Creek at its confluence with the Delaware River in Bensalem and Bristol Townships, Bucks County (see Figure 1).

Area A is located within Neshaminy State Park to the south of State Road in Bensalem Township. Area A is a tidal marshland along the western bank of the Neshaminy Creek and is located approximately 0.43 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Area B is a relatively flat area with deciduous trees and is also located within Neshaminy State Park immediately south of the terminus of Totem Road in Bensalem and approximately 0.35 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Area C is a relatively flat area with deciduous trees and is also located within Neshaminy State Park immediately west of the confluence of Neshaminy Creek and the Delaware River in Bensalem Township. Area D, located within tidal wetlands immediately west of 5th Avenue in Bristol Township approximately 0.25 to 0.65 miles to the north of the confluence of Neshaminy Creek and the Delaware River.

1.3 SCOPE OF WORK AND PROJECT PERSONNEL

The historical and archaeological assessment consisted of background research, an architectural assessment of the existing structures, and a pedestrian survey of the Project Area. Background research, conducted in October 2010, included the examination of survey reports and historic and archaeological site files at the PHMC/BHP, in Harrisburg, on-line cartographic clearing houses such as the Greater Philadelphia GeoHistory Network, the David Rumsey collection, and the Library of Congress, and maps and other documents held at the Historical Society of Bensalem.

A pedestrian survey was conducted on October 13, 2010 to document the current conditions of the Project Area to assist in the assessment of the archaeological potential of this Project. An historic architectural field survey was also conducted on October 13, 2010 to photo-document extant structures and buildings within the Project Area and vicinity that are greater than 50 years of age and/or historic properties that have been previously listed in or previously determined eligible for listing in the National Register of Historic Places listed or eligible historic properties by the PHMC/BHP.

Mr. Zachary J. Davis, an RPA-certified archaeologist served as the Project Manager, Mr. Kristofer M. Beadenkopf, RPA, served as Principal Investigator, and Ms. Deborah Van Steen served as the architectural historian for this Project. Background research was conducted by Mr. Beadenkopf and Ms. Van Steen. The report was written by Mr. Beadenkopf, Ms. Van Steen, and Mr. Davis. Mr. Davis created the report's graphics.

1.4 RESEARCH OBJECTIVES

The objectives of the Phase IA cultural resource investigations included:

- Development of an historic, prehistoric, and environmental background for the Project Area, and its immediate vicinity;
- Identification of all previously documented archaeological resources in the Project Area and vicinity;
- Description of previously documented archaeological resources including their horizontal and vertical extent, structure, artifact and feature content and distributions, temporal and cultural associations, soil characteristics, and environmental variables;
- Assessment of the prehistoric and historic archaeological potential of the Project Area;
- Assessment of potential Project effects to possible archaeological resources within the Project Area;
- Identification of historic architectural properties listed in and/or previously determined eligible for listing in the National Register of Historic Places;
- Identification of historic architectural resources greater than 50 years within the Project Area and vicinity which have not been previously surveyed/documented;
- Assessment of potential Project effects to National Register listed or previously determined eligible historic architectural resources within the Project Area;
- Preparation of a report that describes, in detail, the purpose, methods, and findings of the investigations and recommendations for any further investigations that may be necessary.

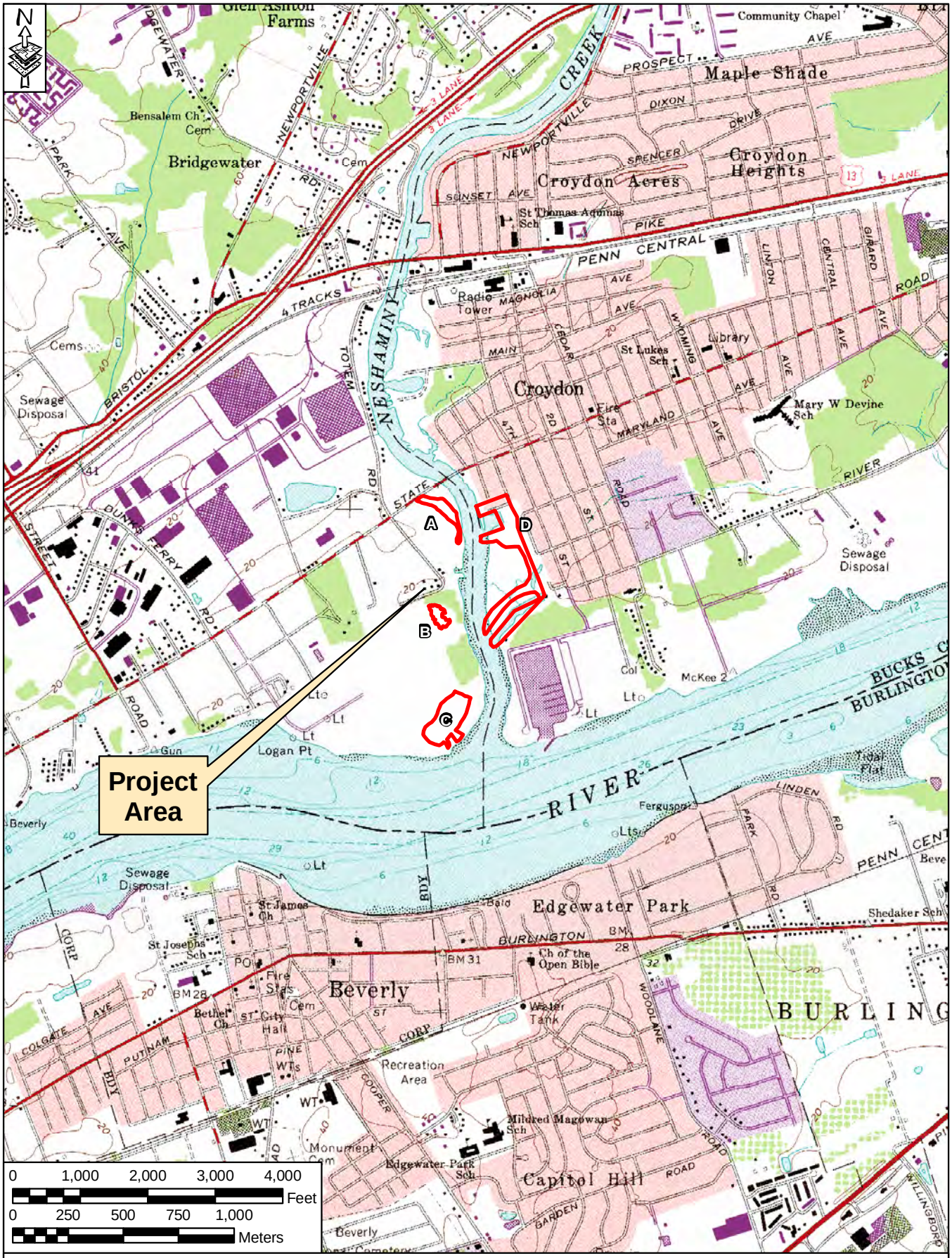

FIGURE 1: Overview of the Proposed Wetland Mitigation Project Area

SOURCE: USGS 7.5' Series Quad, Beverly, PA-NJ, 1979

FIGURE 2: Aerial View of the Proposed Wetland Mitigation Project Area

SOURCE: PAMAP Program, Cycle 2 http:// 146.186.163.133, 2007-08

2.0 BACKGROUND

Background research was conducted using the PHMC/BHP Cultural Resource Geographic Information System (CRGIS), the files maintained by the PHMC/BHP, the Bucks County Historical Society, and the Historical Society of Bensalem Township. Additional cartographic resources and historic photographs were obtained from internet clearinghouses such as the Greater Philadelphia GeoHistory Network, the David Rumsey Map Collection, the Library of Congress, PennPilot historic aerials, and historicaerials.com.

2.1 ENVIRONMENTAL BACKGROUND

The environmental variables characteristic of the proposed Project's setting and its vicinity determine to some extent the suitability of the area for prehistoric and historic human use. The following descriptions of the area's environmental characteristics are abridged directly from Soil survey of Bucks and Philadelphia Counties (Tompkins 1975) and the USDA NRCS web-based soil survey (websoilsurvey.nrcs.usda.gov/app/HomePage.htm).

2.1.1 Physiography and Geology

The Project Area is located within the Lowland Section of the Atlantic Coastal Plain Province and consists of a flat upper terrace surface that is cut by numerous short streams. Most of these stream valleys range from very narrow and steep sided to those with wider bottoms and less steep slopes. The upper terrace surface is underlain by unconsolidated to poorly consolidated sand and gravel overlying various metamorphic rocks of the Wissahickon schist formation that were deposited during the Precambrian Age. Local relief is very low in this section with elevations ranging from sea level to 200 feet above mean sea level. The floodplain of the Delaware River is included in this Section.

At the end of the Wisconsin glaciation (ca. 12,000 B.C.) the Delaware River Basin was flooded with glacial meltwater and increased the level of the river by as much as 18 meters (Kraft 1977). As a result, sand and gravel was eroded from the Appalachian Mountains and were subsequently re-deposited throughout the Project Area through stream action (Cuff et al. 1989).

The numerous native (original) wetlands within the Project Area would have provided valuable nutritional and technological resources for prehistoric and historic human populations which have occupied mainland areas (non-marsh land) with higher elevations.

The climate of Bensalem and Bristol Townships is one of long cold winters and pleasantly mild summers. An ample supply of precipitation is received throughout the year. Since prevailing winds are from the west, the weather systems affecting this area originate in continental regions. As a result, Philadelphia is subject to a wide variety of weather. Several successive days of very warm temperatures in summer and of near 0 degrees Fahrenheit in winter are not uncommon. One climatic feature of considerable persistence is that of cloudy skies during winter and early in spring. The average temperature is 55°F with average low temperatures in January (32.5 °F) and high temperatures in August (76°F). Average rainfall is between 40 and 46 inches per year and the frost free growing period is between 161 and 215 days per year.

The climate of Bensalem and Bristol Townships is/was suitable for permanent human presence although the long and occasionally severe winters may have selected for seasonal use (late spring through early fall).

2.1.2 Soils

According to the National Resources Conservation Service (NRCS), soils within Area A are classified as Nanticoke-Hatboro silt loams (Na) (Figure 3). Nanticoke-Hatboro silt loams (Na) are located on tidal flats and floodplains and are poorly drained and are subject to occasional flooding. Slopes are approximately 0 to 1 percent and the average depth to bedrock varies between 60 to 99 inches. The water table is located between 0 and 6 inches below the surface.

Soils within Areas B and C of the Project Area are classified as Udothents, gravelly (Ua). Udothents, gravelly (Ua) are located on flats and are well drained. Slopes are approximately 0 to 8 percent and the average depth to bedrock varies between 72 to 99 inches. The water table is located between 30 and 72 inches below the surface.

Three soil types have been mapped within Area D of the Project Area and include the following: Urban land-Matapeake complex, 0-8 percent slopes (UtB); Udothents, gravelly (Ua); and Nanticoke-Hatboro silt loams (Na)[1]. Urban land-Matapeake complex, 0-8 percent slopes (UtB) are located on terraces and hill slopes and are well drained. Slopes are approximately 0 to 8 percent and the average depth to bedrock varies between 10 to 99 inches. The water table is located more than 80 inches below the surface.

Review of historic cartographic sources from the mid-nineteenth through the mid-twentieth centuries indicates that Areas A, B, C, and D were marshland/floodplain and that development was located more than 1,000 feet from the banks of Neshaminy Creek, i.e. beyond the limits of the marsh/floodplain.

2.1.3 Hydrology

The principal drainage in the vicinity of the Project Area is the Delaware River which is located between 304 and 608 meters (1,000 to 2,000 feet) to the south east of the Project Area and flows from the north to the south. Additionally, Neshaminy Creek is located to the east of Areas A, B, and C and to the west of Area D.

2.1.4 Current Conditions

Area A

Area A is located within Neshaminy State Park to the south of State Road in Bensalem Township. Area A is a tidal marshland along the western bank of the Neshaminy Creek and is located approximately 0.43 miles to the north of the confluence of Neshaminy Creek and the Delaware River (Figure 4). Mature phragmites, more than 8-feet tall, predominates the western portion of Area A (Plate 1), whereas intertidal grasses dominate the eastern portion of the area (see Figure 4).

Area B

Area B is also located immediately south of the terminus of Totem Road within Neshaminy State Park approximately 0.35 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Although a designated wetland exists to the south of Area B, the area is dry and relatively flat and is dominated by approximately 40 year old deciduous trees and low vegetation (Figure 5; Plate 2).

[1] Udothents, gravelly (Ua); and Nanticoke-Hatboro silt loams (Na) are described above.

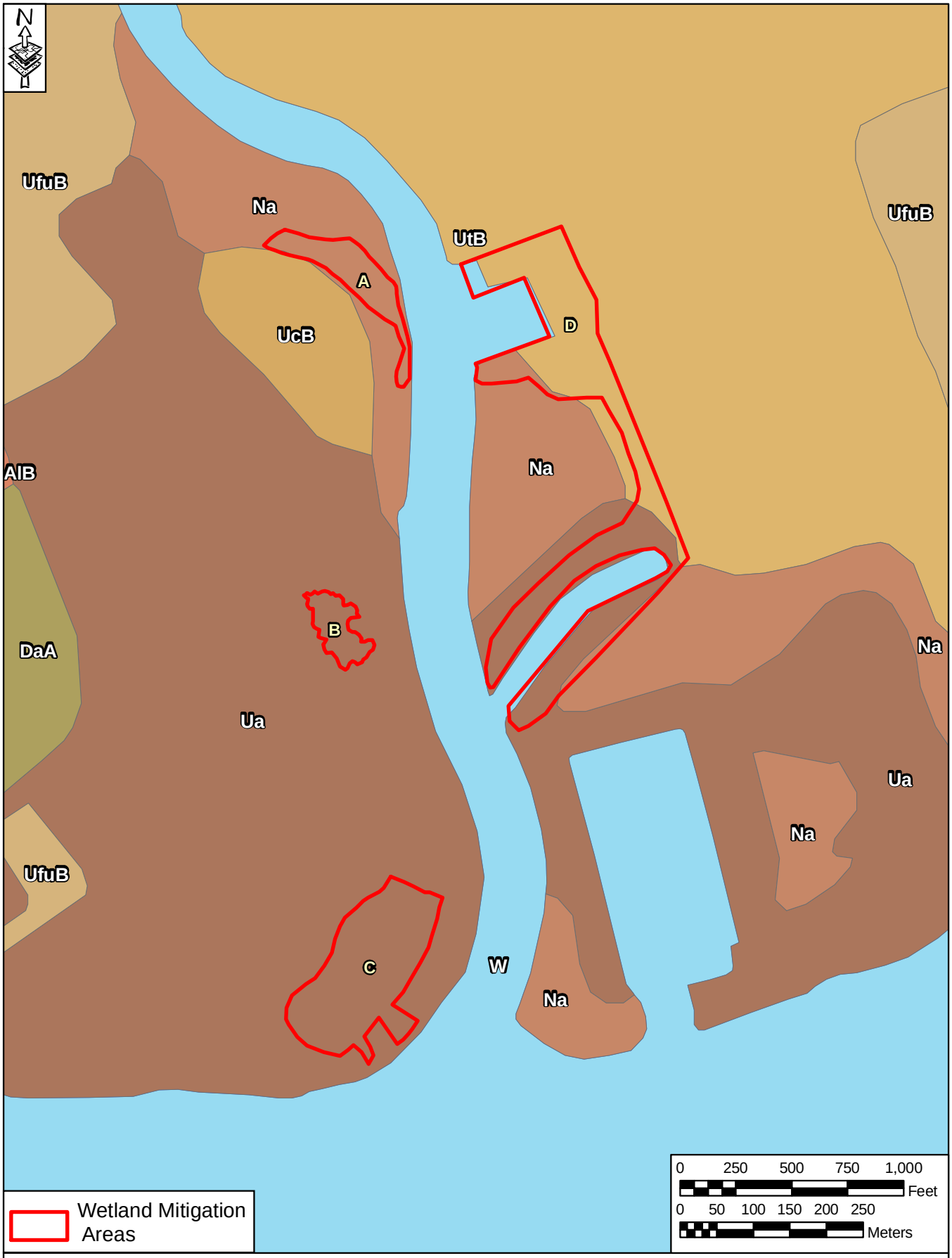

FIGURE 3: Mapped Soil Types within the Proposed Wetland Mitigation Project Area *SOURCE: USDA 2010*

Figure 4: Oblique Aerial Image of Area A. View West. ***Source:*** ***www.bing.com/maps 2010***

Plate 1: Current Conditions of the Western Portion of Area A Showing Mature Phragmites Growth. View East. *Photographer: K. Beadenkopf (10/13/2010)*

Figure 5: Oblique Aerial Image of Area B. View East. ***Source:*** *www.bing.com/maps 2010*

Plate 2: Current Conditions of the Eastern Portion of Area B Showing Dense Tree Growth. View West. *Photographer: K. Beadenkopf (10/13/2010)*

Area C

Area C is also located within Neshaminy State Park. The area is a relatively flat area with approximately 40 year old deciduous trees and is located immediately west of the confluence of Neshaminy Creek and the Delaware River (Figure 6; Plate 3). The area is in the location of a "Diked Hydraulic Fill Settling Basin" that is depicted on the 1971 Neshaminy State Park Existing Facilities Map. A pedestrian path borders the eastern edge of Area C. This path is elevated above the floodplain of the Neshaminy Creek and appears to have been constructed of soils that were mechanically pushed from the interior of Area C to create the settling basin which also created a thoroughfare that is protected from flooding (Plate 4).

Figure 6: Oblique Aerial Image of Area B. View North. ***Source:*** *www.bing.com/maps 2010*

Plate 3: Current Conditions within Area C. View West. *Photographer: K. Beadenkopf (10/13/2010)*

Plate 4: Current Conditions within Area C Showing the Difference in Elevation between the Path and Area C. View Northeast. *Photographer: K. Beadenkopf (10/13/2010)*

Area D

Area D is located within tidal wetlands immediately west of 5th Avenue in Bristol Township approximately 0.25 to 0.65 miles to the north of the confluence of Neshaminy Creek and the Delaware River (Figures 7 and 8). Portions of Area D contain imported fill to create land on which 5th Avenue and marina structures associated with the former location of Jack's Marina (formerly Bradley's Boat Basin; currently the Three Seasons Marina) were built after 1971. As a result, Area D "has been repeatedly disturbed over the last 50 years" and "was further excavated in the 1980s as a wetlands mitigation measure for placement of a roadway culvert" (T. H. Properties 2007). Additionally, "test borings [within Area D] indicate that fill comprised of dredge and demolition materials has been placed to depths of six to nine feet" (T. H. Properties 2007).

At the time of the pedestrian reconnaissance, Area D appeared abandoned and was enclosed by a chain link fence. Although entry into Area D was prohibited, photographs of the northern portion of the area were taken through the fence to document the presence of asphalt pavement and debris throughout the area (Plates 5 and 6).

Figure 7: Oblique Aerial Image of the Northern Portion of Area D. View West. ***Source:*** *www.bing.com/maps 2010*

Figure 8: Oblique Aerial Image of the Southern Portion of Area D. View West.

Source: *www.bing.com/maps 2010*

Plate 5: Current Conditions within the Northern Portion of Area D along 5th Avenue. View Southeast. *Photographer: K. Beadenkopf (10/13/2010)*

Plate 6: Current Conditions within the Northern Portion of Area D North of the Boat Basin/Marina. View West. *Photographer: K. Beadenkopf (10/13/2010)*

2.2 PREHISTORIC BACKGROUND

The prehistory and history of the Pennsylvania is traditionally divided into six cultural periods:

Paleoindian Period	prior to 8,000 BP
Archaic Period	8,000 - 3,750 BP
Transitional Period	3,750 - 2,750 BP
Woodland Period	2,750 BP - AD 1500
Protohistoric Period	1,500 BP - AD 1650
Contact Period	AD 1650 – AD 1737

The prehistoric cultural periods are understood to reflect temporally and culturally distinct occupations and are defined on the assumption that changes in artifact types and styles mirror cultural changes. Stylistic variation in projectile points, other stone tools, and later, ceramics define the traditional cultural periods (Coe 1964; Kinsey et al. 1972).

A reorganization of the traditional chronology above, based on ecological adaptation, was proposed by Gardner (1978) and applied to Pennsylvania's Eastern Plateau and Poconos Study Unit by Raber (1986). This alternative chronology views changes in adaptive strategies rather than artifact styles as the milestones in cultural chronology (see also Custer and Wallace [1982] and Custer [1996]).

The discussion below of the prehistoric period is based on a review of published reports and the "gray literature" resulting almost exclusively from compliance-driven archaeological efforts. The descriptions and interpretations included are based on investigations in areas selected largely by the dictates of infrastructure and commercial development and not by reference to a regional sampling strategy. As a result, the existing knowledge base is focused on areas that are not statistically representative of actual prehistoric site distributions in the region during any period.

Furthermore, the majority of site-specific archaeological studies so far undertaken have not been methodically consistent or systematic. The investigations have employed such a wide variety of sampling, recovery, analytical, and reporting methods that their findings are difficult or impossible to compare. The result is a corpus of site descriptions and interpretations variously gathered, analyzed, and reported that do not constitute statistically reliable or comparable data.

The archaeological record in itself is not fully representative of past cultural activity as it is incomplete. For example, prehistoric people likely spent much of their time in the riparian/woodland ecotonal areas taking advantage of the relative abundance and variety of resources therein. However, the Late Pleistocene and Early Holocene rivers were much more energetic than in the middle and late Holocene, and many Paleoindian and Early Archaic floodplain sites have likely been substantially scoured and/or buried by river action. Older sites have been exposed to erosion, sedimentation, and decomposition for longer periods of time, which tend to obscure and/or destroy sites and their contents. An older site exposed to such processes will yield less cultural material than originally deposited; unless the processes depleting the site are taken into consideration, the low volume of material might suggest that the culture represented by that material was less populous than it actually was.

Because of gaps in the archaeological record, it is difficult for archaeologists to test diachronic and synchronic site distribution models and to present a reliable characterization of prehistoric sites and the cultures that created them. Current population estimates, settlement distribution models, and interpretations of their behavioral correlates are based on unsystematic regional and site sampling and should be considered untested and very preliminary.

The characteristics of the surviving artifact/ecofact assemblages—their forms, distributions, and ecological associations—constitute the bulk of the evidence for the presence and behavior of prehistoric people. Their projectile points, ceramic vessels, tools, debris, intra-site feature distributions, and site distributions varied over time and space. Similar constellations of these characteristics found at different places or dating to different times are almost certainly indicative of the relatedness of the people who left them. These similarities are indicative of related social and technological adaptations. Conversely, diachronic and synchronic variations in the characteristics of artifact assemblages are indicative of strategic and/or overall cultural differences. Changes through time resulting from a mix of in situ innovation, diffusion, and migration are not yet clearly understood. Nevertheless, the following discussion reflects current understandings.

2.2.1 Paleoindian Period

Paleoindian sites are recognized archaeologically by distinctive fluted projectile points that have been found throughout North America. In the east these points have been recovered from contexts with radiocarbon dates that range between 10,600 BC at the Duchess Quarry Cave in Orange County, New York (Funk 1977), and 8000 to 6000 BC at the St. Albans Site in Kanawah County, West Virginia (Broyles 1971). Approximately 50 miles northeast of the proposed Project, the Shawnee-Minisink Site in the Upper Delaware Valley yielded a fluted point with an associated radiocarbon date of between 8640 and 8880 BC (McNett et al. 1977:198). This site represents the earliest reliably dated Paleoindian occupation of eastern Pennsylvania.

Along with fluted projectile points, toolkits of the period include bifacial knives, drills, gravers, burins, flake cores, scrapers, and flake tools with no formalized shapes. These assemblages display a consistent preference for high-quality cryptocrystalline lithic materials. Gardner (1977) has suggested that sources of these raw materials may have influenced the distribution of settlements and the overall size and shape of exploitative territories.

Paleoindian subsistence strategies appear to have emphasized the hunting of game. Few traces of additional economic activities, such as the collection and processing of plant foods, have been detected. At the Shawnee-Minisink Site, however, the Paleoindian component produced fish bones and remains of edible seeds and plants, indicating the use of such resources by these populations (McNett et al. 1977).

Paleoindian settlement/subsistence patterns are thought to be the result of seasonal migrations by small groups. Gardner (1978) has asserted that seasonal rounds would have focused on sources of lithic raw materials. Groups would have returned to these outcrops once or several times a year to replenish their tool supplies. Where primary outcrops of lithic materials were unavailable, Custer (1996) has suggested that groups would have obtained raw materials from glacially deposited cobbles and pebbles. Because this strategy would allow procurement of materials while pursuing other subsistence activities, groups would not necessarily focus on specific sources. Hunter Research, Inc. (1990) has suggested, however, that in areas where cobbles and pebbles accumulated in localized concentrations, Gardner's model might apply.

Paleoindian sites in this region Pennsylvania consist primarily of isolated point finds and surface sites that contain low frequencies of projectile points and other hunting-related artifacts. These sites tend to lie in lowland settings within river valleys and appear to represent short-term camps used by single individuals or very small groups. It is suggested that Paleoindian populations in eastern Pennsylvania consisted of small groups that moved frequently across the landscape. The patchy distribution of exploitable resources in the region during this period would have favored small and highly mobile groups that could shift repeatedly from one location to another. A further influence on settlement was the behavior of elk and

caribou, which were likely the large game preference of Paleoindian. These species migrate between isolated food sources seasonally and this behavior would have provided an impetus for highly mobile human populations (Hunter Research, Inc. 1990:IV-11).

Traditional wisdom suggests that Paleoindians were quite mobile and that their settlements were relatively short-term encampments. Sites, such as hunting camps, devoted to the seasonal procurement of specialized resources were situated to allow exploitation seasonally available resources (Ritchie and Funk 1973). However, Raber (1986) suggests that Paleoindians may have been somewhat less mobile than previously believed. He argues that instead of randomly ranging over a wide and ill-defined geographic expanse in search of food and raw materials, Paleoindians exploited a well-defined "home range" that provided consistently adequate resources.

There is little direct evidence for the details of Paleoindian culture. Paleoenvironmental reconstructions suggest that the rivers were highly variable before circa 6000 years BP. River channels meandered, and probably destroyed much evidence of early prehistoric occupation and use (Bergman et al 1994:160-161). Subsequent floodplain sediment accumulation has been substantial and has probably buried additional evidence of Paleoindian presence (Stewart 1990).

Based on the locations of known Paleoindian sites in adjacent regions, the types of settings that were probably attractive to these groups included high well-drained ground near streams or wetlands. These settings offered vantage points for observing game. Paleoindian sites have also been identified in rock shelters, areas near lithic sources, and on lower river terraces.

2.2.2 Archaic Period

The warming Holocene climate resulted in environmental changes that encouraged population migrations and the development of new subsistence strategies. These developments characterize the Archaic period, dating from circa 6000 to 1750 BC. Compared to the preceding Paleoindian period, the Archaic period produced greater varieties of artifact types, suggesting that new and varied technologies were employed in the exploitation of more diverse resources.

Early Archaic Period

The Early Archaic appears to represent an elaboration of earlier Paleoindian lifeways. The Early Archaic is traditionally divided from the Paleoindian period on the basis of distinctive projectile point types that include corner-notched, stemmed, and bifurcated stemmed varieties (Broyles 1971; Coe 1964). Cavallo (1980) and Gardner (1978), however, have argued that cultural adaptations during the Early Archaic were not substantially different from those of the preceding period. Based on similar overall technologies, site distributions, and other adaptations, these researchers contend that Early Archaic cultures represent a continuation of Paleoindian traditions (Cavallo 1980; Custer 1996; Gardner 1978). The primary difference in the tool assemblage from the Paleoindian period is the introduction of new projectile point forms. The balance of the toolkit remained essentially the same.

The location and distribution of sites suggest that group territories and general settlement rounds were comparable to those of the Paleoindian period. There was an increasing proportion of deciduous vegetation in the region, and these new environments may have been attractive to Early Archaic populations. The presence of higher frequencies of Early Archaic sites relative to those of the preceding period suggests population increases or a greater use of the general region.

Because Paleoindian and Early Archaic lifeways are thought to represent a continuum, similar influences would have affected the subsistence/settlement strategies of both groups. However, as noted above, higher numbers of Early Archaic sites suggest the exploitation of new environments that began to form in the early Holocene. Early Archaic sites likely reflect the same functions and activities as Paleoindian sites. Base camps, if established, were presumably located in lowlands along larger rivers and streams, where environmental diversity, and in turn, exploitable resources were greater (Hunter Research, Inc. 1990).

Middle Archaic Period

The Middle Archaic is problematic because of unclear typological definitions for the period. The paucity of information on the Middle Archaic in the region frequently leads researchers to combine this period with either the Early or Late Archaic (Hunter Research, Inc. 1990). Diagnostic projectile points dating to the Middle Archaic include Kirk-like, Stanly Stemmed, Morrow Mountain, Neville, and Stark points (Kinsey et al. 1972; Kraft 1986; Ritchie 1971). These designations are based largely on formal similarities to projectile point types of the southeast or New England. Efforts to understand the Middle Archaic in eastern Pennsylvania have been hindered by an absence of stratified deposits yielding diagnostic artifacts.

In addition to diagnostic projectile points of this period, the Middle Archaic toolkit includes hunting and butchering-related objects similar to those of the preceding periods. Additions to the assemblage include atlatl weights, chipped-stone axes or celts, adzes for woodworking, and netsinkers. Flat and pitted stones that may represent milling equipment are found associated with Middle Archaic sites.

The subsistence/settlement strategies that prevailed during the Middle Archaic in eastern Pennsylvania were most likely influenced by changes in local environmental conditions. After 5000 BC, a variety of hardwood species, including birch, maple, beech, and hemlock, and later hickory, supplanted the coniferous-deciduous forests. Elk, deer, and moose were the primary large game animals in this habitat. Until circa 5500 BC, human populations probably followed essentially the same subsistence/settlement patterns as described for the Paleoindian/Early Archaic populations, that is, with small mobile groups exploiting seasonal resources such as elk. With the onset of warmer conditions and greater floral and faunal diversity after 5500 BC, shifts in settlement and subsistence strategies were required. Such shifts most likely included an increase in the use of aquatic resources along with the collection and processing of wild plant foods. The processing of these materials is suggested by the presence in the region of fire-cracked rock features, and charred hickory nuts and pounding and crushing tools found in association with these features. Nuts, fish, and bones were most likely boiled to render their nutritious oils and grease.

The settlement patterns of the Middle Archaic period in general are reflected in the remains of residential base camps located in settings with easy access to diverse resources. High artifact density and variety characterizes such sites. Small groups or individuals would have made forays from these camps to other areas to procure resources or to accomplish other tasks. Little variety in artifact types and relatively sparse artifact distribution would be expected at such sites.

Late Archaic Period

The Late Archaic period is marked by a greater number of sites and, possibly, growing human populations. The changes that occurred during this period have been correlated with climatic changes that resulted in the introduction of chestnut trees into the region around 3500 BC, followed by the introduction of birch forests that dominate the region today. Estuarine and riverine habitats stabilized by 2000 BC,

and environmental conditions in the region approached those of the present. Changes in the environment presented new options for Late Archaic groups. Archaeological sites of the period reflect the new adaptive strategies employed by these populations.

Diagnostic projectile points of the Late Archaic include a variety of narrow-bladed notched and stemmed specimens. Among these are Lackawaxen, Poplar Island, Brewerton, Lamoka, and Normanskill points. Late Archaic artifact assemblages reflect the variety of exploitative activities practiced during the period and the diversity of habitats that were utilized. Artifacts found include knives, drills, atlatl weights, axes, celts, grinding and pounding implements, and netsinkers. The variety of lithic resources employed in tool manufacture indicates an emphasis on materials such as quartzite and vein quartz, which were previously used only infrequently.

Relative to earlier periods archaeological sites are more common for the Late Archaic and are present in a variety of upland and lowland settings. The marked increase in the frequency, size, and depositional intensity of Late Archaic sites suggests the growth of human populations and the exploitation of new resources. By the Late Archaic environmental conditions fostered the appearance of nut-bearing trees, such as hickory, oak, and chestnut, and animal species dependent on them (e.g., deer, bear, and turkey). The stabilization of riverine habitats would have provided constant supplies of aquatic resources as well.

In contrast to the preceding periods the Late Archaic appears to be characterized by hunter-gatherer groups with well-defined and scheduled settlement and subsistence patterns. Residential base camps continued to be primary components of the settlement pattern. Three alternative models for Late Archaic settlement are probable. The first of these involves a central-based wandering system wherein a fixed base camp is occupied on a semi-sedentary basis. Seasonal or constant forays to other camps would occur, with the base camp periodically or seasonally abandoned and reoccupied during the later parts of the annual cycle. A second alternative settlement pattern involves a shifting base-camp location. This model suggests that base-camp positions would move when local resource bases became depleted or as seasonal resources became available. The third alternative model proposes restricted wandering inside a given territory with periodic group consolidation at changing base-camp locations as resource availability allowed. In all three of these alternative models, base-camp locations would most likely be located along larger water courses. As in the preceding period, local variations of these models could have occurred in response to regional topography.

2.2.3 Transitional Period

Marked changes occurred in certain procurement and processing implements and sociocultural organization in approximately 2000 BC (Snethkamp et al. 1982). Large, thin, broad-bladed stemmed and notched points, and carved soapstone vessels, made their initial appearance in the regional archaeological record, and so form the basis upon which the Transitional period is defined. Diagnostic points of the Transitional period in the Project vicinity include Susquehanna Broad, Lehigh-Snook Kill, and Perkiomen. Lithic raw materials used in their manufacture included locally available high-quality jaspers and cherts. The appearance of new technologies and toolkits in the region has been subject to various interpretations; these include the migration of new populations northward and the incorporation of new technologies into an existing technological tradition.

2.2.4 Woodland Period

It is likely that by the beginning of the Woodland period, regional climates and environments were rough approximations of historic/modern conditions. The productive deciduous element of plant environments would have remained intact. The major difference between the sites of each period is the density of

artifact deposits: Archaic sites tend to have light artifact scatters over a moderate to broad area, while Woodland sites exhibit moderate to dense artifact scatters over relatively smaller areas. This contrast hints at changes in the frequency with which certain environments may have been used and the size of the groups involved in their exploitation.

Woodland peoples, operating in relatively small groups, appear to have used uplands and low-order stream environments more frequently than did their Archaic predecessors. At the same time, major Woodland habitation sites located in the floodplains of rivers show a degree of permanence or sedentism not evinced in Archaic settlements. The more frequent use of peripheral habitats during Woodland times is probably a direct result of longer occupations at floodplain habitation sites, in effect, an intensification of traditional hunting and gathering subsistence activities. What led to the increased sedentism at habitation sites during the Woodland period is still a subject requiring much more archaeological research.

Early Woodland Period

The Early Woodland period is distinguished by the use of ceramic technology and evidence of cultivated plants. Ceramic technology made possible the production of highly portable and durable containers that could withstand the rigors of cooking with direct heat and provided waterproof storage. While cooked foods may have affected the nutrition and population dynamics of Woodland groups, the use of ceramic containers also enhanced the capability of these groups to store food. Food storage has implications for population dynamics since stored reserves can support sedentary, long-term settlements while partially offsetting the seasonal fluctuations in resource availability.

The economic base of Early Woodland cultures in the region is not well understood. It is apparent from evidence recovered from Meadowcroft Rockshelter near Pittsburgh that Early Woodland people had knowledge of domesticated plants such as corn (Zea mays) and small pumpkins or squash (Cucurbita sp.). It can be surmised that even minimal attention given to the propagation of domesticated plants requires a formal scheduling of settlement movements, if not prolonged habitation at select sites during the summer. There is as yet no evidence of a major settlement or subsistence shift to farming or garden-oriented villages in arable floodplain locations during the Early Woodland. Such a shift is evident during the Late Woodland period when populations are concentrated in farming-oriented villages in floodplain or high stream terrace settings. Early Woodland peoples are best characterized as specialized hunters and gatherers.

The toolkit of the period is essentially that of Late Archaic times, excluding stylistic changes in projectile points and the addition of ceramics. Ornaments and stone or clay pipes are also relatively new additions to artifact assemblages.

The repeated occurrence of Late Archaic and Early Woodland artifacts on the same sites suggests that there are many common elements in the respective settlement patterns. Early Woodland sites are anticipated to co-occur with Late Archaic deposits.

Middle Woodland Period

Middle Woodland cultures in eastern Pennsylvania show a basic continuity of lifestyles with their Late Archaic and Early Woodland predecessors. This includes a general overlap of where sites are located and the types of activities that were performed in various locations. Ceramic studies suggest, however, that the exploitative territories of some groups were more restricted during the Middle Woodland than in earlier times. In the absence of significant environmental and technological change, the limiting of

territorial boundaries is viewed as a result of growing populations and elaborations of social relationships and organization.

Late Woodland Period

During Late Woodland times, farming-related base camps or villages are added to the inventory of site types. Although hunting and gathering remained important subsistence pursuits, the cultivation of domesticated plants such as corn, beans, and squash was a significant activity. The size of the exploitative territories of groups seems to decline from its Middle Woodland level, and the appearance of fortifications at some sites indicates the occurrence of intergroup conflicts. More frequent social contacts necessitated by greater population densities and the need to maintain access to resources that might have been outside a group's territory do not seem to have resulted in the development of complex societies or political hierarchies beyond those in existence during the Middle Woodland period.

Base camps or villages are located somewhat farther from stream edges than the major sites of earlier times although there is overlap of site locations in many cases. Late Woodland base camps are also related to a series of procurement sites in nearby uplands and low-order stream environments. A greater number of procurement sites per area might be expected during Late Woodland times given the long-term residence expected to have occurred at base camps. It is also expected that some Late Woodland procurement sites might appear in peripheral environments never before exploited, depending on the degree of strain that base camp populations placed on local resources. Neither of these contentions has yet been tested.

2.2.5 The Protohistoric Period

The Protohistoric period includes the times during which there was no actual contact among Native American populations of the region and Europeans. Local people encountered European diseases, artifacts, rumors, and second-hand descriptions of Europeans from groups in direct contact.

New diseases, against which the Native Americans had no immunities, spread from Native American groups in direct contact with Europeans and must have had a substantial effect on population size and cultural integrity. Snow (1980) calculated mortality rates from imported diseases on New England's Native American populations at 55-98 percent. The young and old were disproportionately affected. The loss of young people had a devastating effect on the size and viability of subsequent generations. The loss of elders likely diminished the transmission of cultural traditions to younger generations and so diminished cultural integrity.

Awareness of Europeans and the availability of European artifacts and technologies certainly prompted profound changes in Native American cultures prior to actual substantial contacts with Europeans. Native American refugees from areas already invaded by Europeans not only brought European diseases and artifacts with them, but also introduced much-altered remnants of their own cultures. Native Americans in southeastern Pennsylvania probably had been so changed during the more than 100-year-long Protohistoric period that the people and cultures first actually encountered by the earliest Europeans must have been very different from their recent prehistoric ancestors.

2.2.6 Contact Period

This Contact Period is the historically documented period in which Native American populations and European colonists come into contact with each other. The native populations of southeastern

Pennsylvania and western New Jersey commonly referred to themselves as the Lenape; a people who were often referred to as the Delaware by Europeans.

At the time of contact, the Lenape consisted of three loosely organized tribal/clan sub-groups: the Munsee (Upper Delaware), the Unami (Middle Delaware Valley), and the Unalachtigo Lower Delaware Valley) (Becker 1985; Kraft 1986). The Unami clan was the Native American group who occupied the area of Bensalem at the time of European contact (Lichtenwalner 1984:2)

Beginning in the seventeenth century, Europeans gradually purchased most of the Lenape territory culminating in the "Walking Purchase of 1737" which represented the sale of the last portion of Lenape land in southeastern Pennsylvania (Becker 1985). As a result, in the late nineteenth century, the Lenape began their westward migration; first to the Susquehanna Valley and then ultimately Oklahoma.

2.3 PREVIOUSLY DOCUMENTED PREHISTORIC ARCHAEOLOGICAL SITES

Research at the PHMC/BHP revealed that one archaeological site, the Neshaminy State Park Site (36BU0211), was previously documented approximately 250 feet to the north of Area B of the Project Area. That site was identified as part of a *Preliminary Archaeological Survey in Selected Areas of the Delaware River Coastal Zone, Southeastern Pennsylvania* by J.M. Cushman and John Milner and Associates in 1981 (Cushman 1981; ER#1984-1708-042-B). The site is characterized as an open habitation prehistoric site and contained chert and jasper stone debitage. At the present, the PHMC/BHP does not have sufficient information to determine if the site is NRHP eligible. No other archaeological sites have been previously recorded within a 2–mile radius of the Project Area.

2.4 HISTORIC BACKGROUND

2.4.1 Historic Overview of Bucks County

The first European explorer to venture into the vicinity of Bucks County was Henry Hudson. In 1609, under the employment of the Dutch East India Company, he sailed *De Halve Maan* ("The Half Moon") up Delaware Bay, opening the area to further exploration (Battle 1887). In 1616 the Dutch United Netherlands Company, funded Cornelius Hendricksen's journey into the Delaware River and Bay. Hendricksen claimed the surrounding area for Holland, calling it "New Netherlands." Anxious to secure new territory, the Dutch government granted a charter in 1622 to the Dutch West India Company, and by the following year the company sponsored an expedition. As a result of the expedition led by Cornelius Mey, thirty religious refugees landed in New Jersey near the Delaware Bay in 1632 and founded Fort Nassau in present day Gloucester County (Stevens 1897). Driven by the promise of a prosperous whaling industry, the Dutch settlement of what is now southern New Jersey and Pennsylvania continued to expand. The whaling industry, however, was short lived as resources became depleted. The economy then diversified into fur trading, fishing, lumbering, and agriculture.

During the 1630s the fur trade began to flourish. However, Dutch control of Delaware Bay, and subsequently the fur trade, was challenged by the Swedish West India Company. Under the control of Peter Minuit, the Swedes established Fort Christina in Delaware in 1638 and claimed the area as "New Sweden." The settlement soon spread to both sides of the Delaware, including southeastern Pennsylvania. In 1644 the Swedes continued to expand their settlement, establishing Fort Elfsborg on the Salem River in New Jersey, and moving the seat of government to Tinicum Island at the mouth of the Schuylkill River in Pennsylvania (Battle 1887). However, the northern limits of Swedish territorial accessions never extended beyond the confluence of the Schuylkill and Delaware rivers (Paxson 1926:67).

As the population increased in the area surrounding the Delaware Bay, tensions between the Swedish and Dutch began to grow. In 1655 Dutch troops commanded by Peter Stuyvesant captured all Swedish strongholds, ending Sweden's claims to the region (Stevens 1897). The Dutch domination of the region, however, did not bring stability. The English viewed the Dutch settlements along the Delaware as a threat to British colonial expansion. Charles II waged a campaign against the Dutch in 1663, gained control of all their possessions in America, and subsequently granted this land to his younger brother, James Stuart, the Duke of York (Elmer 1869).

Early roads in Bucks County followed existing Native American paths and Bristol Pike, which paralleled the Delaware River from Philadelphia to Morrisville, was in use by 1672 (Battle 1887: 365). King's Road, which was so named in 1675, extended across the lower portion of Bucks County north of Bristol Pike. Old York Road also connected the central part of the County with Philadelphia and stage coach service from Philadelphia to New York was created with stops throughout Bucks County by 1756 (Battle 1887: 339-340).

The first land acquisition made by the English within Pennsylvania was made in 1675 by Governor Andros and included approximately one-half of the land in present day Bucks County (McNealy 1970:37). On March 4, 1681, Charles II formally granted lands within Pennsylvania by a Royal Charter to William Penn as debt payment on a loan made by Penn's father (McNealy 1970:34). Penn's interest in the land, it is alleged, did not stem from acquisitiveness, but grew out of his desire to establish a safe haven for the Quakers and members of all religious persuasions. In 1682 Penn purchased land in Bucks County from the Indian chief for "three hundred and fifty fathoms of Wampan" (McNealy 1970:37). This deed covered approximately the same territory previously purchased by Governor Andros (McNealy 1970).

More settlers soon began arriving in Pennsylvania. Twenty-three ships carrying mostly English Quakers arrived on the shores of the Delaware between December 1681 and December 1682 (McNealy 1970). The Quakers settled in and around the city of Philadelphia and soon controlled most of the lower half of Bucks County. However, Welsh, Irish, and German settlers soon followed the English. As the European population in the area increased, the land was formally divided into counties for purposes of administration. Although it is not known exactly when the original three counties of Bucks, Philadelphia, and Chester were organized, the first election under this new system occurred in November 1682. Thus, the counties must have been organized sometime on or before this date (McNealy 1970). In the summer of 1683 a second tract of land was purchased by Penn from the Indians and included the townships of Bensalem, Southhampton, Northhampton, Warminster, and the adjacent portion of Philadelphia County because, although European colonists already settled this land, Penn felt the need to establish clear legal title (McNealy 1970).

The Dutch introduced African slaves into Pennsylvania in the early seventeenth century. Philadelphia became the general port of entry with most slaves arriving from Barbados in the months of May through July. Although the Quakers approved of slavery and possessed many slaves, public agitation at the institution began in 1688 when the Mennonites entered a formal plea with the Quakers against their use of slaves (Battle 1887). In the years that followed the Revolutionary War, the institution of slavery slowly receded. In 1780 there were 514 African slaves listed in Bucks County, but within a decade the number had dropped to 261 (Battle 1887:352).

The population of southern Bucks County continued to expand with the settlers pushing north in search of more land. In 1703 James Logan undertook the first survey of land in the "Great Swamp," the area now known as Milford, Richland, and East and West Rockhill townships. Welsh Quakers began to settle in this area, and by 1719 there were enough colonists in the Great Swamp to require the appointment of an

overseer of highways. The Scots-Irish, mainly Presbyterians, began immigrating into this area in the 1720s and expanded their settlement into central and upper Bucks County (McNealy 1970).

In 1737, John and Thomas Penn entered into a contract with Native Americans known as the "Walking Purchase," thereby securing a tract of land encompassing roughly 750,000 acres in northern Bucks County. Although the Native Americans signed the deed, they felt as if they had been treated unfairly and became alienated from the government of Pennsylvania. According to McNealy (1970), this purchase was one of the principal factors inducing the Native American groups of Pennsylvania to unite with the French against the British during the French and Indian War in the 1750s.

Throughout the Colonial period the economy of Bucks County was predominately agricultural with wheat, corn, oats, and potatoes comprising the principal crops (McNealy 1970). Milling also played an important role in the economy. Gristmills were very common, and Richard Heaton opened the first gristmill in the county in 1683 on Mill Creek. Several gristmills were located in the county, including four along Tohickon Creek. The second major milling industry was sawmilling, which reached its peak in the mid-nineteenth century (Kolb 1977).

In addition to mills, other forms of industry also prospered in Bucks County. In 1728 the Durham Iron Company established a blast furnace in Durham, and refined pig iron from the nearby ore deposits. This furnace remained productive until 1794 when it ceased operation. In 1848 it was reopened and continued in operation for an additional twenty-six years. However, in 1874 the furnace was finally shut down to make room for a new blast furnace. The new furnace operated from 1876 to 1908 when it ceased production and was finally closed down (Kolb 1977). Another Bucks County industry was the manufacture of case clocks. Many German and English clockmakers moved into the county and began to ply their trade. Over 3,500 clocks were produced in Bucks County during the early eighteenth century. Production of case clocks continued into the mid-eighteenth century, when the gradual preference for mantle clocks put the German and English manufacturers out of business (Kolb 1977).

The Revolutionary War stimulated the economy of Bucks County by placing an increased demand for agricultural products. Bucks County and its environs provided food for Washington's troops and became known as the "bread basket for the American Army." Only a few minor skirmishes were fought in the county, including two minor confrontations between the American and British forces. The first skirmish occurred at Newton in February 1778, and the second skirmish took place at Bristol one month later (Cuff et al. 1989).

Washington's forces, however, passed through the area several times. In December 1776 Washington's army retreated across the Delaware into Bucks County and remained encamped for several weeks. Although the army entered the county in defeat, Washington led a successful attack against the British in New Jersey on Christmas Day and returned in triumph. The following year, the American army again passed through Bucks County, camping along the Little Neshaminy Creek, just north of Hartsville. Washington and his troops waited here to determine the movements of the British, and on August 23, 1777, Washington's army headed south to defend Philadelphia against General Howe. In the fighting that ensued, the American army was defeated at both Brandywine and Germantown. Washington was forced to retreat to Valley Forge, where he established winter quarters, leaving Philadelphia to the British (McNealy 1970).

The evacuation of Philadelphia brought many refugees through Bucks County, and it is rumored that the Liberty Bell was moved through the county, stopping in Quakertown overnight (McNealy 1970). During the British occupation of Philadelphia, Bucks County, and the surrounding area were plundered by British troops. However, many settlers of Bucks County were Tories, and aided the British.

In 1778 the British evacuated Philadelphia, allowing the American army to pass through Bucks County for the last time. On the way to engage the British at Monmouth, New Jersey, Washington's troops marched from Valley Forge and camped overnight in Doylestown, crossing the Delaware River the next day (McNealy 1970).

After the war, Bucks County flourished, and agriculture continued to dominate the economy. However, in 1798 the residents were levied with the Federal Property Tax which assessed property based on the number of windows in structures (Davis 1905; Kolb 1977). Unhappy with this new tax, some citizens organized a rebellion. John Fries, who lived in Milford Township, organized a group of men to circulate and sign a petition urging the assessors to stay out of the township. Fries, however, was not satisfied with this action. When the first assessments began in Quakertown, Fries and his men captured the assessors and forced them to leave the county with instructions not to return. The Federal government was quick to put down this rebellion. In March of 1779, seventeen men were arrested in the town of Bethlehem (Davis 1905; Kolb 1977). Fries then gathered approximately 150 men to march to Bethlehem to demand the release of the prisoners. Fries men outnumbered the local constabulary and the prisoners were set free. Governor Mifflin of Pennsylvania sent 500 troops to the area to put down the rebellion, capturing Fries and his collaborators. Although Fries was convicted of treason and sentenced to death, he received a pardon from President Adams (Davis 1905; Kolb 1977).

During the War of 1812 the economy of the area was once again stimulated by the demand for agricultural products such as corn and wheat, increasing the market price of these goods. This increase in prices, coupled with the fact that no battles or skirmishes occurred in the area, provided a period of solid economic growth for Bucks County (Kolb 1977).

However, this period of prosperity did not last long. After the war ended, the price of goods dropped dramatically, causing the financial ruin of many farmers (Kolb 1977). To supplement their income, many residents experimented with exotic agricultural products. Between 1837 and 1839 hundreds of mulberry trees were brought into the county in an attempt to establish a silk industry. This short-lived enterprise, however, proved wholly unsuccessful and ended in financial disaster for many residents. Tobacco cultivation also became popular. In 1855 the first tobacco was grown in the county, and cigar making proved a viable industry. Sellersville, Perkasie, and Richland townships became cigar-manufacturing centers, and continued production into the twentieth century. In the middle of the nineteenth century some farmers of Bucks County experimented with the raising of sugar cane and sorghum (Kolb 1977). Mills were built in several townships, among them Warwick, Buckingham, Newton, and Upper Makefield, but the enterprise proved unsuccessful and by 1868 all the mills were closed (Kolb 1977).

During the first half of the nineteenth century, the Delaware Division of the State Canal system was constructed (1827-1832) to connect Bristol to Easton, Pennsylvania and connected to the larger Lehigh Canal (Baer 1981). In addition to increased development and settlement throughout Bucks County, the canal system provided a new means of economic viability based on the shipment and transportation of "exotic" cargo such as coal from the north and west and local commodities such as lumber and hay to larger urban markets (Davis 1905: 541).

The arrival of the railroad in the mid-nineteenth century helped to stimulate the economy of Bucks County and spurred the decline of the canal system. The first railroad was chartered in 1833 and construction was completed in 1835. The rail line ran from Philadelphia to Trenton, opening up eastern Pennsylvania to development. Closer to the proposed project area, the Northern Pennsylvania Railroad ran from Bethlehem to Philadelphia, passing through Quakertown. This line was built between 1853 and 1857, at a cost of $8,733,120.09 (Davis 1905:252). An additional line was later opened from Quakertown

to Reigelsville (Davis 1905). The addition of these railroads helped in the transportation of goods out of Bucks County, increasing the access of local producers to markets.

During the Civil War, many men from Bucks County volunteered to serve with the Union Army. In 1861 Fort Lacey was established as a training camp and Union garrison in Doylestown. The Doylestown Guard, comprised of forty men, were the first volunteers to fight for the Union. Although no military engagements occurred in Bucks County, six men from the county received the Congressional Medal of Honor for distinguished conduct (Kolb 1977).

After the Civil War, Bucks County continued as an agricultural center and the industrialization and subsequent population growth of nearby urban centers, such as Philadelphia, did not have a significant impact on Bucks County. By the turn of the twentieth century, Bucks County remained predominantly agricultural. Through the mechanization of agriculture, the area experienced an increase in crop yields. Orchards began to replace cultivated fields in the early twentieth century, and by 1924 Bucks County had become one the largest producers of apples in Pennsylvania (Cuff et al. 1989).

In 1903, the Pennsylvania Department of Transportation was established in response to the increased use of the automobile, which began to transform Bucks County. By 1911 the Department established a statewide highway construction and road improvement program. Federal highway funding began in 1916. The demand for more and better roads throughout the county continued to grow, and in 1930 the Department of Transportation started a program to pave secondary roads, including many of the roads in Bucks County (Cuff et al. 1989). The Pennsylvania Turnpike first opened in 1940 and the southern extension through Bucks County was completed in 1950, providing the area with a limited-access, high-speed highway.

After World War II, Bucks County underwent a period of rapid growth and industrialization. Caught up in the post-war economic boom, the population in the county reached over 260 persons per square mile after 1940 (Cuff et al. 1989). With the outbreak of the Korean War in 1950, the military faced a great demand for steel. The United States Steel Corporation immediately began plans to expand its productive capacity and established the East Coast Mill on the Delaware River near Morrisville in southern Bucks County. By December 1952, the Fairless Works was operational, bringing numerous jobs into the county (Bucks County Historical-Tourist Commission 1975). The presence of the steel mill doubled the population of the county with a total population increase of 113.4 percent. The rural population, however, experienced a 15.7 percent decrease as a result. By 1960 the county's population had been transformed into 75 percent urban (Bucks County Historical-Tourist Commission 1975).

In the last decades of the twentieth century, Bucks County continued to develop and the United States Steel Corporation was joined by other industrial corporations such as Rohm and Hass, and the Penn-Warner Company (Kolb 1977). Although lower Bucks County was transformed into an industrial area with an expanding population base, agriculture remains an important economic activity in the area.

2.4.2 Historic Overview of Bensalem and Bristol Townships

In 1684, the area of what would become Bensalem Township (originally known as Salem) was divided between by twelve individuals including Nathaniel Allen, Samuel Allen, John Bowen, Walter Forrest, John Gilbert, John Gray, Joseph Growden, Lawrence Growden, Nathaniel Hardin, Klaus Johnson, and Francis Walker, and Dunken Williams (also known as Dunk Williamson) (Lichtenwalner 1984: 6). Although the modern geo-referencing of the Project area and the 1681 *Map of the Improved Part of the Province of Pennsylvania* by Thomas Holme illustrates mapping errors inherent in the seventeenth

century depiction of the banks of the Delaware River and Neshaminy Creek, Areas A, B, and C were likely located within the parcel originally belonging to John Bowen (Figure 9).

Bristol Township, incorporated in 1692 as Buckingham Township and renamed Bristol in 1702, was the first legislative seat of Bucks County (1681) and had twenty original proprietors, one of which, William Clark, received a land grant (containing Area D of the Project Area) from Governor Andros in 1679. When William died in 1683 his widow, Anne Clark, took title to the land (Battle 1887: 384) (see Figure 9).

Dunken Williams (also known as Dunk Williamson) operated "Dunk's Ferry" as early as 1675 and the section of Bensalem now known as Eddington was known as "Dunksville" until the early nineteenth century (Lichtenwalner 1984: 169) (Figure 10). Dunks Ferry, located approximately 0.5 miles to the southwest of the Project Area, was the second ferry established north of Philadelphia and transported cargo and passengers across the Delaware River (MacReynolds 1955: 135). Dunk's Ferry was also the location in which Continental General Cadwalader lead his troops across the Delaware River on Christmas Eve 1776. Cadwalader's crossing at Dunk's Ferry drew British and Hessian troops away from Trenton and created a diversion for General Washington's crossing into New Jersey (Davis 1905: 105).

Other early settlers to the area of Bensalem included the Gibbs, Kingstons, Vandergrifts, and Vanhornes and by 1742, the population of Bensalem consisted of 78 individuals and had grown to 825, including 625 whites and 175 African Americans by 1784 (Davis 1905: 110-125). Most of the early development in the Bensalem area was along Bristol Pike (PA Route 13) and in the early-to-mid nineteenth century, Bensalem residents included a variety of trades people such as blacksmiths, tinsmiths, and carpenters, wheelwrights, masons, tailors, painters, shopkeepers, and farmers and factories, located near watercourses, produced brooms, carpets, flour, lumber, and shoes (Lichtenwalner 1984:223). Fishing and ship building, including a shad fishery located at Dunk's Ferry, added to the economic viability of the Bensalem and Bristol area in the nineteenth century.

Analysis of historic cartographic sources and aerial photographs of the four discontiguous areas that comprise the Project Area was conducted to develop a detailed understanding of the development and land use history of the Project Area between 1850 and 2010. The historical development of each of the four areas is discussed below relative to the year in which each was mapped[2].

1850

The 1850 *Map of Bucks County* by W.E. Morris indicates that although residential development existed to the west of Areas A and B, these two portions of the Project Area were undeveloped (Figure 11). Although Area C is shown on Figure 11 as being located within Neshaminy Creek, it is most likely that this portion of the Project Area was located in the undeveloped area along the banks of the Delaware River at the confluence with the Creek. Area D was also undeveloped at this time and was approximately 500 feet to the west of the "Whitehall Collegiate institute" and a residence owned by "J. Longstreth".

[2] It is important to note that errors of the coastline of the Delaware River and the banks of Neshaminy Creek exist in the historic mapping methods. As a result, the locations of the Project Area, which are geo-referenced to the historic roadways, appear in approximate locations in relation to the historic maps.

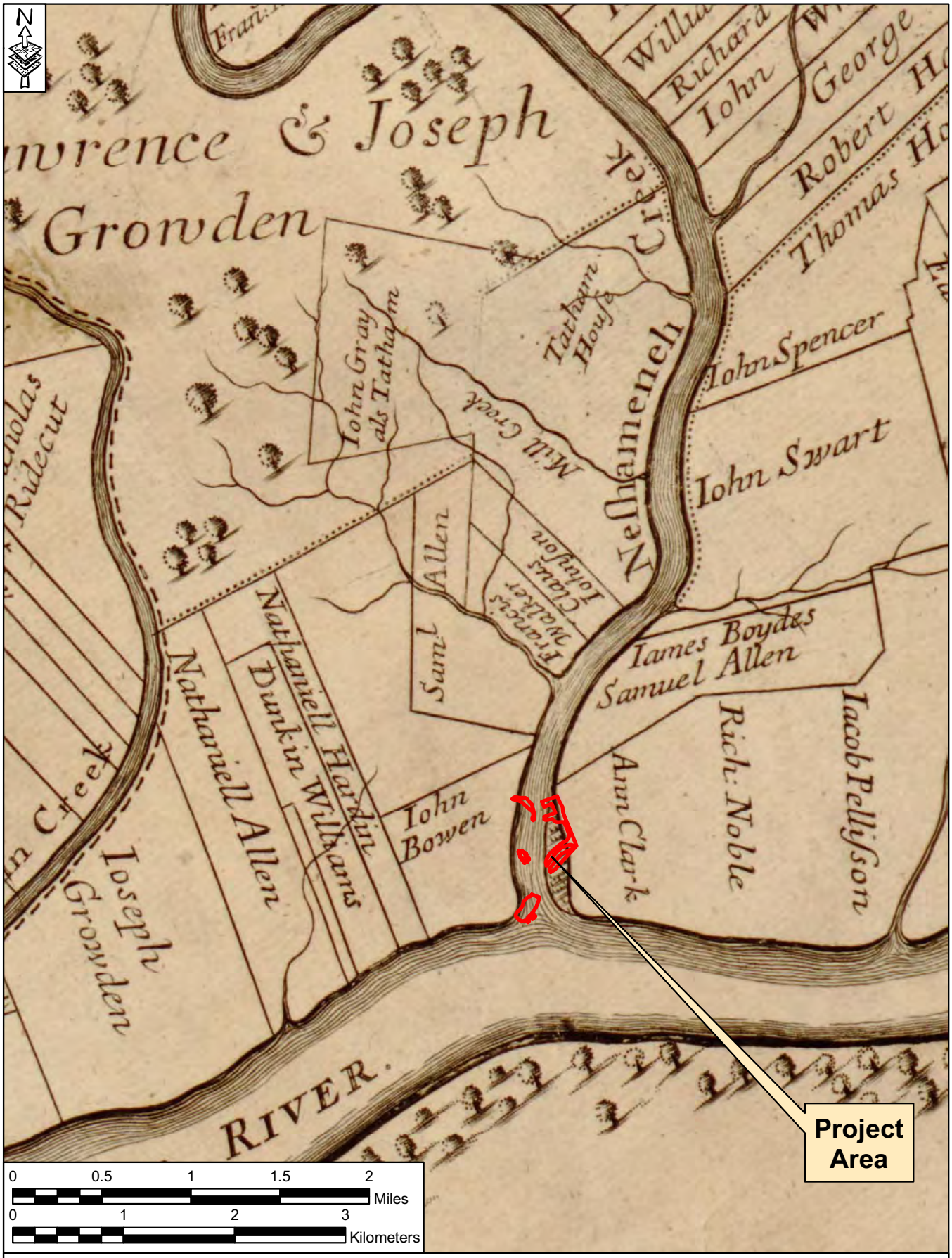

FIGURE 9: 1681 View of the Proposed Wetland Mitigation Project Area *SOURCE: Holme 1681*

FIGURE 10: 1831 View of the Proposed Wetland Mitigation Project Area *SOURCE: Kennedy 1831*

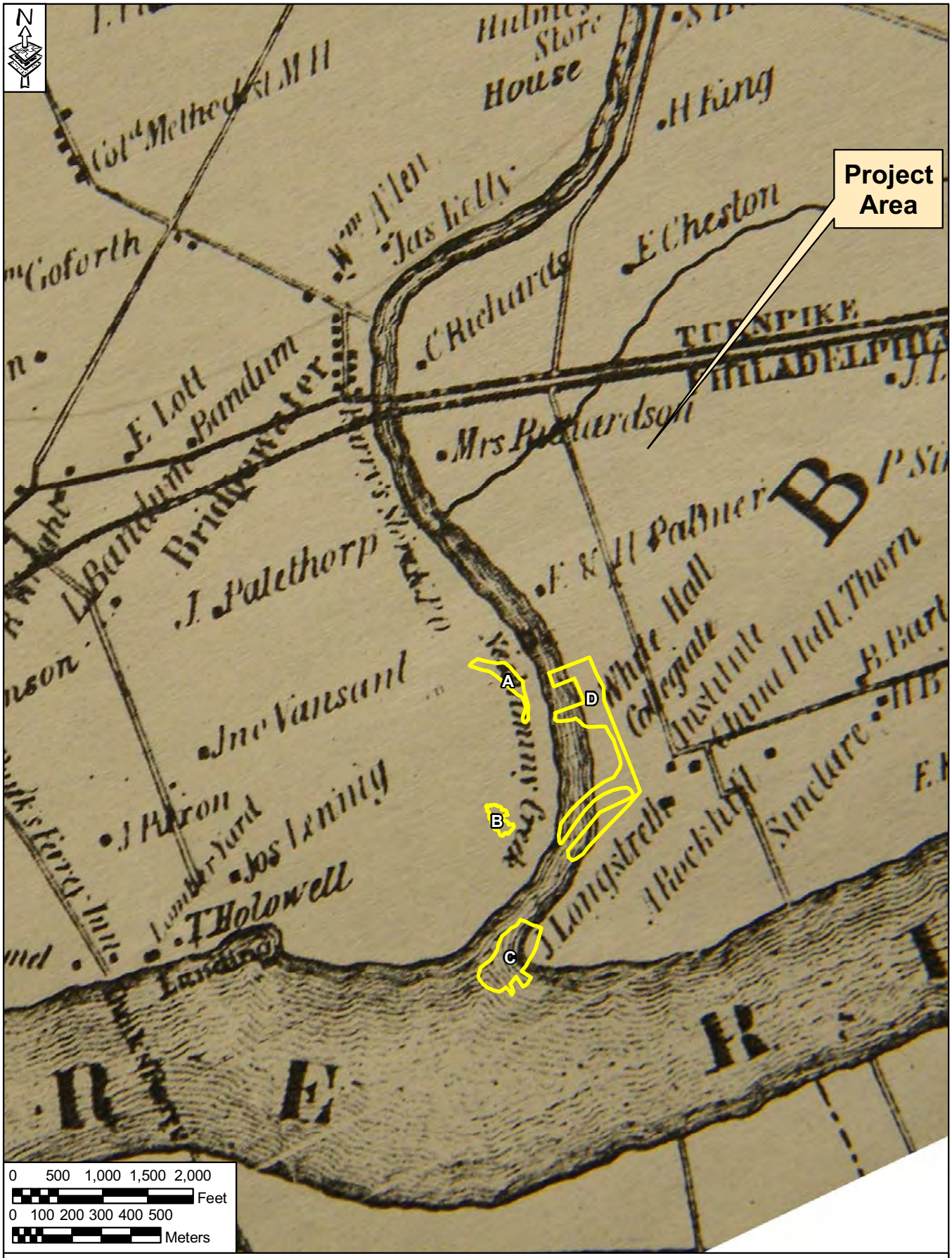

FIGURE 11: 1850 View of the Proposed Wetland Mitigation Project Area *SOURCE: Moriris & Smith 1850*

1853

The 1853 *Map of the Vicinity of Philadelphia from actual surveys* by R.P. Smith is a more accurate depiction of the Project Area and indicates that Areas A, B, and C were located within undeveloped portions of Bensalem Township along Neshaminy Creek (Figure 12). The residences that were depicted to the west of these portions of the Project Area in 1850 remain. Area D was also undeveloped at this time and was located immediately west of the residence owned by "J. Longstreth" and the "Institute".

1857

The 1857 *Map of Bucks and Montgomery Counties and the Consolidated City of Philadelphia* by R.K. Kuhn and W.B. Shrope indicates that although residential development existed to the west of Areas A and B, these two portions of the Project Area were undeveloped (Figure 13). Although Area C is shown on Figure 13 as being located within the Delaware River, it is most likely that this portion of the Project Area was located in the undeveloped area along the banks of the Delaware River at the confluence with the Creek and approximately 1,000 feet to the east of a residence owned by "J. Longstreth". Area D was also undeveloped at this time and was approximately 500 feet to the north and west of the "College" and a residence owned by "J. Longstreth".

1869

The 1869 *Map Of The Vicinity Of Philadelphia* by S.N. Beers indicates the presence of residential development to the west and east of Areas A and B, these two portions of the Project Area were undeveloped (Figure 14). Although Area C is depicted within undeveloped wetlands located along the Delaware River. Area D was also undeveloped at this time and was approximately 500 feet to the north and west of the "Collegiate Institute", the "China Retreat" (a late eighteenth century mansion built by Andreas Houckgeest, an ambassador from Holland to China in 1796) and a residence owned by "J. Sherwood".

1876

The 1876 *Combination Atlas of Bucks County, Pennsylvania* by J.D. Scott provides separate maps for Bensalem and Bristol Townships; both of these maps depict the western side of Neshaminy Creek differently, resulting in geo-referencing errors (Figure 15). Nevertheless, Areas A, B, and C continue to be shown as undeveloped land at this time. Area D is also undeveloped but a structure is shown in what is currently tidal wetlands immediately west of Area D.

1891

The 1891 *Atlas of Bucks County, Pennsylvania* by E.P. Noll and Company also provides separate maps for Bensalem and Bristol Townships; both of these maps depict the western side of Neshaminy Creek differently, resulting in errors when geo-referenced (Figure 16). Nevertheless, Areas A and B continue to be shown as undeveloped land within a 75-acre parcel known as "Point Farm" owned by "H.C. Fox". Although Area C is shown as being located within the Delaware River on Figure 16, the actual location of Area C would have also been within an undeveloped portion of "Point Farm". Area D also remains undeveloped and is shown within two parcels; the northern portion of Area D was located within the southern part of a 53-acre parcel owned by "J. Bunting" and the southern portion of Area D was located within the western portion of a 147-acre parcel owned by "Captain Jonathan May". It is significant to note that residential development is located between 500 and 1,000 feet from all of the four sections of the Project Area, possibly indicating that the Project Area was, at least, intermittently inundated and therefore not suitable for development.

FIGURE 12: 1853 View of the Proposed Wetland Mitigation Project Area *SOURCE: Smith 1853*

FIGURE 13: 1857 View of the Proposed Wetland Mitigation Project Area *SOURCE: Kuhn & Shrope 1857*

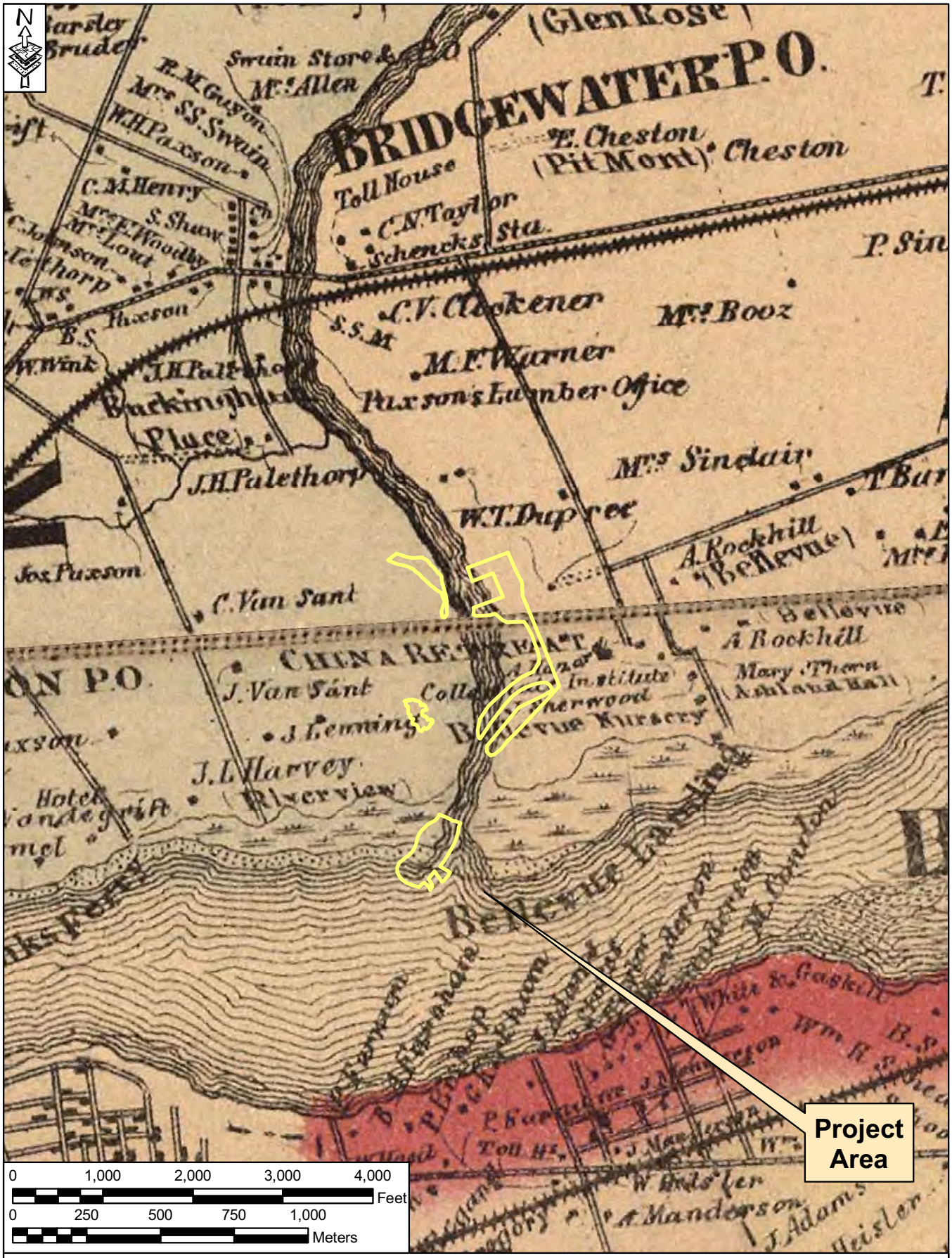

FIGURE 14: 1869 View of the Proposed Wetland Mitigation Project Area *SOURCE: Beers 1869*

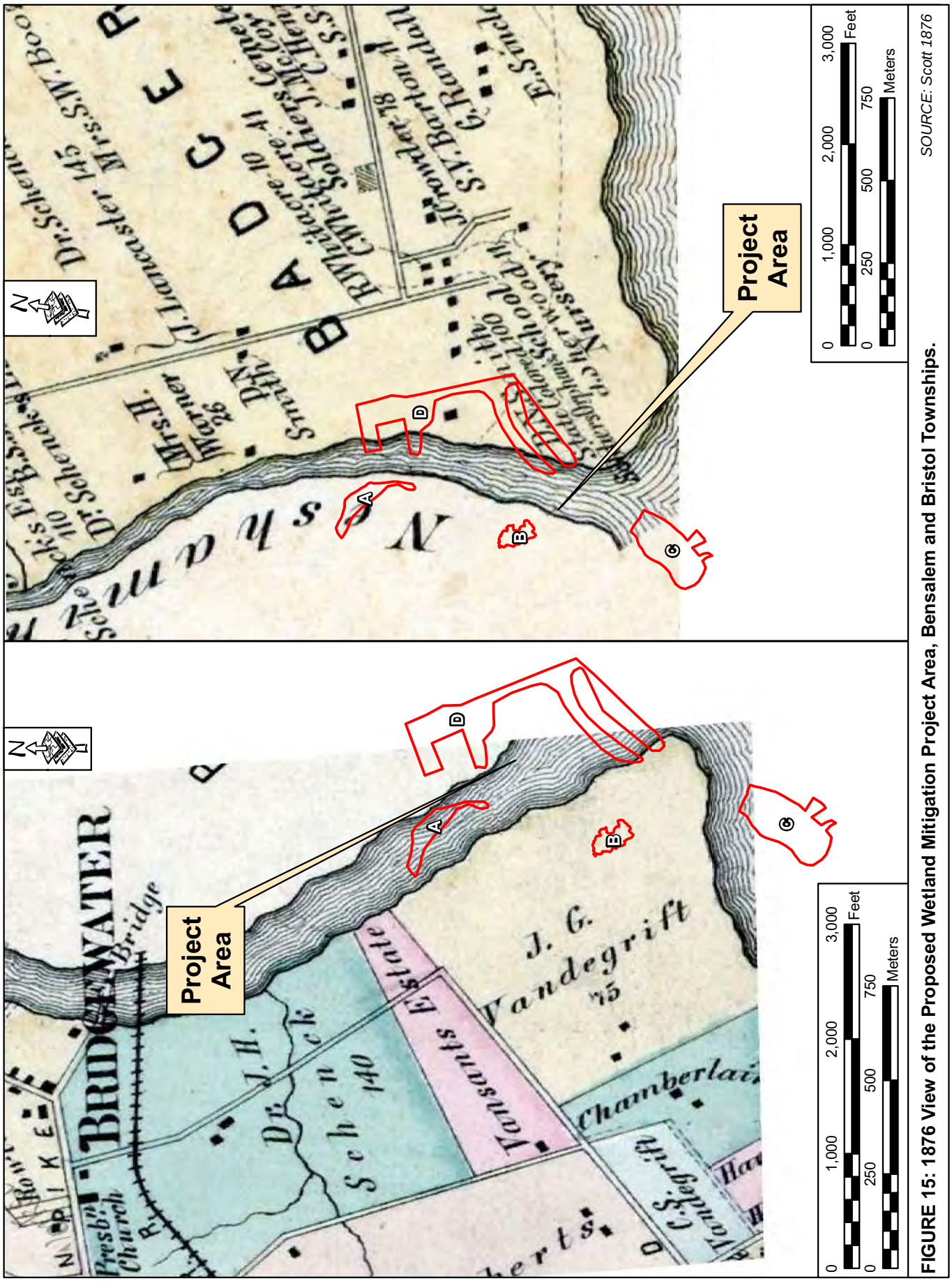

FIGURE 15: 1876 View of the Proposed Wetland Mitigation Project Area, Bensalem and Bristol Townships.

SOURCE: Scott 1876

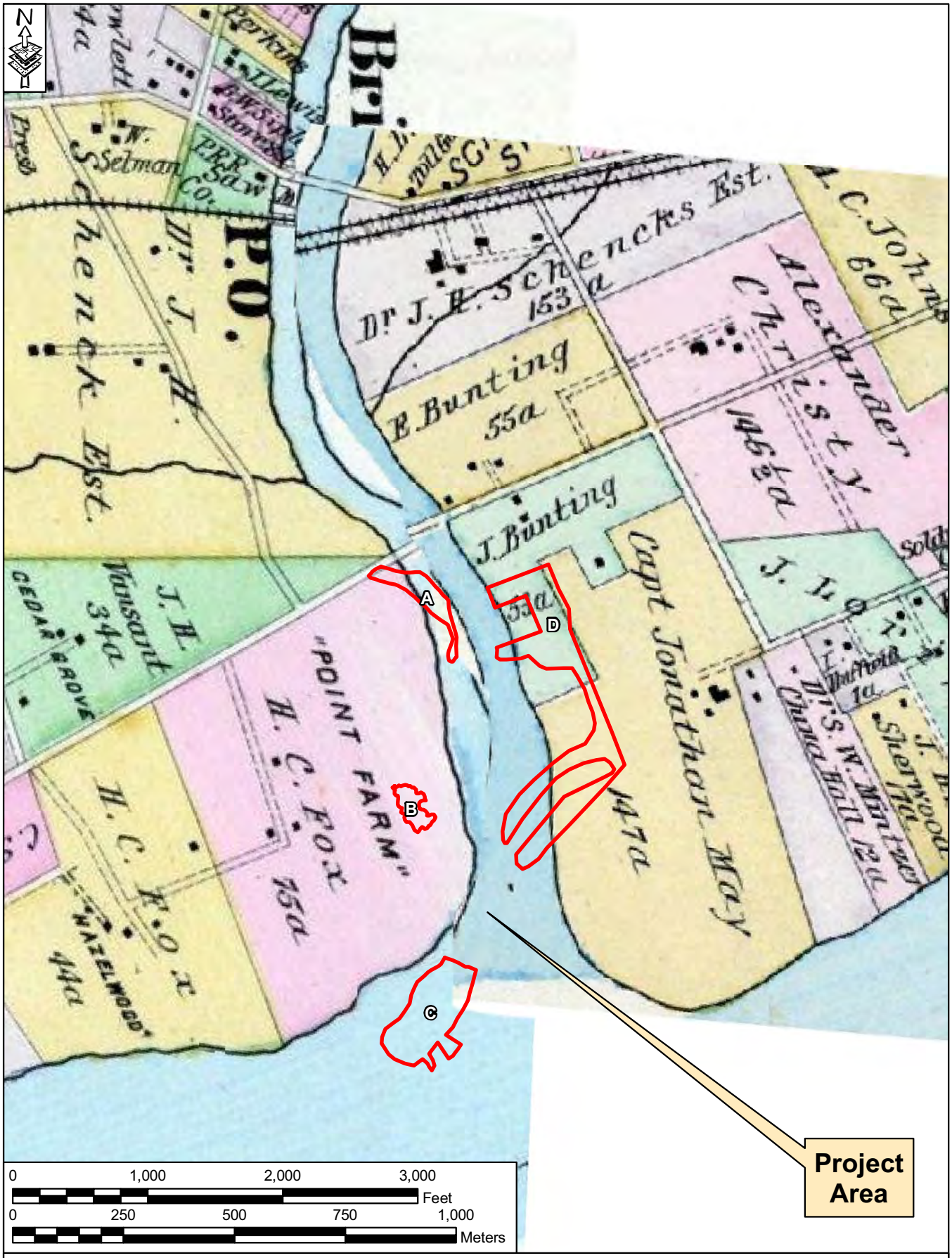

FIGURE 16: 1891 View of the Proposed Wetland Mitigation Project Area *SOURCE: Noll & Co., 1891*

1901

The 1901 *Map of Bucks County, Pennsylvania* by J.D. Scott indicates that Areas A and B continue to be shown as undeveloped land within a 75-acre parcel known as "Point Farm" owned by "H.C. Fox" (Figure 17). Although Area C is shown as being located within the Delaware River on Figure 17, the actual location of Area C would have also been within an undeveloped portion of "Point Farm". Although this map does not depict any detail regarding the eastern side of Neshaminy Creek in Bristol Township, it is to be extrapolated that Area D remained undeveloped at that time.

1904

The 1904 *Burlington NJ –PA 15 Minute Series Topographic Quadrangle* by the United States Geological Survey depicts all four sections of the Project Area as undeveloped wetlands (Figure 18).

1930

The 1930 *Map of Bensalem Township, Bucks County, Pennsylvania* by C.H. Moon (Figure 19) indicates that Area A of the Project Area was located within "Marsh or Flats" to the northeast of the "Philadelphia Turngemeinde" (a chapter of the German immigrant association, now known as the "Turners", that was founded in 1849 to promote physical education as well as social and political reform) (www.eicheturners.org 2010). Area B is depicted as an undeveloped portion of a 69.7-acre parcel owned by "Sara W. Logan. Area C is shown as undeveloped wetlands along the Delaware River. Although this map does not depict any detail regarding the eastern side of Neshaminy Creek in Bristol Township, it is to be extrapolated that Area D remained undeveloped wetlands at that time.

1938

The 1930 aerial image (Figure 20) provides the first photographic evidence of the actual conditions of the Project Area. This photograph shows that Area A of the Project Area was located within undeveloped tidal wetlands to the northeast of the "Philadelphia Turngemeinde" complex. Area B is depicted as an undeveloped agricultural landscape to the south of the "Philadelphia Turngemeinde" complex. Area C is shown as undeveloped wetlands along the Delaware River. Although dense residential development to the north and east of Area D is depicted on the image, Area D remained undeveloped wetlands at that time. It is also apparent from this image that construction of the artificial inlets of what would later be known as the "Bradley Boat Basin" and later "Jack's Marina" had begun by 1938.

1958

The 1958 aerial image (Figure 21) provides photographic evidence of the actual conditions of the Project Area at that time. This photograph shows that Area A of the Project Area was located within undeveloped tidal wetlands to the northeast of the "Philadelphia Turngemeinde" complex. Area B is depicted as an undeveloped agricultural landscape to the south of the "Philadelphia Turngemeinde" complex. Area C is shown as undeveloped wetlands along the Delaware River. Dense residential development continued to grow to the north and east of Area D. In addition, although no structures are apparent on the photograph, boats can be seen in the artificial basin constructed in the northern portion of Area D. The southern portion of Area D remained undeveloped.

FIGURE 17: 1901 View of the Proposed Wetland Mitigation Project Area *SOURCE: Scott 1901*

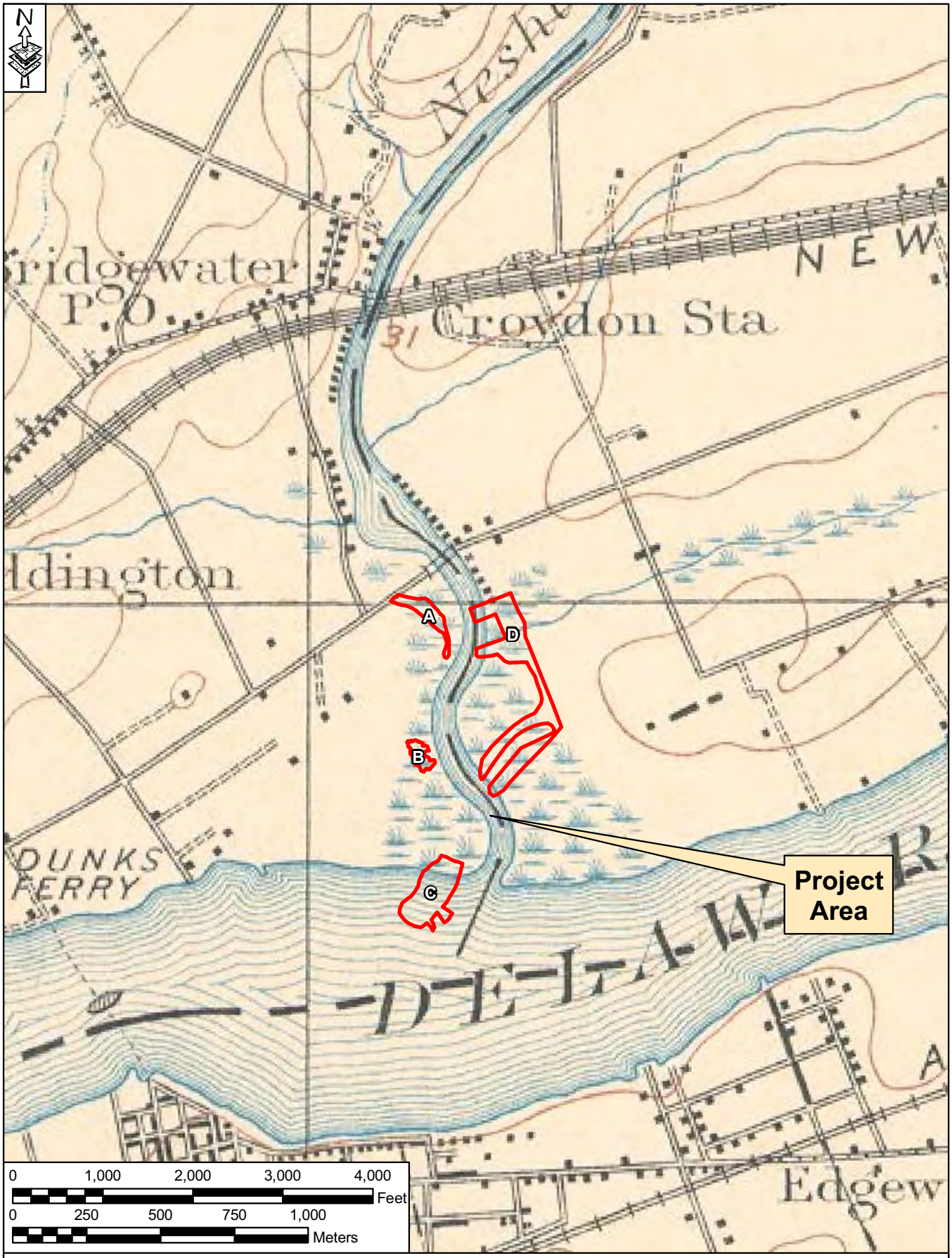

FIGURE 18: 1904 View of the Proposed Wetland Mitigation Project Area

SOURCE: USGS, 15' Series Quad, Burlington, NJ-PA, 1904

FIGURE 19: 1930 View of the Proposed Wetland Mitigation Project Area *SOURCE: Moon 1930*

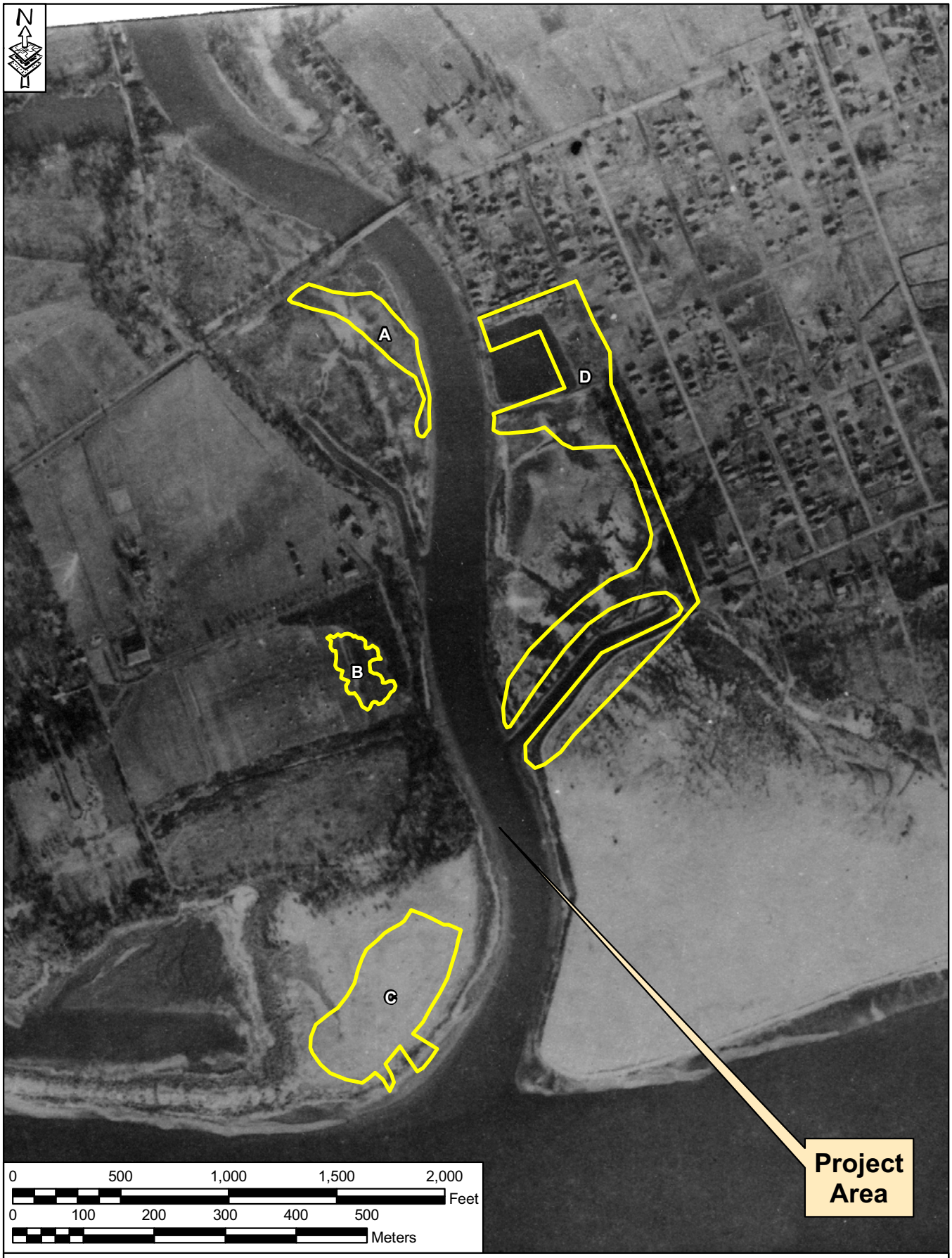

FIGURE 20: 1938 View of the Proposed Wetland Mitigation Project Area *SOURCE: USDA 1938*

FIGURE 21: 1958 View of the Proposed Wetland Mitigation Project Area *SOURCE: USDA 1958*

1971

The 1971 aerial image (Figure 22) provides additional photographic evidence of the actual conditions of the Project Area at that time. This photograph shows that modifications, such as pathways and tree plantings, were well underway within the land that was designated as the Neshaminy State Park in 1956. Area A of the Project Area continued to be located within undeveloped tidal wetlands. Area B was still undeveloped although the former agricultural landscape to the west shown on earlier aerial images was being modified at this time. Area C, along the Delaware River, was also apparently being modified to create a "Diked, Hydraulic Fill Settling Basin" as depicted on the 1971 map of the existing facilities within Neshaminy State Park (Figure 23). Dense residential development continued to grow to the north and east of Area D. In addition, boat storage structures and boats can be seen in the artificial basin constructed in the northern portion of Area D and boats can be seen lining the piers constructed in the southern portion of Area D. Area D was known as the "Bradley Boat basin" at that time (see Figure 23).

1971 to 2010

Aerial Images of the four sections of the Project Area available from www.historicaerials.com and Google Earth were examined to examine the more recent development history of the Project Area (1971-2010). Area A continued to remain undeveloped tidal wetland through this period (see Figure 2). Area B, which was agricultural land in the 1930s and 1950s, continued to remain undeveloped but became increasingly forested during this period (see Figure 2). Area C, which was disturbed by the creation of a create a "Diked, Hydraulic Fill Settling Basin" circa 1971, became increasingly forested during this period (see Figure 2).

Documentation regarding Area D that was provided to the PHMC/BHP as part of an environmental review for the then proposed, Newport Landing residential development project (ER# 2003-2767-017-A) indicated that the area "has been repeatedly disturbed over the last 50 years" and "was further excavated in the 1980s as a wetlands mitigation measure for placement of a roadway culvert" (T. H. Properties 2007). Further, the documentation indicated that "test borings indicate that fill comprised of dredge and demolition materials has been placed to depths of six to nine feet" (T. H. Properties 2007).

The former location of Bradley's Boat Basin, later known as Jack's Marina and currently the Three Seasons Marina, apparently ceased operation between March 2004 and June 2004 as seen in Figure 24.

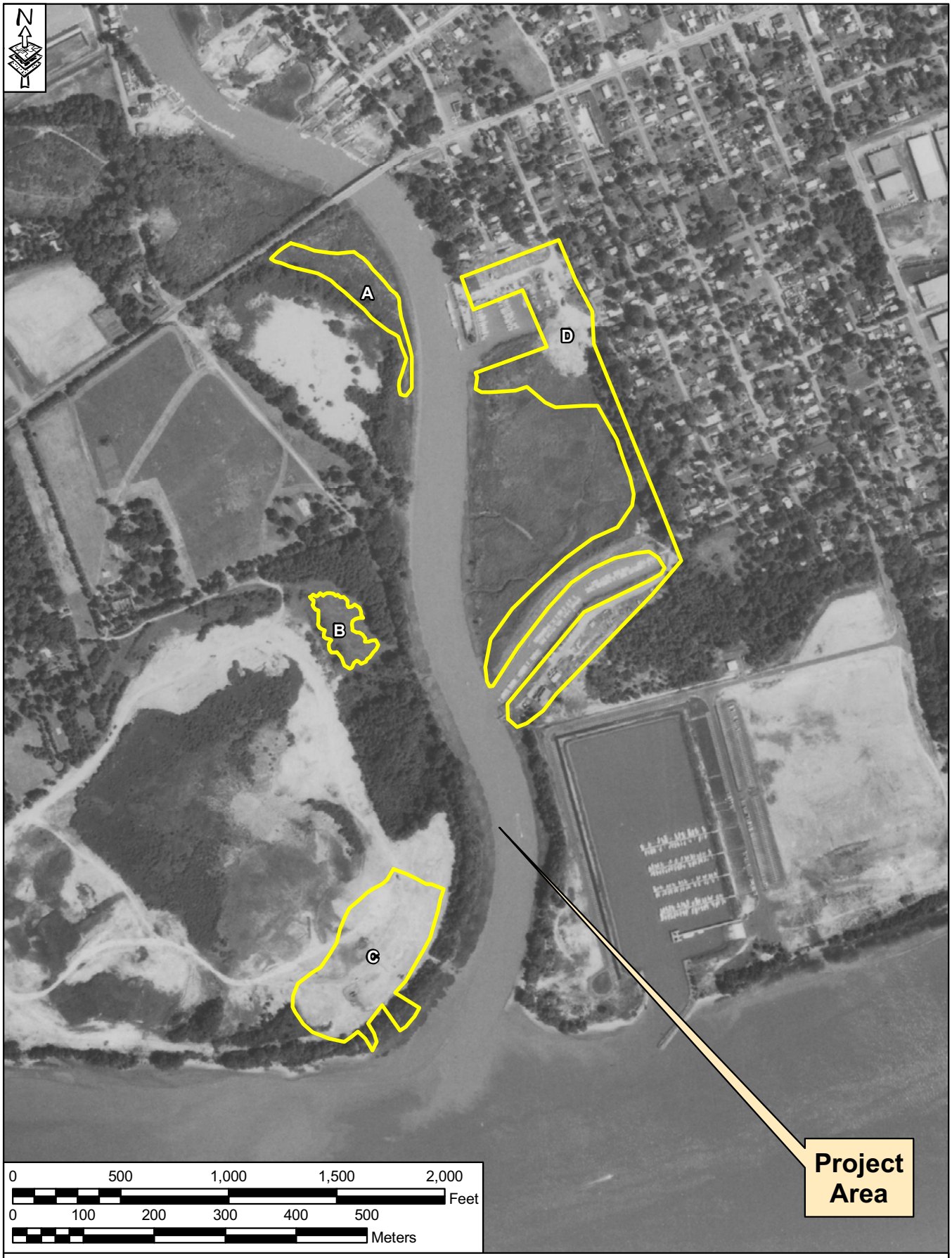

FIGURE 22: 1971 Aerial View of the Proposed Wetland Mitigation Project Area *SOURCE: USDA 1971*

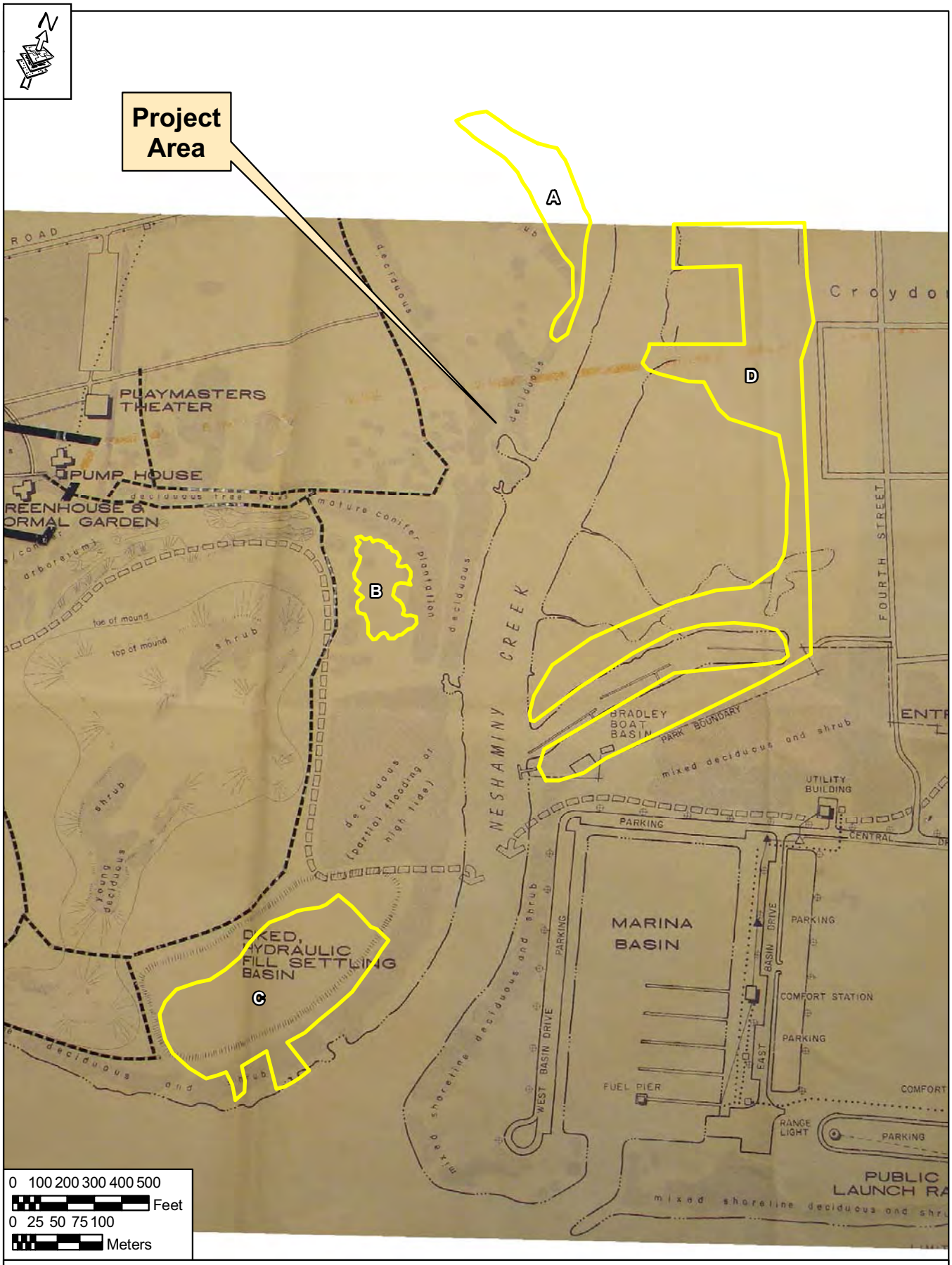

FIGURE 23: 1971 View of the Proposed Wetland Mitigation Project Area

SOURCE: Neshaminy State Park Existing Facilities 1971

Figure 24: Aerial View of Area D in March 2004 (Left) and June 2004 (Right) Depicting the Apparent Abandonment of the Marina known as Jack's Marina. *Source: Google Earth 2004*

2.5 PREVIOUSLY DOCUMENTED HISTORIC ARCHAEOLOGICAL SITES

Although the Project Area is located within the Neshaminy State Park and is located to the north of the location of the seventeenth century Dunk's Ferry and other historic development, no historic archaeological sites have been previously documented within the Project Area.

2.6 PREVIOUS CULTURAL RESOURCE SURVEYS

Background research in the files of the PHMC/BHP indicates that one previous cultural resource survey was conducted within the Project Area (ER# 1984-1708-042-B) and one environmental review was previously conducted for Area D of the Project Area (ER#: 2003-2767-017-A and B).

The *Preliminary Archaeological Survey in Selected Areas of the Delaware River Coastal Zone, Southeastern Pennsylvania (*ER#1984-1708-042-B), which encompassed Areas B, C, and a portion of Area D of the current Project Area was conducted by J.M. Cushman and John Milner and Associates in 1981 (Cushman 1981). That study identified one archaeological site, the *Neshaminy State Park Site* (36BU0211) approximately 250 feet to the north of Area B of the current Project Area. The site is characterized as an open habitation prehistoric site and contained chert and jasper stone debitage. The PHMC/BHP has indicated that it does not have sufficient information to determine if the site is NRHP eligible.

Area D was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER# 2003-2767-017-A) in 2003 for the then proposed, Newport Landing residential development project. Although the PHMC/BHP indicated that the permit area for that project (Area D of the currently proposed project) possessed a "high probability that

archaeological resources may occur within the proposed permit area" and indicated that "a Phase I archaeological survey of the project area is recommended but not required [as part of that review], additional documentation was presented to the PHMC/BHP by the applicant (T.H. Properties, Inc.) in 2007. That documentation indicated that the permit area (current Area D) "has been repeatedly disturbed over the last 50 years" and "was further excavated in the 1980s as a wetlands mitigation measure for placement of a roadway culvert" (T. H. Properties 2007). Further, the additional documentation indicated that "test borings indicate that fill comprised of dredge and demolition materials has been placed to depths of six to nine feet" (T. H. Properties 2007). As a result, the PHMC/BHP indicated that the Newport landing Project which encompassed current Area D, would "have no effect on significant cultural resources" in its letter dated June 6, 2007 (ER# 2003-2767-017-B).

3.0 HISTORIC ARCHITECTURAL PROPERTIES

3.1 PREVIOUSLY DOCUMENTED HISTORIC ARCHITECTURAL RESOURCES

Research at the PHMC/BHP indicates that no previously recorded historic architectural resources are located within the Project Area.

3.2 HISTORIC ARCHITECTURAL SURVEY

Berger has conducted a survey of historic architectural resources greater than 50 years of age within the four areas of the Project Area. This survey was based on the pedestrian reconnaissance conducted within the Project Area on October 13, 2010, as well as the historic and background research conducted for the Project. No historic architectural resources greater than 50 years of age were identified within Areas A, B or C of the Project Area.

Although the boat basin associated with the former location of Jack's Marina in Bristol Township, was created circa 1938, the structures currently located within Area D were built circa 1971 and were not surveyed as part of this project because Area D was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER# 2003-2767-017-A) in 2003 for the then proposed, Newport Landing residential development project and because the PHMC/BHP indicated that "no evaluation of historic structures [would] be necessary for [that] project" in its letter dated October 3, 2003 (ER# 2003-2767-017-A). As the Newport Landing project contained the location of Area D of the current Project, no historic architectural survey was conducted for Area D of the Project Area.

4.0 ARCHAEOLOGICAL RESOURCE POTENTIAL

4.1 PREHISTORIC ARCHAEOLOGICAL RESOURCE POTENTIAL

Berger developed a site location predictive model based on an archaeological potential/sensitivity assessment that categorized the prehistoric archaeological potential of the Project Area into areas of high, low, moderate, and no potential. High potential areas are defined herein as those where archaeological sites have been previously documented and/or areas containing landforms known to be associated with the occurrence of archaeological sites.

The assessment of archaeological potential within the Project Area was based primarily on cartographic evidence for steep slopes, naturally occurring sources of surface potable water, and historic architectural properties depicted on historical cartographic resources as well as modern USGS quadrangles and aerial photography. The cartographic data were supplemented by data gathered during the course of pedestrian surveys of the Project Area. The location of one known prehistoric archaeological site (36BU0211), located approximately 250 feet to the north of Area B and the locations of prehistoric archaeological sites elsewhere in southeastern Pennsylvania provide information regarding site location patterns in this portion of Bucks County and suggest a preference for settlement near upland and terraced riverine environments demonstrated in the Archaic through Late Woodland cultural periods. Therefore, it was considered probable that prehistoric sites, most likely temporary campsites, would be present within the Project Area on uplands near naturally occurring sources of surface potable water. Although higher elevations overlooking marshlands and floodplains are considered to have a high potential to contain prehistoric archaeological deposits marshlands themselves were not habitable by prehistoric populations.

Based on the topography and the presence of known archaeological sites dating from the Late Archaic to the Woodland periods in similar settings elsewhere in Bucks County, the prehistoric archaeological resource potential for those <u>undisturbed</u> portions of the Project Area with less than 15-degree slopes and within 300-feet of naturally occurring sources of surface potable water was considered to be high. The archaeological potential of undisturbed areas with less than 15-degree slopes but beyond 300 feet of naturally occurring sources of surface potable water was considered to be moderate or low. Archaeological deposits are not likely to be present or intact in areas that have evidence of thorough mixing by mechanized construction activities (i.e., bulldozing/grading), naturally imported sediments (colluvium), and artificially imported sediments (fill) and/or which been artificially mined, trenched, stripped for topsoil, or graded for development. Additionally, areas from which sediments with the potential for containing archaeological deposits have been removed by natural agents such as erosion, stream scour, and channel meandering likewise lack archaeological integrity.

As discussed in Section 2.4.2 of this report, Area A was historically tidal wetland and continues to be tidal wetland on the western banks of Neshaminy Creek. As a result, although Area A is in close proximity to Neshaminy Creek, the area was historically marshland and therefore there is no likelihood that intact significant prehistoric archaeological remains are located within Area A.

Area B is in close proximity to Neshaminy Creek and a designated wetland exists immediately south of the area. Although the area was historically relatively flat agricultural land, the area was never historically developed or disturbed. In addition, a prehistoric archaeological site (36BU0211) was identified approximately 250 feet to the north of Area B. Therefore, Area B is considered to have a high potential to contain intact prehistoric archaeological deposits.

Although Area C is in close proximity to the Delaware River and Neshaminy Creek, the area was historically undeveloped and likely tidal wetland. In addition, Area C was disturbed by the creation of a "Diked, Hydraulic Fill Settling Basin" as depicted on the 1971 map of the existing facilities within Neshaminy State Park. Therefore, Area C is considered to have no potential to contain intact significant prehistoric archaeological deposits.

Area D was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER# 2003-2767-017-A) in 2003 for the then proposed, Newport Landing residential development project. Although the PHMC/BHP indicated that the permit area for that project (Area D of the currently proposed project) possessed a "high probability that archaeological resources may occur within the proposed permit area" and indicated that "a Phase I archaeological survey of the project area is recommended but not required [as part of that review], additional documentation was presented to the PHMC/BHP by the applicant (T.H. Properties, Inc.) in 2007. That documentation indicated that the permit area (current Area D) "has been repeatedly disturbed over the last 50 years" and "was further excavated in the 1980s as a wetlands mitigation measure for placement of a roadway culvert" (T. H. Properties 2007). Further, the additional documentation indicated that "test borings indicate that fill comprised of dredge and demolition materials has been placed to depths of six to nine feet" (T. H. Properties 2007). As a result, the PHMC/BHP indicated that the Newport landing Project which encompassed current Area D, would "have no effect on significant cultural resources" in its letter dated June 6, 2007 (ER# 2003-2767-017-B). As a result, Area D of the current Project Area is considered to have no potential to contain intact significant prehistoric archaeological deposits.

4.2 HISTORIC ARCHAEOLOGICAL RESOURCE POTENTIAL

A review of historic literature and cartographic resources pertaining to the Project Area were also consulted in conjunction with pedestrian surface surveys to examine the potential of the proposed Project to affect historic archaeological features related to historic archaeological resources within the Project Area.

As discussed in Section 2.4.2 of this report, Areas A, B, C, and D lacked development. Furthermore, Areas A, C, and D were likely marshland throughout much of the historic period and were unsuitable for development. As a result, due to the absence of historic development, Areas A, B, C, and D are considered to have no potential for containing significant historic archaeological deposits.

5.0 SUMMARY AND RECOMMENDATIONS

The Louis Berger Group, Inc. (Berger), of Morristown, New Jersey, conducted a Phase IA cultural resources assessment for the proposed creation of wetlands within the Neshaminy State Park and Jack's Marina in Bucks County, Pennsylvania as part of the required wetland mitigation associated with the proposed Southport Development Project in the City of Philadelphia. The proposed wetland mitigation consists of four discontinuous areas (Areas A, B, C, and D) (Project Area). Areas A through C are located within the Neshaminy State Park in Bensalem Township and Area D is located within Bristol Township.

As the proposed wetland mitigation project requires extensive ground disturbance to create the new wetland areas, this Phase IA cultural resources assessment was conducted in October 2010 with the objective of investigating the potential for previously undocumented archaeological resources to exist within the Project Area and to record the presence of historic architectural resources listed in or eligible for inclusion in the National Register of Historic Places (NRHP) and/or the Pennsylvania Register of Historic Places (PARHP) within the Project Area.

Archaeology

Area A was never historically developed and is therefore not considered to have historic archaeological potential. Additionally, Area A was historically tidal marshland along the western bank of the Neshaminy Creek and approximately 0.43 miles to the north of the confluence of Neshaminy Creek and the Delaware River. Although higher elevations overlooking marshlands and floodplains are considered to have a high potential to contain prehistoric archaeological deposits marshlands themselves were not habitable by prehistoric populations. Pedestrian reconnaissance of Area A confirmed the absence of land with higher (dry) elevations and as a result, A is considered to have no potential for containing significant prehistoric archaeological deposits. No further archaeological investigations are recommended for Area A of the Project.

Area B was never historically developed and is therefore not considered to have historic archaeological potential. Area Pedestrian reconnaissance of Area B, located approximately 0.35 miles to the north of the confluence of Neshaminy Creek and the Delaware River, indicated that although a designated wetland exists to the south of Area B, Area B is higher (dry) in elevation and as a result of its proximity to the Neshaminy Creek, Area B is considered to have a high potential to contain prehistoric archaeological deposits. Additionally, given the close proximity of previously documented *Neshaminy State Park Site* (36BU0211) approximately 250 feet to the north of Area B, a Phase IB archaeological survey is recommended to determine the presence or absence archaeological deposits within Area B.

Although Area C, located immediately west of the confluence of Neshaminy Creek and the Delaware River was never historically developed and is therefore not considered to have historic archaeological potential. Area C was also historically depicted as undeveloped or tidal marshland along the western bank of the Neshaminy Creek. The location of Area C was depicted as a "Diked Hydraulic Fill Settling Basin" on the 1971 Neshaminy State Park Existing Facilities Map. As Area C was modified in the recent past to create a settling basin, Area C is considered to have a no potential to contain prehistoric archaeological deposits. No further archaeological investigations are recommended for Area C of the current Project.

Area D was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER# 2003-2767-017-A) in 2003 for the then proposed, Newport Landing residential development project. Although the PHMC/BHP indicated that the permit area for that project (Area D of the currently proposed project) possessed a "high probability that archaeological resources may occur within the proposed permit area" and indicated that "a Phase I

archaeological survey of the project area is recommended but not required [as part of that review], additional documentation was presented to the PHMC/BHP by the applicant (T.H. Properties, Inc.) in 2007. That documentation indicated that the permit area (current Area D) "has been repeatedly disturbed over the last 50 years" and "was further excavated in the 1980s as a wetlands mitigation measure for placement of a roadway culvert" (T. H. Properties 2007). Further, the additional documentation indicated that "test borings indicate that fill comprised of dredge and demolition materials has been placed to depths of six to nine feet" (T. H. Properties 2007). As a result, the PHMC/BHP indicated that the Newport landing Project which encompassed current Area D, would "have no effect on significant cultural resources" in its letter dated June 6, 2007 (ER# 2003-2767-017-B). As a result, Area D of the current Project Area is considered to have no potential to contain intact significant prehistoric archaeological deposits and n o further archaeological investigations are recommended for Area D of the current Project.

Historic Architecture

Research at the PHMC/BHP revealed that no previously recorded historic architectural resources are located within the Project Area.

Berger has conducted a survey of historic architectural resources greater than 50 years of age within the four areas of the Project Area and immediate vicinity. This survey was based on the pedestrian reconnaissance conducted within the Project Area on October 13, 2010, as well as the historic and background research conducted for the Project. No historic architectural resources greater than 50 years of age were identified within Areas A, B or C of the Project Area. No further historic architectural survey is recommended for Areas A, B or C of the Project Area.

Although the boat basin associated with the former location of Jack's Marina in Bristol Township, was created circa 1938, the structures currently located within Area D were built circa 1971 and were not surveyed as part of this project because Area D was the subject of a Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (PHMC/BHP) environmental review (ER# 2003-2767-017-A) in 2003 for the then proposed, Newport Landing residential development project and because the PHMC/BHP indicated that "no evaluation of historic structures [would] be necessary for [that] project" in its letter dated October 3, 2003 (ER# 2003-2767-017-A). As the Newport Landing project contained the location of Area D of the current Project, no further historic architectural survey is recommended for Area D of the Project Area.

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APPENDIX A:
RESUMES OF KEY PERSONNEL

KRISTOFER M. BEADENKOPF
The Louis Berger Group, Inc.
Senior Archaeologist

EDUCATION

- M.A.A. (Master of Applied Anthropology), Historical Archaeology, University of Maryland, 2002.
- B.A., Anthropology, Monmouth University, 1998.

PROFESSIONAL REGISTRATION

- Register of Professional Archaeologists (RPA)
- Eastern States Archaeological Federation
- Archaeological Society of New Jersey
- Society for Pennsylvania Archaeology

TECHNICAL TRAINING

- C.R.M. Essentials, New Jersey Historic Preservation Office, Trenton. October 26, 2007.
- Cultural Resources Best Workshop, New Jersey Historic Preservation Office, Trenton. October 27, 2006.
- Section 106 Essentials, Advisory Council for Historic Preservation, Washington, D.C. Don Klima (Instructor), August 11-12, 2004.
- Trenching and Excavation Safety—OSHA Construction Industry Standards, Subpart P (29 CFR 1926.650-652). Emilcott Associates, Inc., June 2, 2004.

PROFESSIONAL EXPERIENCE

Mr. Beadenkopf's background includes archaeological investigations at prehistoric sites dating to the Archaic through the Late Woodland periods and historic sites dating to the eighteenth through the early twentieth centuries throughout the Northeast, Middle Atlantic, and Southeast. As Principal Investigator he is responsible for the design and execution of archaeological research projects involving historic and prehistoric resources in the Northeast. His responsibilities include implementing surveys and excavations, performing background and site-specific research, analysis and interpretation of archaeological data and artifacts, preparation of technical reports, and consultation with regulatory agencies. His specialties include urban and historical archaeology and public archaeology. His experience includes public interpretation at several archaeological sites, education, presentations, and creation of displays of archaeological collections and information. Projects in Stavelot, Belgium; Idalion, Cyprus; and Rio Bravo, Belize, illustrate his international experience. Since joining The Louis Berger Group, Inc., Mr. Beadenkopf's major projects have included the following.

- **Documentary Analysis, Preliminary Field Investigations, and Grave Marker Inventory, Saint Vincent's Cemetery, Philadelphia, Pennsylvania**. Principal Investigator, documentary review of burial ledgers, permits, and historic cartographic resources, subsurface probing and excavation of buried grave markers, survey/mapping of the cemetery, and photo-recordation, transcription, and German-English translation of more than 90 grave markers in cemetery established in 1855. For St. Vincent's Homes. 2009.

- **Phase I/II Cultural Resource Investigations, Susquehanna to Roseland 500kV Transmission Project, Warren, Sussex, Morris, and Essex Counties, New Jersey**. In support of federal, state, and local permitting processes, Project Manager and Principal Investigator, cultural resource survey of 47.5-mile transmission corridor and more than 140 miles of temporary access

roads across northern New Jersey. Identified and evaluated 28 prehistoric archaeological sites and more than 1,000 historic architectural resources. For Public Service, Electric and Gas.

- **Phase I/II Cultural Resource Investigations, Susquehanna to Roseland 500kV Transmission Project, Luzerne, Lackawanna, Wayne, Pike, and Monroe Counties, Pennsylvania**. In support of federal, state, and local permitting processes, Project Manager and Principal Investigator, cultural resource survey of 100-mile transmission corridor and more than 100 miles of temporary access roads. Identified and evaluated 17 prehistoric archaeological sites and more than 1,000 historic architectural resources. For Pennsylvania Power and Light.

- **Phase I/II Cultural Resource Investigations, Susquehanna to Roseland 500kV Transmission Project, Delaware Water Gap National Recreation Area (DEWA), Monroe County, Pennsylvania, and Warren County, New Jersey**. As part of the Section 106 process, Project Manager and Principal Investigator, cultural resource survey of the portions of the transmission project extending through the Delaware Water Gap National Recreation Area (DEWA). Identified and evaluated 27 prehistoric and/or historic archaeological sites and historic architectural resources (including the Appalachian Trail) within DEWA. For Pennsylvania Power and Light and Public Service, Electric and Gas.

- **Phase I/II Cultural Resource Investigations at Four Proposed Wetland Mitigation Areas as Part of the New Jersey Turnpike Interchanges 6 to 9 Program, Burlington, Middlesex, and Mercer Counties, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, cultural resource survey of four wetland mitigation areas. Identified and evaluated 10 prehistoric and/or nineteenth-century archaeological sites. For the New Jersey Turnpike Authority.

- **Phase I/II Cultural Resource Investigations of Detention Basin and Pipeline Relocation Areas as Part of the New Jersey Turnpike Interchanges 6 to 9 Program, Burlington, Middlesex, and Mercer Counties, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, cultural resource survey of more than 70 detention basins locations and more than 20 miles of pipeline relocations associated with the New Jersey Turnpike Interchanges 6 to 9 Program. For the New Jersey Turnpike Authority.

- **Phase I Cultural Resource Survey, New Jersey Turnpike Widening, Interchanges 6 to 9, Gervasoni Farm Property, Robbinsville Township, Mercer County, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, Phase I/II subsurface archaeological investigation and building material analysis for former farm. Identified one historic archaeological site, the Robbins Gervasoni Farm Site (28-Me-374), but no significant associated deposits were encountered in the project area. For the New Jersey Turnpike Authority.

- **Phase I Cultural Resource Survey, New Jersey Turnpike Widening, Interchanges 6 to 9, Appleby House Investigation, Chesterfield, Burlington County, New Jersey**. As part of the E.O. 215 process, Project Manager and Principal Investigator, Phase IB subsurface archaeological survey and building material analysis for former toll house for the Bordentown and Crosswicks Turnpike between 1857 and 1901. For the New Jersey Turnpike Authority.

- **Phase I Archaeological Survey, Fretz Road (SR1008) Bridge Replacement, Lower Salford Township, Montgomery County, Pennsylvania**. Principal Investigator, archaeological survey in advance of the replacement of the 1923 Fretz Road (SR1008) Bridge over Skippack Creek. For the Pennsylvania Department of Transportation, Engineering District 6-0, King of Prussia.

- **Phase IA Cultural Resource Survey, Trenton-Robbinsville Airport Improvements**. Principal Investigator, cultural resource survey in advance of the construction of new hangars and access improvements at the Trenton-Robbinsville Airport. For DY Consultants, Roslyn Heights, New York.

- **Phase I Cultural Resource Survey, Burlington Sod Farm, Springfield Township, Burlington County, New Jersey**. Principal Investigator, cultural resource survey as part of the E.O. 215 process in advance of rezoning and construction of proposed county fairgrounds. Identified and evaluated several early nineteenth-century farmstead locations and identified five loci with historic and/or prehistoric archaeological potential. For the Freeholders of Burlington County.

- **Phase II Archaeological Investigation for Proposed Improvements to the Woodloch Intersection of SR590 and SR0408, Lackawanna Township, Pike County, Pennsylvania**. Principal Investigator/Field Director, implementation of the scope of services for historic architectural and archaeological resources, assessment of impacts, client coordination, and Section 106 compliance. Managed the excavation of more than 40 1x1-meter test units to delineate the boundaries and evaluate the National Register eligibility of multi-component (Middle Archaic to Late Woodland) prehistoric site and ruins of historical mill with associated raceways and residence located in/adjacent to the project right-of-way. For the Pennsylvania Department of Transportation, Engineering District 4-0, Dunmore.

- **Phase I Archaeological Assessment, Alcan Aluminum Corporation Focused Remedial Investigation Project, Oswego County, New York**. Principal Investigator, Phase I archaeological assessment under SEQRA for the Alcan Facility prior to the execution of a project designed to mitigate contaminated soils. Involved historical and cartographic research, including the identification and analysis of past disturbances and/or prior settlement and land use, the assessment of the property for its potential to contain archaeological resources, and archaeological subsurface survey. For Blasland, Bouck and Lee, Inc.

- **Archeological Overview and Assessment for the Edison National Historic Site (EDIS), West Orange, Essex County, New Jersey**. Principal Investigator, management and completion of archeological overview and assessment (AOA) of the three units that form the EDIS: the Laboratory Unit (the experimental facility of Thomas A. Edison from 1887 to 1931); the Glenmont Unit (the residence of Edison from 1886 to 1931); and the Maintenance Area (not historically related to Edison). The AOA provided information on known and potential historic-period archaeological resources, areas within the EDIS boundaries that have potential for pre-contact Native American sites, the relationship between Edison period and non-Edison-related activities that have been documented in vicinity of extant and former structures in each unit, and recommendations for additional research to locate and evaluate known and potential archaeological resources. For this AOA, the EDIS was stratified into areas of high, low, and no archaeological potential to facilitate future investigations and interpretation. Developed detailed matrix for the Laboratory Unit to dovetail with traditional archaeological sensitivity models to contribute to development of the unit's historic archaeological predictive model, including information on the major experiments conducted at the West Orange Laboratory, archaeological features and remains that may be associated with each experiment, and suggested methods for the identification of those chemicals/materials/features associated with experiments. The AOA presented general and specific recommendations for the management and protection of archaeological resources to be considered in the development of a formal Cultural Resources Management Plan for the EDIS. For the National Park Service, Northeast Region.

- **Phase I Archaeological Investigation, Stream Restoration and Related Work in the Sweet Brook Bluebelt, Annadale, Staten Island, New York**. Principal Investigator, archaeological investigations in advance of restoration and alteration of two sites along the Sweet Brook Bluebelt and associated wetlands owned by the New York City Department of Environment Protection and regulated by the New York State Department of Environmental Conservation. Involved assessment of past ground disturbance and potential for historic archaeological resources in the project area, and archaeological subsurface survey. For the JRC Construction Corporation.

- **Phase IA Archaeological Assessment, Restoration of the Rutherford/East Rutherford Drainage Ditch System in the Boroughs of Rutherford and East Rutherford, Bergen County, New Jersey**. Principal Investigator, archaeological resource assessment to support a United States Army Corps of Engineers Section 404/Section 10 permit application in advance of restoration of 35 acres of exiting drainage ditch system in the New Jersey Meadowlands. For the New Jersey Meadowlands Commission.

- **Phase I Cultural Resource Survey for Proposed Sentinel Williams/TRANSCO Pipeline Expansion Project: Mountain View and Turnpike Loops and five Meter Station Modification Locations, Bergen, Burlington, Mercer, Middlesex, Somerset, and Union Counties, New Jersey**. As part of the FERC permitting process and Section 106 compliance, Principal Investigator/Field Director, cultural resource survey of 3.78-mile proposed Mountain View Loop corridor, 1.3-mile proposed Turnpike Loop, and five Meter Station Modification Locations. Identified one Middle to Late Archaic period prehistoric site. For Williams/Transco, Houston, Texas.

- **Phase IB Archaeological Survey, Jamaica Avenue School, Block 4102, Lots 19, 27, 33, 35 & 36**, **Cypress Hills, Brooklyn, Kings County, New York**. Principal Investigator/Field Director, archaeological trenching at proposed New York City school location. Excavations identified, evaluated, and mitigated extensive backyard deposits dating to the late nineteenth through early twentieth centuries. For the New York City School Construction Authority.

- **Archaeological Investigation of the Frazee House, Scotch Plains, Union County, New Jersey**. As part of a holistic approach to the preservation of the eighteenth-century Frazee House, Principal Investigator/Field Director, removal of 0.5 to 2.0 feet of sediment in the house's basement. The investigations revealed cobblestone and brick paved sections of the basement and a drainage trough that may indicate that the basement was used for food storage. Archaeological survey of the grounds indicated that although much of the rear yard had been disturbed, the front yard remained intact and contained a buried ground surface with eighteenth- and early nineteenth-century artifacts. For the Fanwood/Scotch Plains Rotary/the Aunt Betty Frazee Project.

- **Phase IB Archaeological Survey for the Proposed Eagle Academy for Young Men, Bronx, New York**. Principal Investigator, Phase IB archaeological survey of mid-nineteenth- to early twentieth-century domestic lot in the Bronx. Excavations identified and evaluated six archaeological features, including a buried historic ground surface and a circa 1930 bottle dump, in the lot that represent the late nineteenth- through twentieth-century occupation, although extensive disturbance had severely impacted the integrity of these archaeological deposits. For the New York City School Construction Authority.

- **Phase IA Archaeological Assessment, Crab Island Wetland Mitigation Bank, Sayreville, Middlesex County, New Jersey**. Principal Investigator for an archaeological resource assessment to support a United States Army Corps of Engineers Section 404/Section 10 permit

application in advance of the restoration of 41 acres of wetland on the south bank of the Raritan River and on Crab Island in Sayreville, New Jersey. For EarthMarkNJMitigation LLC., Concord, North Carolina.

- **Phase IB Archaeological Survey, World Trade Center PATH Terminal, New York City**. Principal Investigator, archaeological investigations in advance of construction of the new WTC PATH Terminal. Coordinated excavation of 170-foot trench to 15 feet below the surface and within OSHA safety regulations. Identified, evaluated for National Register eligibility, and mitigated late eighteenth- and early nineteenth-century backyard residential archaeological features. For the Port Authority of New York and New Jersey.

- **Phase I Archaeological Survey for Proposed Improvements to the New Jersey Turnpike Interchanges 6 to 8A, Burlington, Middlesex, and Mercer Counties, New Jersey**. As part of the E.O. 215 process, Principal Investigator/Field Director, cultural resource survey of 25 miles of the turnpike. For the New Jersey Turnpike Authority.

- **Phase IA Archaeological Assessment, Rockaway Boulevard Site, Rockaway Boulevard & Nassau Expressway, Block 14260, Lot 1, Jamaica, Queens County, New York**. Principal Investigator/Field Director, archaeological resource assessment of proposed New York City Transit bus parking facility next to JFK International Airport. For New York City Transit.

- **Phase I/II Archaeological Survey/ for Proposed Improvements to SR 706, Susquehanna County, Pennsylvania**. Principal Investigator/Field Director, geomorphological assessment and archaeological survey of five locations along the SR0706 corridor. Identified two prehistoric archaeological sites and one nineteenth-century domestic archaeological site. For Pennsylvania Department of Transportation, Engineering District 4-0.

- **Phase I Archaeological Screening for Proposed Mulhockaway Creek Restoration, Hoffman Park, Union Township, Hunterdon County, New Jersey**. Principal Investigator/Field Director, cultural resource survey as part of the Hoffman Park Stream Restoration Project. The project was the first to be conducted under the New Jersey Highlands Water Protection and Planning Act and received the American Council of Engineering Companies of New Jersey (ACEC) Distinguished Award in March 2007. For Stony Brook-Millstone Watershed Association and the New Jersey Water Supply Authority.

- **Phase I Archaeological Survey for Proposed Bridge Replacement, Forkston, Wyoming County, Pennsylvania**. Principal Investigator/Field Director, overseeing the geomorphological investigation and archaeological survey of the Mehoopany Creek floodplain surrounding the proposed bridge replacement on SR0087. For Pennsylvania Department of Transportation, Engineering District 4-0, PennDOT District 4, Dunmore, Pennsylvania.

- **Phase I Cultural Resource Assessment, Trenton-Morrisville Toll Bridge Rehabilitation and One Auxiliary Northbound Lane, Morrisville, Pennsylvania, and Trenton, New Jersey**. Principal Investigator/Field Director, cultural resource assessment of improvements to interchanges and the Trenton-Morrisville Toll Bridge over the Delaware River. Involved archaeological assessment of proposed ground disturbance and historic architectural assessment of proposed interchange improvements to local structures, including the National Historic Landmark Delaware Division of the Pennsylvania Canal. For the Delaware River Joint Toll Bridge Commission.

- **First Presbyterian Church of Newark, Essex County, New Jersey Disinterment**. Principal Investigator/Field Director. Assisted with the disinterment of human remains from the

nineteenth-century First Presbyterian Church Cemetery in downtown Newark. Berger's archaeological investigations involved the careful use of heavy machinery and conscientious hand excavation of individual grave shafts. Photo-documentation and standardized burial forms were completed for each shaft/burial. After 21 days of intensive field efforts, Berger's team of approximately 30 archaeologists and field technicians identified 581 grave shafts, one crypt, and exhumed the remains of 510 individuals. For Langan Engineering and Environmental Services, Elmwood Park, New Jersey.

- **Phase I Archaeological Survey for Proposed Improvements to the Woodloch Intersection of SR590 and SR0408, Lackawanna Township, Pike County, Pennsylvania**. Principal Investigator/Field Director, implementation of the scope of services for historic architectural and archaeological resources, assessment of impacts, client coordination, and Section 106 compliance. Preliminary survey results indicated that both ruins of a historic mill and prehistoric deposits were located in or immediately adjacent to the project right-of-way. For the Pennsylvania Department of Transportation, Engineering District 4-0, Dunmore, Pennsylvania.

- **Phase IA Cultural Resource Assessment for the Proposed Belmar 2 Verizon Wireless Communication Facility, Borough of Belmar, Monmouth County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey

- **Phase I Archaeological Survey for the Proposed Albany Verizon Wireless Communications Facility, City of Albany, Albany County, New York**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Costich Engineering.

- **Phase IA Archaeological Assessment, Remedial Options Pilot Study, Grasse River Study Area, Alcoa-Massena, Massena, New York**. Principal Investigator, Phase IA archaeological assessment of early twentieth-century Alcoa fabricating, ingot, and extrusion and smelting plant under the jurisdiction of the U.S. EPA as a Superfund Site. Involved research and analysis of past disturbances and potential for historic archaeological resources associated with the industrial use of the project area. For Blasland, Bouck and Lee, Inc.

- **Phase IA Archaeological and Historical Survey for the Proposed Kearny 6 Verizon Wireless Communication Facility, Town of Harrison, Hudson County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey

- **Phase IA Archaeological and Historical Survey for the Proposed Old Bridge 3 Verizon Wireless Communication Facility, Old Bridge Township, Middlesex County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase IA Cultural Resource Assessment, East Orange Demonstration Project, Pre-K to 12th Grade School for the Performing Arts, City of East Orange, Essex County, New Jersey**. Principal Investigator, cultural resource assessment of a proposed new school to be constructed at the present location of the circa 1910 East Orange High School. Determined the project's potential to affect potential archaeological resources and coordinated the determination of the East Orange High School's National Register eligibility and the recordation of the school prior to demolition. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment for the Proposed Harlem Hospital Rehabilitation, New York, New York**. Principal Investigator. For the Dormitory Authority of the State of New York and the Harlem Hospital Corporation.

- **Phase IA Cultural Resource Assessment for the Proposed Fort Lee 6 Verizon Wireless Communication Facility, Fort Lee, Bergen County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For IVI International, White Plains, New York.

- **Phase I Archaeological Survey for the Proposed Wall 3/Hinks Turkey Farm Verizon Wireless Communications Facility, Wall Township, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase I Archaeological and Historical Survey for the Proposed Matawan 2 Verizon Wireless Communication Facility, Town of Matawan, Monmouth County, New Jersey**. Principal Investigator, archaeological survey of a proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase I Archaeological Survey for the Proposed Pound Ridge Vista Nextel Wireless Communication Facility, Town of Lewisboro, Westchester County, New York**. Principal Investigator, archaeological survey of proposed Nextel cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Union County Courthouse Time Capsule Relocation for the 2005 Centennial Celebration. Elizabeth, Union County, New Jersey**. Principal Investigator. Assisted the Union County Board of Trustees with the relocation of the Union County Courthouse time capsule in advance of the 2005 centennial celebration. For the Union County Board of Trustees.

- **Phase IA Cultural Resource Assessment for the Proposed Vent Plant Rehabilitation, West 30th Street and 6th Avenue, New York, New York**. Principal Investigator, archaeological resource assessment of proposed vent plant installation. Employed GIS technology to georeference historical maps to trace potential archaeological resources in the project area. For New York City Transit.

- **Phase IA Cultural Resource Assessment for the Proposed Wall 3/Hinks Turkey Farm Verizon Wireless Communications Facility, Wall Township, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase IA Cultural Resource Assessment, Proposed Oakwood Avenue Elementary School Addition, City of Orange, Essex County, New Jersey**. As part of the E.O. 215 process, Principal Investigator, cultural resource assessment of an addition to the existing circa 1888 Oakwood Avenue School. For New Jersey School Construction Corporation.

- **Phase I Archaeological Investigations for the Proposed Fence Enclosure of the First Presbyterian Church Grounds, Elizabeth, Union County, New Jersey**. Principal Investigator. For the First Presbyterian Church of Elizabeth, Elizabeth, New Jersey.

- **Phase I Archaeological Investigations for the Proposed Nextel Wireless Communication Facility, Colesville, Town of Wantage, Sussex County, New Jersey**. Principal Investigator,

archaeological survey of proposed Nextel cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase I Archaeological Investigations for the Proposed Verizon Wireless Communication Facility, Pellettown, Town of Wantage, Sussex County, New Jersey**. Principal Investigator, archaeological survey of proposed Verizon cell tower installation. For Herbst-Musciano Architects/Planners, Cedar Knolls, New Jersey.

- **Phase III Archaeological Data Recovery Investigations at the Hanover 5 Proposed Telecommunication Facility, Town of Whippany, Morris County, New Jersey**. Principal Investigator, archaeological data recovery of proposed Verizon wireless cell tower installation. For Innovative Engineering, Inc., Toms River, New Jersey.

- **Phase IB Archaeological Survey for the Proposed Omnipoint Wireless Communication Facility, Town of Pound Ridge, Westchester County, New York**. Principal Investigator, archaeological survey of proposed cell tower installation. For IVI International, White Plains, New York.

- **Phase IA Cultural Resource Assessment, Proposed Peshine Avenue School, Elementary School Replacement, City of Newark, Essex County, New Jersey**. Principal Investigator, cultural resource assessment of proposed new school to be constructed at the present location of the circa 1911 Peshine Avenue Elementary School. Determined the project's potential to affect potential archaeological resources through the use of GIS technology to geo-reference historical maps to trace potential archaeological resources in the project area. For New Jersey School Construction Corporation.

- **Phase IB Archaeological Survey for the Proposed Omnipoint Wireless Communication Facility 195 Greenbrook Road, North Plainfield, Somerset County, New Jersey (Cell Tower Location NJ-06-552C)**. Principal Investigator, archaeological survey of proposed cell tower installation. For IVI International, White Plains, New York.

- **Phase IB Archaeological Survey for the Proposed Omnipoint Wireless Communication Facility, Morristown, Morris County, New Jersey (Cell Tower Location NJ7237b)**. Principal Investigator, archaeological survey of cell tower installation. For IVI International, White Plains, New York.

- **Phase I Cultural Resource Investigation of the Garafalo Property, Town of Bangor, Washington Township, Northampton County, Pennsylvania**. Principal Investigator, archaeological survey of proposed commercial project. For McFall, Layman and Jordan, P.C.

- **Phase IA Cultural Resource Assessment, Proposed Burnet-Warren Elementary School Replacement, City of Newark, Essex County, New Jersey**. As part of the E.O. 215 process, Principal Investigator for cultural resource assessment of proposed new elementary school to be constructed within the limits of the James Street Commons Historic District, a National Register-listed historic district. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment of the Proposed Andover 2 Wireless Telecommunications Facility, State Route 206, Andover Borough, Sussex County, New Jersey**. Principal Investigator, archaeological survey of proposed cell tower installation. For Innovative Engineering, Toms River, New Jersey.

- **Phase I Archaeological Survey of the Proposed Rye Wireless Telecommunications Facility, 615 Milton Road, Rye, Westchester County, New York**. Principal Investigator, archaeological survey of proposed cell tower installation. For IVI International, White Plains, New York.

- **Cultural Resource Eligibility/Effects Investigations for the Proposed Tuckahoe Road (C.R. 557) Bridge Over Cape May Branch Rail Line Replacement, Atlantic County, New Jersey**. Principal Investigator/Field Director, Section 106 compliance activities for NJDOT's proposed improvements to bridge. Involved subsurface archaeological investigation and historic architectural survey in the area of potential effect (APE). The architectural survey indicated that the Tuckahoe Road Bridge had previously been determined not eligible for the National Register of Historic Places. The Cape May Rail Line, also in the APE, was determined to be potentially eligible for inclusion in the National Register as a historic district owing to its role in the development of New Jersey's rail transportation system and in the growth of the state's seashore tourist resort communities. Berger concluded that the proposed bridge replacement would not have an adverse effect on the Cape May Branch Rail Line.

PREVIOUS PROFESSIONAL EXPERIENCE

Greenhouse Consultants Inc., New York, New York. Principal Investigator/Historian/Field Director. Composed technical reports and proposals, developed budgets and marketing strategies, conducted client and regulatory agency consultation. Selected projects are listed below.

- **Phase IB Archaeological Testing of the Proposed Silver Lake Subdivision in the Town of Clinton, Dutchess County, New York**. Principal Investigator. For the Chazen Companies.

- **Phase IA/IB Archaeological Investigations of a Classified Site in the Town of Owego, Tioga County, New York**. Principal Investigator and Historian. For the Chazen Companies.

- **Phase IA/IB/II Archaeological Investigations of the Port Jervis Educational Complex, Port Jervis, Orange County, New York**. Principal Investigator and Historian. For McGoey, Hauser and Edsall PC.

- **Phase IA/IB Archaeological Investigations of the Jockey Hollow Girl Scout Camp, Morristown, New Jersey**. Co-Principal Investigator. For Paulus, Sokolowski and Sartor Engineering, PC.

- **Phase IA/IB Archaeological Investigations of the New York State Route 92 Sidewalk Expansion, Village of Manlius, Orange County, New York**. Principal Investigator and Historian. For Barton and Loguidice, PC.

- **Phase IA Archaeological Sensitivity Investigation, Andros Hills Subdivision, Long Island, New York**. Principal Investigator and Historian. For Bourke, Flanagan, & Asato, PC.

- **Phase IA/IB Archaeological Sensitivity Investigation and Archaeological Survey, Brookside Loop Development, Staten Island, New York**. Principal Investigator and Historian. For FSK Construction Corp.

- **Phase IA Archaeological Sensitivity Investigation, West Street Rezoning, Tribeca North, New York, New York**. Principal Investigator and Historian. For Parsons Brinckerhoff, New York, New York.

- **Southern Research, Columbus, Georgia**. Principal Investigator/Historian/Field Director. Composed technical reports, developed excavation plans, supervised field technicians, and conducted client and regulatory agency consultation.

- **Phase III Archaeological Investigations in the Backyard Area of the Old Governor's Mansion, Milledgeville, Georgia**. Principal Investigator and Historian. For Lord, Aeck, and Sargent and the Old Governor's Mansion.

- **Phase II Archaeological Survey of the Augusta Canal Headgates Area, Columbia County, Georgia**. Principal Investigator and Historian. For the Augusta Canal Authority.

- **Phase III Archaeological Data Recovery at the Site of the New Jacksonville Public Library**. **Jacksonville, Florida**. Principal Investigator and Co-Historian. For Ellis and Associates and the City of Jacksonville.

- **Phase II Archaeological Testing of the 21st Century Chattanooga Waterfront Project Area South of the Riverfront Parkway, Hamilton County, Tennessee**. Principal Investigator and Historian. For Hargreaves Associates on behalf of the River City Company.

- **Archaeological Investigations in the Jekyll Island Club Hotel Parking Lot, Jekyll Island, Georgia**. Principal Investigator and Historian. For the Jaeger Company on behalf of the Jekyll Island Authority.

- **Archaeology in Annapolis Laboratory, University of Maryland, College Park, Maryland**. Laboratory Director. Composed technical reports, supervised laboratory technicians, and managed the artifact collections from 20 years of the Archaeology in Annapolis Project's excavations.

- **University of Maryland, College Park, Maryland**. Field Director. Developed excavation plans, supervised field technicians, and conducted client and regulatory agency consultation.

- **Parsons Brinkerhoff, Rockville, Maryland**. Archaeological Field Technician. Native American Woodland period camp site.

- **URS Greiner Woodward and Clyde, Florence, New Jersey**. Archaeological Field Technician. Various prehistoric and historic archaeological projects.

- **Richard Grubb and Associates, Cranbury, New Jersey**. Archaeological Field Technician. Various prehistoric and historic archaeological projects.

- **Progamme for Belize Archaeology Conservation Area, Orange Walk District, Belize**. Research Assistant/Excavator. Chawak But'o'ob (RB47) Post-Classic Maya domestic center.

- **Cultural Resource Consulting Group (CRCG), Highland Park, New Jersey**. Archaeological Field Technician. Various prehistoric and historic archaeological projects.

ACADEMIC POSITIONS

Graduate Teaching Associate, Department of Anthropology, University of Maryland, College Park, Maryland. Co-Instructor: Anthropology 496/696, University of Maryland Field School in Urban Archaeology, 2001 and 2002. Co-Instructor: Anthropology 240, Introduction to Archaeology, 2000 and 2001.

Teaching Associate, Department of Anthropology, Monmouth University, West Long Branch, New Jersey. Co-Instructor: Anthropology 315, Field Research in Archaeology. 2001.

Teaching Associate, Department of Anthropology, Montclair State University, Upper Montclair, New Jersey. Co-Instructor: Anthropology 470, Archaeological Field Methods. 1998 and 1999.

University of Indianapolis, Indianapolis, Indiana. Excavator/Field School Student. Bronze Age Temple Complex in Dali (Idallion), Cyprus.

University of Liege, Liege, Belgium. Excavator. Eleventh- to eighteenth-century abbey complex in Stavelot, Belgium.

PUBLIC ARCHAEOLOGY/EDUCATIONAL PROJECTS

- Public Interpreter/Designer, Public Archaeology Program. Archaeology in Annapolis/UMD Banneker-Douglass Museum, Phase III. Annapolis, Maryland. July-August 2001.
- Public Interpreter/Designer, Public Archaeology Demonstration: Maryland Day Activity, University of Maryland College Park, Maryland. April 2001.
- Weekend Public Educator/Volunteer: South Street Seaport Museum, New York. April-July 2000.
- Public Interpreter, Public Archaeology Demonstration: Lenne Lenape Cultural Heritage Festival Sandy Hook, New Jersey. November 1997.
- Artifact Display: Dismal Swamp Lithic Artifacts CRCG Displayed in the Lobby of New Jersey Division of Travel and Tourism, Trenton. Native American Late Archaic Lithic Artifacts. June 1997.
- Public Interpreter, Public Archaeology Demonstration: Oxford Furnace, Warren, New Jersey. Warren County Heritage Festival, 19th Century Industrial (Iron Works) Complex. May 1996.

PRESENTATIONS

- One Ounce of Fact: Consumer Trends and Ethnicity in 19th-Century Jacksonville, Florida. Presented at the 60th Annual Meeting of the Southeastern Archaeological Conference in Charlotte, North Carolina. November 2003.
- Archaeology: An Introduction to Our Past, Present, and Future. Presented to the 8th Grade Class of Sarah Wade School, Jacksonville, Florida. December 2002.
- Critical Archaeology in Public: Results from the 2001 Banneker-Douglass Museum/Courthouse Public Archaeology Program. Presented at the 11th Annual Graduate Student Colloquium, University of Maryland, College Park. April 2002.
- African American Archaeology in Public: Public Archaeology at the Banneker Douglass Museum Site. Presented at the 20th annual Archaeology in Annapolis Archaeological Symposium. Annapolis, Maryland. November 2001.
- Archaeology: An Introduction to Our Past, Present, and Future. Presented to the 9th Grade Ancient History Class, McClean High School, Washington D.C. October 2001.

- Just Across the River: The University of Maryland's 2001 Archaeological Investigation of Eastport, Maryland. Presented to the Historic Annapolis Foundation. September 2001.

- Archaeology: The Ultimate 3D Puzzle. Presented to the 6th Grade Class of Ms. Nyhus, Cherokee Grade School, Adelphi, Maryland. May 2001.

- Late Classical Period (AD 600-900) Households in the Eastern Maya Lowlands: Recent Survey Data from the Three Rivers Region of Northwestern Belize, Central America. Co-authored with Stanley L. Walling Ph.D. et al. Presented at the Student Research Conference of the Sigma Xi Honor Society, May 1, 1999.

- Forsaken History: The Role of the Spanish Mission in the Colonization of the American Southeast. Defense of Senior Honors Thesis, Monmouth University, New Jersey. May 1998.

DEBORAH BALDWIN VAN STEEN
The Louis Berger Group, Inc.
Architectural Historian

EDUCATION

- M.S., Historic Preservation, Concentration in History, Columbia University, 2003.
- B.A. magna cum laude, Liberal Studies: History and Design, Minor in Business, Pace University, 1998.
- Certificate, Interior Design, Pace University, 1998.

PROFESSIONAL TRAINING

- Best Practices Workshop. New Jersey Historic Preservation Office, October 2006.
- Preserving the Recent Past. Drew University, Fall 2007.
- The Connecticut Farm Landscape: Open Space and Historic Buildings. Symposium of the Connecticut Trust Historic Preservation and the Litchfield Historical Society, November 2007.
- A Survey of Vernacular Architecture of New Jersey. Drew University, Spring 2008.
- Introduction to the History of American Interiors: 1830-1950. Drew University, Fall 2009.

PROFESSIONAL AFFILIATIONS

- National Trust for Historic Preservation, Forum
- Society of Architectural Historians
- Vernacular Architecture Forum
- Preservation Alumni, Columbia University
- Preservation League of New York State
- Connecticut Trust for Historic Preservation
- Preservation New Jersey
- Preservation Pennsylvania
- Historic Review Commission, Village of Ossining, New York 2000-Present.
- Ossining Historical Society Museum, 1997-Present. President, 2003-2006; Vice President 2006-Present; Board of Trustees, 1997-Present.
- Village Historian, Village of Ossining, New York 2010-Present.

AWARDS

- Columbia University Historic Preservation Program, Outstanding Thesis Award, for *The Architecture of Calvin Pollard (1797-1850)*, 2003.
- Columbia University Preservation Alumni, Inc., Cleo and James Marston Fitch Thesis Grant, 2002.

PROFESSIONAL EXPERIENCE

Ms. Van Steen joined The Louis Berger Group, Inc., as an Architectural Historian in 2007. She has 10 years of professional experience providing an array of cultural resource management services to transportation agencies and municipal governments. She has provided historic preservation services for federal and state-funded transportation projects in New York and New Jersey in compliance with Section 106 of the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Section 14.09 of the New York State Historic Preservation Act of 1980, and New York's State Environmental Quality Review Act. These undertakings have ranged from small rehabilitation planning projects to large corridor studies and have required the documentation and evaluation of a wide variety of historic resources, including college campus, transportation, residential, agricultural, urban, and rural properties. She has managed architectural and cultural resource identification surveys and historical research, conducted determination of eligibility and project effects and impacts analyses, and prepared project documentation and HABS/HAER narrative reports. In addition, while serving on the Ossining Historical Society Museum's Board of Trustees, Ms. Van Steen wrote and administered several historic preservation grants for the conservation treatment of historic objects and buildings and a historic landscape report. She has also prepared educational materials, brochures, and pamphlets. Ms. Van Steen's major projects included those listed below.

- **Cultural Resource Services, Susquehanna to Roseland 500 kV Transmission Line, Luzerne, Lackawanna, Wayne, Pike, Monroe County, Pennsylvania and Warren, Sussex, Morris and Essex County, New Jersey**. Architectural Historian responsible for the implementation of the scope of services for the survey and evaluation of State and National Register eligibility of historic architectural resources adjacent to the 147-mile transmission line right-of-way which included areas of post World War II residential development, twentieth-century seasonal/recreational housing, farmsteads, state forest lands, and the National Park Service Delaware Water Gap National Recreation Area. For PPL Electric Utilities Corporation in Pennsylvania and PSE&G in New Jersey.

- **Cultural Resource Services, Louis Armstrong House Museum National Historic Landmark, Corona, Queens County, New York**. Evaluation of National Register eligibility of properties adjacent to project area and potential impacts to the Louis Armstrong House Museum, a National Historic Landmark, for proposed construction of new Visitors Center. For Dormitory Authority of the State of New York.

- **Cultural Resource Services, Goethals Bridge Replacement Project, Elizabeth, Union County, New Jersey, and Staten Island, Richmond County, New York**. Section 106 and NEPA compliance involving evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to bridge, assessment of adverse effects, and development of stipulations for Memorandum of Agreement. For United States Coast Guard and the Port Authority of New York and New Jersey.

- **Cultural Resource Services, Second Avenue Subway, Phase 1, New York, New York**. Identification and evaluation of National Register eligibility of historic architectural resources adjacent to the proposed station locations for Second Avenue Subway, from East 63rd to East 99th streets. For New York City Transit.

- **Church Cemetery, Addison Township, DuPage County, Illinois**. Forensic Genealogist. Compiled extensive descendant-based genealogies to locate unknown heirs and assisted in determination of next of kin for approximately 800 individuals interred at German church cemetery in Illinois. Applied methods consistent with professional guidelines, including the Genealogical Proof Standard, and prepared supporting documentation on a variety of litigation issues. Exhaustive research included analysis and interpretation of original German church baptism, marriage, and death records dating to the mid-nineteenth century to present day, census records, obituaries, newspaper articles, state death and marriage records, social security death indexes, cross-referenced major genealogical repositories, and reviewed private collections.

- **Cultural Resource Services, Garden State Parkway, Interchanges 9, 10, and 11, Middle Township, Cape May County, New Jersey**. Evaluation of State and National Register eligibility of and potential impacts for historic architectural resources adjacent to the Parkway and related cross streets. For New Jersey Turnpike Authority.

- **Cultural Resource Services, Broadway Triangle Rezoning Project, Williamsburg, Brooklyn, New York**. Survey of historic properties, evaluation of National Register and NYC Landmarks eligibility, and potential impacts for historic architectural resources adjacent to and/or in the proposed rezoning area. For New York City Department of Planning.

- **Cultural Resource Services, Gowanus Canal Corridor Rezoning Project, Gowanus, Brooklyn, New York**. Survey of historic properties, evaluation of National Register and NYC

Landmarks eligibility of and potential impacts for historic architectural resources adjacent to and/or in the proposed rezoning area. For New York City Department of Planning.

- **Cultural Resource Services, Dutch Kills Rezoning Project, Long Island City, Queens, New York**. Survey of historic properties, evaluation of National Register and NYC Landmarks eligibility of and potential impacts for historic architectural resources adjacent to and/or in the proposed rezoning area. For New York City Department of Planning.

- **Brooklyn College Performing Arts Center, Brooklyn, New York**. Evaluation of National Register eligibility of and completion of NYSOPRHP Historic Resource Inventory Form for Gershwin Hall and Whitman Theater. For the Dormitory Authority of the State of New York.

- **Cultural Resource Services, Lehman College New Science Facility, Environmental Review, Bronx, New York**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to proposed science building with emphasis on survey and evaluation of the (twentieth-century) college campus buildings. For the Dormitory Authority of the State of New York.

- **Cultural Resource Services, Fordham University New Residence Halls, Fordham University, Rose Hill Campus, Bronx, New York**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to and/or within the proposed project area. For the Dormitory Authority of the State of New York.

- **Cultural Resource Services, NJ Turnpike Widening Interchange 6-8A, Phase 1, Burlington, Mercer, and Middlesex Counties, New Jersey**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources and historic corridors adjacent to and/or crossing the Turnpike between Exits 6 and 8A. For the New Jersey Turnpike Authority.

- **Cultural Resource Eligibility/Effect Investigation, Two Bridges Road Bridge and West Belt Highway Extension, Townships of Wayne and Fairfield, Borough of Lincoln Park, Passaic, Essex, and Morris Counties, New Jersey**. Evaluation of National Register eligibility of historic architectural resources near the historic bridge over the Pompton River and related roadway improvements. For North Jersey Transportation and Planning Authority and New Jersey Department of Transportation.

- **Cultural Resource Constraints Technical Memo, Dinky Right-of-Way Route 1 BRT Project, Princeton Township, Princeton Borough, and West Windsor Township, Mercer County, New Jersey**. Provided summary of the potential cultural resource constraints identified in the Dinky right-of-way project area of the proposed Route 1 Bus Rapid Transit Project. Conducted field reconnaissance of historic architectural resources adjacent to the proposed BRT right-of-way. For New Jersey Transit.

- **Cultural Resource Services, Central Avenue Bridge Replacement, Phase 1, Rye, New York**. Evaluation of National Register eligibility of historic architectural resources adjacent to historic bridge over Blind Brook. For City of Rye.

- **Phase II Archaeological Investigation for Proposed Improvements to the Woodloch Intersection of SR590 and SR0408, Lackawanna Township, Pike County, Pennsylvania**. Architectural Historian responsible for the implementation of the scope of services for historic architectural resources, assessment of impacts, and evaluation of National Register eligibility of

the historic ruins of former mill with associated raceways, barn foundations, and extant farmhouse located in/adjacent to proposed project right-of-way. Produced Historic Resource Survey forms for Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation. For Pennsylvania Department of Transportation, Engineering District 4-0.

- **Cultural Resource Services for Proposed Replacement Fretz Road Bridge, Lower Salford Township, Montgomery County, Pennsylvania**. Produced Historic Resource Survey Forms for Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation. For Pennsylvania Department of Transportation, Engineering District 6-0.

- **Historic Resource Survey/Eligibility and Effect for Proposed Improvements to the SR171, Jail Hill, Borough of Lanesboro, Susquehanna County, Pennsylvania**. Architectural Historian responsible for the implementation of the scope of services for historic architectural resources, assessment of impacts, and evaluation of National Register eligibility for historic resources located in/adjacent to proposed project right-of-way. Produced Historic Resource Survey Forms for Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation. For Pennsylvania Department of Transportation, Engineering District 4-0.

- **Cultural Resource Services, Sentinel Pipeline Expansion Project, Cultural Resource Survey, New Jersey**. Evaluation of National Register eligibility of and potential impacts for historic architectural resources adjacent to the proposed metering station locations and pipeline expansion for pipeline in Bergen, Burlington, Mercer, Middlesex, Somerset, and Union counties. For Transcontinental Gas Pipe Line Corporation.

PAST PROFESSIONAL EXPERIENCE

Architectural Historian, Lynn Drobbin & Associates, Pelham, New York. Managed and conducted historic preservation compliance studies for federal and state-funded rail transportation projects in New York, New Jersey, and Pennsylvania. Prepared historic architectural resource background studies and effects assessments in compliance with federal and state historic preservation regulations. Identified and documented buildings, objects, structures, and districts as part of National and State Register eligibility determinations. Prepared HABS/HAER documentations. Selected projects included are listed below.

- **Northern Branch Corridor Rail Project, New Jersey**. Prepared Draft Environmental Impact Statement (DEIS) historic resource analysis and effects assessment. For New Jersey Transit.

- **Monmouth-Ocean-Middlesex Counties Rail Corridor Study, New Jersey**. Historic resource survey and eligibility analysis and preparation of DEIS chapters for planned restoration of rail service. For New Jersey Transit.

- **East 180th Street Station Rehabilitation, New York, New York**. Impacts analysis for rehabilitation of historic rail station listed in the National Register and adjacent subway station. For the New York City Transit, Metropolitan Transit Authority.

- **Metro-North Railroad Stations Assessment Project, Westchester, Bronx, and Dutchess counties, New York**. Identified and documented historic features of five railroad stations. For Metro-North Railroad, Metropolitan Transit Authority.

- **West Trenton Passenger Line Restoration, Mercer County, New Jersey**. Historic resource survey and eligibility analysis for proposed restoration of rail service. For New Jersey Transit.

- **Poughkeepsie Station Improvement Project, Dutchess County, New York**. Historic resource and effects analysis for Section 106 compliance review of historic rail station listed in the National Register. For Metro-North Railroad, Metropolitan Transit Authority.

- **Park Avenue Bridge Replacement Project, Mount Vernon, New York**. Historic research and documentation for historic bridge replacement and preparation of HAER report. For Metro-North Railroad, Metropolitan Transit Authority.

- **Lower Hack Vertical Lift Bridge Rehabilitation Project, Jersey City, New Jersey**. Effects assessment for rehabilitation of historic concrete and steel lift bridge. For New Jersey Transit.

- **Lackawanna Cutoff Passenger Restoration Project, New Jersey and Pennsylvania**. Field survey and historic resource eligibility analysis for proposed restoration of rail service. For New Jersey Transit.

- **Pelham Station Adaptive Reuse Project, Pelham, New York**. Assessment of project impacts for proposed alterations and improvements to historic railroad station. For Metro-North Railroad, Metropolitan Transit Authority.

Historian and Historic Preservation Consultant, Ossining, New York. Provided research on local properties through local land records, historical maps, newspapers, census records, photographs, early tax records, and genealogical information. Clients included Charles Lockwood, author of *Bricks and Brownstone*, expert and consultant on restoration of historic townhouse facades and interiors.

Teaching Assistant, Columbia University Graduate School of Architecture, Planning and Preservation. Assisted professor teaching "Architectural History Before 1876" graduate class. Planned and organized Lower Hudson Valley architectural field study.

Graduate Intern, Historic Districts Council (HDC), New York, New York. Researched and wrote additional text for new edition of Historic Districts Council's (New York City historic preservation advocacy agency) publication *Creating an Historic* District. Updated Certification of Appropriateness database. Previewed historic district applications prior to submittal for NYC Landmarks Preservation Commission review.

Sing Sing Prison Museum Committee, Ossining, New York. Committee formed as part of a planning initiative and feasibility study for a proposed Sing Sing Prison museum, to be located in the 1825 original cellblock (remains) and the WPA era power plant, both at the historic prison. Initial work included facility planning, marketing surveys, and tourism projections. The project, which is would be located in a fully operational correctional facility, offers a variety of planning, tourism, economic development, and historic preservation challenges.

Program Development Assistant, Ossining Heritage Area Tourism Committee, Ossining, New York. Partnered with Village and Town of Ossining to develop tourism initiative at Sing Sing Prison encompassing the riverfront, the downtown New York State Heritage Area, and historic portions of the downtown as portion of viable economic development plan. Plan proposed establishment of a museum facility at the prison in the original cell block (built 1825-1828) and former power plant.

Economic Development Assistant, The Alliance for Downtown Ossining (ADO), Ossining, New York. Organized and facilitated informational program emphasizing the benefits of historic preservation as a municipal economic revitalization tool. Identified historic preservation components of economic

development plan including historic districts, levels of preservation, sympathetic renovation, and historic building adaptive reuse. Outlined aesthetic and developmental aspects of the Crescent, Ossining's historic downtown area listed on the National Register. Produced educational brochure on Ossining's historic districts and buildings. Represented the ADO as advocate for economic growth, historic preservation, and increased pedestrian presence in the central business district.

PAPERS AND PRESENTATIONS

- "Early Chilmark Park" House & Garden Tour. Organized event, wrote tour booklet, and conducted tours, Ossining, New York, 2004.

- The Architecture of Calvin Pollard (1797-1850). Study of a prolific and little-known New York City architect in practice during the second quarter of the nineteenth century. Historic Preservation Thesis, Columbia University, 2003.

- Historic Homes Tour 2000. Photographed and presented photographic tour of Ossining's historic residences. The presentation included over 20 houses and featured building interiors and exteriors documenting Ossining's architectural styles from pre-Revolutionary era through 1920s Neoclassical revival. Ossining Historical Society and Ossining Public Library, 2000 and 2001.

- Downtown. Program on the historical development, growth and entrepreneurs of downtown Ossining during the nineteenth and early twentieth centuries. Ossining Historical Society, 2000.

- Architectural Treasures. In *Images of America: Ossining Remembered*, edited by Carl Oechsner. Arcadia, Charleston, 1999 (reprinted 2006). Overview of mansions and estates of Ossining in the nineteenth century.

- Ossining, New York: Journey from Urban Renewal to Historic Preservation. Pace University, 1998.

- Historic Destinations & Tourism of the Hudson River Town of Westchester. Pace University, 1998.

- S. Marvin McCord, Ossining Architect. Pace University, 1997.

ZACHARY J. DAVIS
The Louis Berger Group, Inc.
Principal Archaeologist

EDUCATION

- Interdepartmental Doctoral Program in Anthropological Science, State University of New York at Stony Brook, 2000-2005.
- M.A., Anthropology, State University of New York at Stony Brook, 2000.
- M.A., Archaeology, Institute of Archaeology, University of London, 1994.
- B.A., Archaeological Studies, Boston University, 1993.

PROFESSIONAL REGISTRATIONS

- Register of Professional Archaeologists (RPA)

TECHNICAL TRAINING

- 8-hour refresher for Hazardous Waste Operations and Emergency Response, Emilcott Associates, Inc., October 3, 2008.
- Cultural Resources Best Practices Workshop, 7-Hour Training Program, New Jersey Historic Preservation Office, October 27, 2006.
- 40-Hour H&S for Hazardous Waste Operations and Emergency Response meeting the training requirements of 29 CFR 1910.120. Emilcott Associates, Inc., March 15, 2004.
- Trenching and Excavation Safety—OSHA Construction Industry Standards, Subpart P (29 CFR 1926.650-652). Emilcott Associates, Inc., February 19, 2004.
- Introduction to Section 106 Review (Ralston Cox, instructor), February 20-21, 2002.
- Introduction to GPS using the Trimble Pro XR (Mike Popoloski, instructor), March 19, 2001.

PROFESSIONAL AFFILIATIONS

- Society for American Archaeology
- Millburn-Short Hills Historical Society

PROFESSIONAL EXPERIENCE

Mr. Davis's background includes archaeological investigations at prehistoric sites dating to the Paleoindian through the Late Woodland periods and historic sites dating to the seventeenth century through the early twentieth century. As a Principal Archaeologist he is responsible for client interaction, preparation of innovative research designs, and overall technical supervision and implementation of research and field projects. He also prepares technical reports and agreement documents in compliance with Section 106 of the National Historic Preservation Act (1966), Section 4(f) of the Department of Transportation Act of 1966, and state and local regulations for projects in the metropolitan New York City area and the Northeast and Middle Atlantic. In addition, Mr. Davis has extensive experience with lithic material analysis and Geographic Information Systems database development and analysis for cultural resources. Since joining Berger, Mr. Davis's major projects include the following.

- **Cultural Resource Services, Second Avenue Subway, Phase 1, New York, New York**. Oversight and **c**oordination of cultural resource compliance for final design and construction of Phase 1 of the Second Avenue Subway, from East 63rd to East 99th streets. Responsible for drafting the archaeological field testing plans, archaeological monitoring, and implementing archaeological

fieldwork in advance of and during construction. Coordinated historic architectural resource evaluations of properties adjacent to the proposed ancillary structures associated with the new subway station. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Gowanus Canal Corridor Rezoning, Brooklyn, New York**. Project Manager for the proposed rezoning of a 24-block area located along the Gowanus Canal in Brooklyn. Rezoning was designed to implement a mixed-use district to support a wide range of uses, both residential and commercial. Research was conducted on the ownership and occupation history of 16 lots, with the documentary study finding that each of the lots or portions of each had the potential to contain intact archaeological deposits associated with the residential occupancy of the lots and/or the historic construction of the Gowanus Canal bulkhead, part of the National Register-eligible Gowanus Canal Historic District. Of the properties identified and evaluated as part of this study, 12 individual properties were recommended as eligible for listing in the State and National Registers. For the New York City Department of City Planning.

- **Phase I/II Cultural Resource Assessment, Armed Forces Reserve Center and Implementation of BRAC 05 Realignment Actions, Preferred Site & Alternative 2 Site, Gloucester and Winslow Townships, Camden County, New Jersey**. Project Manager for cultural resource investigations associated with the construction of a new AFRC facility in Camden County. Assessment included background and archival research, an architectural survey, a pedestrian reconnaissance, and a systematic subsurface archaeological survey within the proposed areas of potential effects, yielding two previously unidentified archaeological sites, with one determined eligible for listing in the National Register. For the United States Department of the Army, 99th Regional Support Command.

- **Phase I Archaeological Assessment, GSA Leased Office Space, City of Oswego, Oswego County, New York**. Project Manager for an archaeological investigation of a new Social Security Administration building to be constructed in the City of Oswego. Assessment included background and archival research and a pedestrian reconnaissance of the area of potential effect. For the United States General Services Administration.

- **Phase IA Cultural Resource Assessment, Broadway Triangle Redevelopment Project, Williamsburg, Brooklyn, New York**. Project Manager for the proposed rezoning of a nine-block area located in the Williamsburg area of Brooklyn. Rezoning was designed to implement a mixed-use district to support a wide range of uses, both residential and commercial. Research was conducted on the ownership and occupation history of the rezoning area. The project was found to have no effect on archaeological resources. Of the properties identified and evaluated as part of this study, five were recommended as eligible for listing in the State and National Registers. For the New York City Department of Housing Preservation and Development.

- **Phase IA Cultural Resource Assessment, Newark Liberty International Airport, Redevelopment and Modernization of Terminal A, Elizabeth, Union County and Newark, Essex County, New Jersey**. Project Manager for a cultural resource assessment of proposed improvements to Terminal A at Newark Liberty International Airport. Assessment included determination of archaeological resource potential and historic architectural resources within view of the project's area of potential effect. For the Port Authority of New York and New Jersey.

- **Cultural Resource Eligibility/Effects, Improvements to County Route 571, Princeton/Hightstown Road, Princeton Junction, Mercer County, New Jersey**. Project Manager

for completing the eligibility/effects documentation for proposed improvements to County Route 571. Tasks included determination of the project's archaeological resource potential, evaluation of the presence/absence of archaeological resources, and a survey of the historic architectural resources within view of the project's area of potential effect. For the Delaware Valley Regional Planning Commission.

- **Phase IA Cultural Resource Assessment, Fordham University New Residence Halls, Fordham University Rose Hill Campus, Bronx, New York**. Project Manager for a cultural resource assessment of new residence halls to be located on the southwest portion of the Fordham University campus in the Bronx. For the Dormitory Authority of the State of New York on behalf of Fordham University.

- **Archaeological Documentation, Hudson River Bulkhead, World Trade Center PATH Terminal, New York City**. Project Manager for the documentation of the late nineteenth-century Hudson River Bulkhead located underneath the West Side Highway and within the footprint of the proposed underground pedestrian connector between the new WTC PATH station and the World Financial Center. Tasks included monitoring construction activities and documenting the extent, nature, and design of the Hudson River Bulkhead within the project area. For the Port Authority of New York and New Jersey.

- **Phase IA Archaeological Assessment, Proposed Vent Plants, West 53rd and 55th Streets and Eighth Avenue, New York, New York**. Project Manager for an archaeological resource assessment of two proposed vent plant installations, located in midtown Manhattan. Employed GIS technology to georeference historic maps to trace potential historic archaeological resources within the project area and utilized historic elevation survey data to determine extent of disturbance from construction of Eighth Avenue in the early nineteenth century. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Dutch Kills Rezoning, Queens, New York**. Project Manager for the proposed rezoning of a 40-block area adjacent to the Sunnyside Yards and north of Queens Plaza and Long Island City. Rezoning was designed to implement mixed-use and contextual zoning districts to support the wide range of uses found in Dutch Kills. Research was conducted on the ownership and occupation history of the five lots, with the documentary study finding that each of the five lots or portions of each had the potential for intact archaeological deposits. Of the properties identified and evaluated as part of this study, 10 individual properties and one historic district were recommended as eligible for listing in the State and National Registers. Three of these properties were also recommended as New York City Landmark-eligible. For the New York City Department of City Planning.

- **Phase IA/IB Cultural Resource Assessment, Beacon Institute for Rivers and Estuaries, Beacon, New York**. Project Manager for Phase IA archaeological assessment and limited Phase IB archaeological field survey of the proposed location for the Center for Advanced Environmental Technology, positioned on the remnants of a nineteenth- and twentieth-century historic brick work. Study involved historical and cartographic research, identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For the Dormitory Authority of the State of New York and the New York State Office of Parks, Recreation and Historic Preservation on behalf of the Beacon Institute for Rivers and Estuaries.

- **Phase IA Cultural Resource Assessment, Proposed New Primary/Intermediate School at PS/IS 48, William Wordsworth School, Queens, New York**. Project Manager for the cultural resource assessment of a new primary/intermediary school adjacent to a historic school building. For the New York City School Construction Authority.

- **Cultural Resource Constraints Technical Memo, Dinky Right-of-Way Route 1 BRT Project, Princeton Township, Princeton Borough, and West Windsor Township, Mercer County, New Jersey**. Project manager for a study to identify potential cultural resource constraints within the Dinky right-of-way project area of the proposed Route 1 Bus Rapid Transit Project, between Princeton University and Princeton Junction. For New Jersey Transit.

- **Phase IA Cultural Resource Assessment, Replacement of the Central Avenue Bridge over Blind Brook, Rye, New York**. Project manager for cultural resource assessment of project area, including background research, on-site evaluation, limited field testing and historic architectural survey and evaluation of the bridge and surrounding area. For the City of Rye, New York.

- **Phase IA/IB Archaeological Investigation, Southern Water Pollution Control Facility Expansion Project, Stafford Township, New Jersey**. Project manager for an archaeological assessment and subsurface survey conducted for compliance with the environmental approvals required for a loan application submitted to the New Jersey Department of Environmental Protection Environmental Infrastructure Trust. This study involved historical and contextual background research, archaeological site file and historic property searches at the New Jersey State Museum and the New Jersey Historic Preservation Office, as well as a pedestrian reconnaissance and a subsurface survey. For the Ocean County Utilities Authority.

- **Cultural Resources Eligibility/Effects, Garden State Parkway, Interchange 10 Improvements, Cape May Court House, New Jersey**. Project manager for cultural resource services associated with the environmental compliance to design three new interchanges targeted at eliminating signalized intersections on the National Register eligible Garden State Parkway in Cape May County. This study involved background research, field efforts to identify the presence/absence of archaeological resources, recommendation of five previously unidentified archaeological sites as eligible for listing in the National Register and survey of historic architectural resources within the view of the proposed project. For the New Jersey Turnpike Authority.

- **Phase IA Cultural Resource Assessment, Lehman College New Science Facility Project, Lehman College, Bronx, New York**. Project Manager for the cultural resource assessment conducted for the proposed construction of a new science facility at the Lehman College Campus in Bronx, New York. For the Dormitory Authority of the State of New York.

- **Phase IA Cultural Resource Assessment, Proposed Oak Point Detention Facility, Block 2604, Lot 174, Bronx, New York**. Project Manager for Phase IA archaeological assessment of a late nineteenth- to early twentieth-century rail yard, reviewed under CEQR. This study involved historic and cartographic research, the identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For the New York City Department of Corrections.

- **Phase I Archaeological Investigation, Stream Restoration and Related Work in the Sweet Brook Bluebelt, Annadale, Staten Island, New York**. Project Manager for archaeological

investigations in advance of the restoration and alteration of two sites along the Sweet Brook Bluebelt and its associated wetlands in Annadale, Staten Island, New York. For the JRC Construction Corporation.

- **Phase IB Archaeological Survey, Eagle Academy for Young Men, Block 2923, Lots 17, 23, and 26, Bronx, New York**. Project Manager for archaeological field testing at a proposed New York City school location in the Tremont section of the Bronx. Excavations identified, evaluated, and mitigated a buried historic trash scatter and bottle dump feature dating to the early to mid-twentieth century. For the New York City School Construction Authority.

- **Phase IA Cultural Resource Assessment, Burlington Sod Farm, Springfield Township, Burlington County, New Jersey**. Project Manager for a Phase IA cultural resource assessment of a 640-acre agricultural property slated to become a new county fairgrounds. This study involved historic and cartographic research, the identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For the Freeholders of Burlington County.

- **Combined Phase IA/IB Archaeological Assessment, Alcan Aluminum Corporation Focused Remedial Investigation Project, Oswego County, New York**. Project Manager for a combined Phase IA archaeological assessment and Phase IB archaeological field survey under SEQRA for the Alcan Facility prior to the execution of a project designed to mitigate contaminated soils. For ARCADIS/BBL.

- **Phase IB Archaeological Survey, Jamaica Avenue School, Block 4102, Lots 19, 27, 33, 35 and 36**, **Cypress Hills, Brooklyn, Kings County, New York**. Project Manager for archaeological trenching at a proposed New York City school location in the Cypress Hills section of Brooklyn. Excavations identified, evaluated, and mitigated extensive backyard deposits dating to the late nineteenth through early twentieth centuries. For the New York City School Construction Authority.

- **Phase IA Cultural Resource Assessment, Proposed Eagle Academy for Young Men, East 176th Street, Block 2923, Lots 17, 23, and 26, Bronx, New York.** Project Manager for a Phase IA archaeological assessment for a proposed school building in Bronx, New York. This study involved historic and cartographic research, identification and analysis of past disturbances and/or prior settlement and land use, and the assessment of the property regarding its potential to contain historic and/or prehistoric archaeological resources. For New York City School Construction Authority.

- **Phase IB Archaeological Survey, Rockaway Boulevard Site, Rockaway Boulevard and Nassau Expressway, Block 14260, Lot 1, Jamaica, Queens County, New York**. Principal Investigator for an archaeological survey of a proposed New York City Transit Bus parking facility, located adjacent to JFK International Airport. Survey consisted of excavation of shovel tests across the project area. For New York City Transit.

- **Phase IA Cultural Resource Assessment, CCNY/ASRC Science Facility Project, City College of New York Campus, New York, New York**. Project Manager and lead researcher for an archaeological assessment and historic architectural survey of the proposed location for the Advanced Science Research Center Facility Project for the City College of New York. Study involved historic and cartographic research, the identification and analysis of past disturbances and/or prior settlement and land use, use of GIS technology to locate the proposed plans on historical maps, and the

assessment of the project's potential effect on historic properties. Identified the potential location of a nineteenth-century burial vault within the proposed project area. For the Dormitory Authority of the State of New York.

- **Phase IB Archaeological Survey, World Trade Center PATH Terminal, New York City**. Project Manager for archaeological investigations in advance of construction of the new WTC PATH Terminal. Coordinated excavation of a 170-foot-long trench to 15 feet below the surface, following OSHA safety regulations. Identified, evaluated for National Register eligibility, and mitigated late eighteenth- and early nineteenth-century backyard residential archaeological features. For the Port Authority of New York and New Jersey.

- **Phase IA Archaeological Assessment, Rockaway Boulevard Site, Rockaway Boulevard and Nassau Expressway, Block 14260, Lot 1, Jamaica, Queens County, New York**. Principal Investigator for an archaeological resource assessment of a proposed New York City Transit Bus parking facility, located adjacent to JFK International Airport. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Phase I Cultural Resource Assessment, Trenton-Morrisville Toll Bridge Rehabilitation and One Auxiliary Northbound Lane, Morrisville, Pennsylvania, and Trenton, New Jersey**. Project Manager for a cultural resource assessment of improvements to interchanges and the Trenton-Morrisville Toll Bridge spanning the Delaware River. Study involved archaeological assessment of proposed ground disturbance and historic architectural assessment of proposed interchange improvements to local structures, including the National Historic Landmark Delaware Division of the Pennsylvania Canal. For the Delaware River Joint Toll Bridge Commission.

- **Archaeological Monitoring, Condominiums at Cooke Mill, Market and Jersey Streets, Block H0850, Lot 21, City of Paterson, Passaic County, New Jersey**. Principal Investigator for an archaeological monitoring project at the former location of the Cooke Locomotive and Machine Works, which manufactured locomotives from 1852 until 1926. For Silk Mills Ventures, LLC and the City of Paterson Historic Preservation Commission.

- **Phase IA Cultural Resource Assessment, New Stapleton Waterfront Plan, Staten Island, New York**. Project Manager for the cultural resource assessment of a mixed-use development and 12-acre park on the site of the former Navy Homeport in the Stapleton community of Staten Island. Historical deed research was conducted for 11 development parcels, all of which lacked potential for deposits of residential archaeological resources. Analysis of the historic shoreline evolution revealed five locations with the potential to contain historic archaeological resources associated with the waterfront development in the nineteenth century. One historic architectural resource was found to meet eligibility criteria. For the New York City Economic Development Corporation.

- **Replacement/Rehabilitation of the Kosciuszko Bridge, Brooklyn-Queens Expressway (I-278), Queens and Kings Counties, New York**. Provided archaeological consultation services, including the review of previously completed cultural resource documentation, assisted with the preparation of the scope of work for the Phase IB archaeological field testing, and reviewed the archaeological work plan. Conducted as part of an environmental impact statement, enabling the client to meet its requirements under Section 106 of the *National Historic Preservation Act* and Section 4(f) of the *National Transportation Act*. For New York State Department of Transportation.

- **Phase IA Archaeological Assessment, Jamaica Avenue School, Block 4102, Lots 19, 27, 33, 35 and 36**, **Cypress Hills, Brooklyn, Kings County, New York**. Principal Investigator for an archaeological resource assessment of a proposed New York City school location in the Cypress Hills section of Brooklyn. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For the New York City School Construction Authority.

- **Phase IA Archaeological Assessment, Remedial Options Pilot Study, Grasse River Study Area, Alcoa-Massena, Massena, New York**. Principal Investigator for the Phase IA archaeological assessment of an early twentieth-century Alcoa fabricating, ingot, and extrusion and smelting plant under the jurisdiction of the U.S. EPA as a Superfund Site. Study involved the research and analysis of past disturbances and potential for historic archaeological resources associated with the industrial use of the project area. For Blasland, Bouck and Lee, Inc.

- **Phase IA Archaeological Assessment, Proposed Ventilation Fan Plant Rehabilitation,, West 30th Street and Sixth Avenue, New York, New York**. Project manager for an archaeological resource assessment of a proposed vent plant rehabilitation project servicing four NYCT subway lines. The archaeological assessment evaluated the proposed project's potential to adversely affect previously undisturbed archaeological deposits. After consulting historical maps and the present-day mapping of the subway line and utilities, it was determined that the project's area of potential effect lacked archaeological potential because of the disturbances created by the utilities within the sidewalks and streetbeds of West 30th Street and 6th Avenue. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Contextual Study, 153rd Street Pedestrian Bridge Access at Fort Washington Park, Manhattan, New York**. Served as Principal Investigator to assist with the completion of the required environmental documentation for a new pedestrian bridge to provide access from Riverside Drive and 151st Street to Fort Washington Park, crossing over rail lines and the Henry Hudson Parkway (Route 9A). As part of the environmental documentation, a contextual study of the project area was completed, which included an inventory of all historic properties listed and eligible for listing in the state and national registers. For New York State Department of Transportation.

- **Phase IA Archaeological Assessment, Hebrew Academy of Brooklyn/Yeshiva R'tzahd, 965 East 107th Street, Block 8215, Lots 12 and 21, Brooklyn, Kings County, New York**. Principal Investigator for an archaeological resource assessment of a proposed New York City school location in the Canarsie section of Brooklyn. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For the New York City School Construction Authority.

- **Phase I Archaeological Survey, Mount Vernon Avenue Bridge, Chatham, Morris County, Summit, Union County, New Jersey**. Project manager for Phase I archaeological assessment of the proposed replacement for the Mount Vernon Avenue Bridge spanning the Passaic River between the Township of Chatham and the City of Summit. Involved assessing the project's potential to affect archaeological resources adjacent to the existing bridge, constructed in 1906, and archaeological fieldwork to document the presence/absence of archaeological resources. No archaeological deposits were identified within the project's area of potential effect. For the County of Morris, Department of Public Works, and the County of Union, Department of Public Works.

- **Phase IA Cultural Resource Assessment, East Orange Demonstration Project, Pre-K to 12th Grade School for the Performing Arts, City of East Orange, Essex County, New Jersey**. Principal Investigator for a cultural resource assessment of a proposed new school to be constructed at the present location of the circa 1910 East Orange High School. Determined the project's potential to affect potential archaeological resources and coordinated the determination of the East Orange High School's National Register eligibility and the recordation of the school prior to demolition. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Archaeological Assessment, Proposed Vent Plant Installation, West 21st Street and Sixth Avenue, New York, New York**. Principal Investigator for an archaeological resource assessment of a proposed vent plant installation, located in Chelsea. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Proposed Oakwood Avenue Elementary School Addition, City of Orange, Essex County, New Jersey**. As part of the E.O. 215 process, served as the Principal Investigator for a cultural resource assessment of an addition to the existing circa 1888 Oakwood Avenue School. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment, Harlem Hospital Center Modernization, New York, New York**. Project manager for the cultural resource assessment of the proposed modernization project for Harlem Hospital. Project included archaeological assessment of the project's area of potential effect and the historic architectural evaluation of the surrounding area and the preservation, removal, storage, and adaptive reuse of five Works Progress Administration (WPA)-commissioned murals within buildings slated for demolition. For the Dormitory Authority of the State of New York and the New York City Health and Hospitals Corporation.

- **Phase IA Cultural Resource Assessment, Proposed Peshine Avenue School, Elementary School Replacement, City of Newark, Essex County, New Jersey**. Principal Investigator for a cultural resource assessment of a proposed new school to be constructed at the present location of the circa 1911 Peshine Avenue Elementary School. Determined the project's potential to affect potential archaeological resources through the use of GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Cultural Resource Screening, PATH to Newark Airport, Preliminary Design, Newark, New Jersey**. Project Manager for a cultural resource screening to identify previously documented historic properties within the corridor between Newark Penn Station and Newark Liberty International Airport. For the Port Authority of New York and New Jersey.

- **Phase IA Archaeological Assessment, Hudson Yards/Number 7 Subway Line Extension, New York, New York**. Assisted with the analysis of archaeological resource potential for 39 lots on the west side of Manhattan and determined the potential effect of alternatives on cultural resources. For New York City Department of City Planning and New York City Transit.

- **Phase IB Archaeological Survey, Proposed Vent Plant Installation, Chrystie and Stanton Streets, New York, New York**. Principal Investigator for an archaeological survey consisting of a backhoe trench excavated to assess the presence or absence of late nineteenth- and early twentieth-century front yard archaeological resources. For New York City Transit.

- **Phase IA Cultural Resource Assessment, Proposed Grove Street Elementary School Replacement, City of Irvington, Essex County, New Jersey**. As part of the E.O. 215 process, served as the Principal Investigator for a cultural resource assessment of a proposed new elementary school to be constructed within an existing residential neighborhood. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Cultural Resource Assessment, Proposed Burnet-Warren Elementary School Replacement, City of Newark, Essex County, New Jersey**. As part of the E.O. 215 process, served as Principal Investigator for a cultural resource assessment of a proposed new elementary school to be constructed within the limits of the James Street Commons Historic District, a National Register listed historic district. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Cultural Resource Eligibility/Effects Investigations for the Proposed Tuckahoe Road (C.R. 557) Bridge Over Cape May Branch Rail Line Replacement, Atlantic County, New Jersey**. Principal Investigator for Section 106 compliance activities for NJDOT's proposed improvements to the Tuckahoe Road Bridge. Project involved subsurface archaeological investigation and historic architectural survey within the area of potential effect (APE). The architectural survey indicated that the Tuckahoe Road Bridge had previously been determined not eligible for inclusion in the National Register of Historic Places. The Cape May Rail Line, also located within the APE, was determined to be potentially eligible for inclusion in the National Register as a historic district owing to its role in the development of New Jersey's rail transportation system and in the growth of the state's seashore tourist resort communities. Based on the review of project plans, Berger concluded that the proposed bridge replacement project would not have an adverse effect on the National Register eligible Cape May Branch Rail Line.

- **Phase IA Archaeological Assessment, Proposed Fan Plant Rehabilitation, 52nd Street and Sixth Avenue, New York, New York**. Principal Investigator for an archaeological resource assessment of a proposed fan plant rehabilitation, located in midtown Manhattan. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **New Embassy Compound, Baghdad, Iraq**. Research assistant for cultural resource investigations associated with construction of a new embassy compound in Baghdad, Iraq. Tasks included securing historical maps of Baghdad, georeferencing historical maps to modern mapping, and drafting portions of the report's historic background section. For the U.S. Department of State, Overseas Buildings Operation.

- **Cultural Resource Screening, Proposed Middle School Replacement, City of Irvington, Essex County, New Jersey**. As part of the Environmental Assessment process, served as the Principal Investigator for a cultural resource assessment of a proposed new elementary school to be constructed

within an existing residential neighborhood. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New Jersey School Construction Corporation.

- **Phase IA Archaeological Assessment, New South Ferry Terminal, New York, New York**. Responsible for the archaeological resource assessment of a proposed subway terminal project in Battery Park. Required extensive cartographic research documenting the historic evolution of the Lower Manhattan shoreline. Employed GIS technology to georeference numerous historical maps in order to trace potential historic archaeological resources within the project area. Coordinated review with New York City Landmarks Commission and New York State Office of Parks, Recreation and Historic Preservation. Drafted portions of the Memorandum of Agreement and the entirety of the Archaeological Resource Management Plan to be enacted during construction. For New York City Transit.

- **Phase IA Archaeological Assessment, Proposed Fulton Street Transit Center, Fulton Street and Broadway, New York, New York**. Principal Investigator for an archaeological resource assessment of the proposed downtown transit facility, located at Fulton Street and Broadway. Reviewed historic maps and documents and summarized past disturbances to the project area to calculate the project area's potential for archaeological resources. Drafted portions of the project's Programmatic Agreement. For New York City Transit.

- **Phase IA Archaeological Assessment, Proposed Fan Plant Rehabilitation, Lafayette and Flatbush Avenues, Brooklyn, New York**. Principal Investigator for an archaeological resource assessment of a proposed fan plant rehabilitation, located in Fort Green, Brooklyn. Employed GIS technology to georeference historical maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Triborough Bridge Rehabilitation Project, Randall's and Ward's Islands, New York, New York**. Principal Investigator. A strong possibility for human burials from the Manhattan Psychiatric Center necessitated archaeological monitoring by an RPA-certified archaeologist during all geotechnical borings for the project. Fieldwork included the observation of soil stratigraphy, inspection for human remains, and recordation of archaeological materials. No human remains were identified during the testing, however; specifications related to archaeological issues and the potential for human remains were drafted and incorporated into the bid documents for the construction contracts.

- **Cultural Resource Constraints, Louise Nevelson Plaza Redesign, William Street, Maiden Lane and Gold Street, New York, New York**. Project manager for the preparation of cultural resource screening report to identify previously documented historic resources within the proximity of the proposed project and assessment of archaeological potential within the proposed project's area of potential effect. For the Lower Manhattan Development Corporation.

- **Phase IA Archaeological Assessment, Proposed Vent Plant Installation, Chrystie and Stanton Streets, New York, New York**. Principal Investigator for an archaeological resource assessment of a proposed vent plant installation, located on Manhattan's Lower East Side. Employed GIS technology to georeference historic maps to trace potential historic archaeological resources within the project area. For New York City Transit.

- **Phase IB Archaeological Survey, SUNY College at Purchase, New Residence Hall, Purchase, New York**. Principal Investigator for an archaeological field survey of a 2-acre parcel slated for development as new residence halls. Limited archaeological testing revealed the absence of potential culture-bearing soil horizons in highly disturbed locations. For the Dormitory Authority of the State of New York.

- **Phase IA Archaeological Assessment, Niagara Mohawk, Hudson (Water Street) Site, City of Hudson, New York**. Principal Investigator for the Phase IA archaeological assessment of a late nineteenth-/early twentieth-century coal-to-gas generating facility located on the banks of the Hudson River. Study involves the research and analysis of past disturbances and potential for historic archaeological resources associated with the industrial use of the project area. For Blasland, Bouck and Lee, Inc.

- **Phase I Archaeological Investigation, Sweet Brook Drainage Area, Carlton Boulevard, Annadale, Staten Island, New York**. Principal Investigator for a Phase I archaeological survey for sewage installation project along the Sweet Brook in southern Staten Island. For JRC Construction Corporation at the request of NYC DEP.

- **Phase I Archaeological Survey, Luzerne County Road No. 9, Jackson, Lehman, and Dallas Townships, Luzerne County, Pennsylvania**. Documented the results of a previously conducted road-way survey, located along Luzerne County Road 9, designed to assess the project's potential impact on late historic period archaeological deposits. For Pennsylvania Department of Transportation Engineering District 4-0.

- **Cultural Resource Constraints Assessment, Route 9 and Garden State Parkway, Cape May County, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the South Jersey Transportation Planning Organization.

- **Stage IA Archaeological Assessment, Cross Harbor Freight Improvement Project, Greenville Yards, Jersey City, New Jersey**. Co-Principal Investigator for the Phase IA archaeological assessment of the Greenville Yard. Study involved the research and analysis of past disturbances and potential for prehistoric and historic period resources. For Allee King Rosen & Fleming, Inc. in association with New York City Economic Development Corporation (NYCEDC).

- **Cultural Resource Constraints Assessment, Route 17, Bergen County, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the North Jersey Transportation Planning Organization.

- **Cultural Resource Constraints Assessment, Route 22, Essex and Union Counties, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the North Jersey Transportation Planning Organization.

- **Cultural Resource Constraints Assessment, Route 57 , Warren County, New Jersey**. Conducted background research on archaeological and historic architectural resources within the project

corridor. Prepared GIS files for cultural resources and summary cultural resource assessment of the project corridor. For the North Jersey Transportation Planning Organization.

- **Phase IA Archaeological Assessment, East 126th Street Bus Garage, New York, New York**. Responsible for the archaeological and architectural site file review at New York City Landmarks Commission (LPC), background research, and archaeological assessment for the half-block project area. For New York City Transit.

- **Cultural Resource Eligibility/Effects Documentation for Final Scope Development of Routes 1 and 9 at North Avenue, City of Elizabeth, New Jersey**. Principal Investigator for the identification and evaluation of archaeological resources (Phase I/II) and historic architectural properties (eligibility/effect) within the proposed project area for roadway improvements. Also conducted all background research and prepared archaeological report. For the New Jersey Department of Transportation.

- **Hudson Energy Project, Hudson River Bulkhead at Pier 92, Manhattan, New York**. Responsible for the archaeological and architectural site file review at New York City Landmarks Commission (LPC), background research, and field inspection of the study area from the bulkhead at Pier 92 to the ConEd substation at West 94th Street in Manhattan. For Genpower Hudson Energy.

- **New Jersey Cellular Telecommunications**. Principal Investigator for several Phase IA Archaeological Assessments and Historic Architectural Resource assessments for proposed Nextel cell tower installation in Essex, Berger, Morris, Sussex, Warren, Hunterdon, Somerset, Middlesex, and Monmouth counties. For IVI Environmental, Inc.

- **La Tourette Park, Staten Island, New York**. Principal Investigator for a Historic Architectural Resource assessment of a proposed Omnipoint cell tower installation in Richmond County, New York. For Goodkind and O'Dea, Inc.

- **U.P.N. Pallet Co. Cell Tower, Penns Grove, New Jersey**. Principal Investigator for a Phase IB archaeological assessment of a proposed AT&T cell tower installation in Salem County, New Jersey. For Rescom Environmental Corporation.

- **Clayton Cell Tower, Clayton, New Jersey**. Principal Investigator for a Phase IB archaeological assessment of a proposed AT&T cell tower installation in Gloucester County, New Jersey. For Rescom Environmental Corporation.

- **Peach County Cell Tower, Mantua, New Jersey**. Principal Investigator for a Phase IB archaeological assessment of a proposed AT&T cell tower installation in Gloucester County, New Jersey. For Rescom Environmental Corporation.

- **P.S. 234-Q, Long Island City, Queens, New York**. Principal Investigator for a Phase IB archaeological assessment for a proposed New York City public school in Astoria, Queens. For Parsons Brinckerhoff, Inc and the New York City School Construction Authority.

- **Arthur Kill Road Bus Maintenance Facility, Staten Island, New York**. Principal Investigator for a Phase IB archaeological survey for prehistoric and historic resources. For New York City Transit.

- **Arbutus Avenue Sewer Project, Staten Island, New York**. Principal Investigator for a Phase I archaeological survey for sewage installation project along the Arbutus Creek. For JRC Construction Corporation.

- **Two Bridges Road Bridge, Lincoln Park, Wayne and Fairfield, New Jersey**. Principal Investigator for cultural resource screening of archaeological and historic architectural properties, including five known prehistoric Native American sites, several historic residences predating 1950, and the 1887 National Register-eligible steel truss bridge. Project involved assessing archaeological sensitivity for the area surrounding the confluence of the Passaic and Pompton rivers. For the County of Passaic.

- **Interchange 142 (Garden State Parkway and I-78), Hillside, Irvington, and Union, New Jersey**. Principal Investigator for a Phase IB archaeological survey along the Garden State Parkway at Exit 142, straddling the Union/Essex County line. For the New Jersey Highway Authority.

- **Interchange 142 (Garden State Parkway and I-78), Hillside, Irvington, and Union, New Jersey**. Contributed to the Historic Architectural Evaluation with background research on and evaluation of the Elizabeth River Park, a National Register-eligible park in Union County. For the New Jersey Highway Authority.

PREVIOUS PROFESSIONAL EXPERIENCE

- **Calverton Naval Weapons Industrial Reserve, Calverton, New York**. Geographic Information Systems analyst. Integrated GIS analysis with lithic analysis to interpret prehistoric activity patterns.

- **PS 56R Site, Staten Island, New York**. Lab Director. Analysis, curation, and data entry for cultural material derived from the mitigation of a primarily Late Archaic prehistoric site.

- **Calverton Naval Weapons Industrial Reserve, Calverton, New York**. Field Supervisor. Cultural resource survey of 6,000-acre parcel with several early to mid-twentieth-century buildings and several Late Archaic and Late Woodland prehistoric sites.

- **Russian Mission, Bronx, New York**. Lithic Analyst. Cultural resource survey of a Late Archaic/Woodland quartz quarry site.

- **Long Island College Hospital, Brooklyn, New York**. Excavator. Monitoring heavy machine excavation of eighteenth-, nineteenth-, and twentieth-century historical archaeological deposits for the construction of a parking garage along Atlantic Avenue.

- **Robin's Island, Southold, New York**. Field Supervisor and Lithic Analyst. Survey of 450-acre island located in the Peconic Bay, revealing several prehistoric and historic sites.

- **Hudson Valley Rod & Gun Club, Pawling, New York**. Excavator. Mitigation of a Middle and Late Archaic prehistoric site.

- **Umm el Tlel, Syria**. Excavator. Long-term excavations of an open-air site containing cultural material from the terminal Lower Palaeolithic, through the Middle, Upper, and Epi-Palaeolithic, to the Neolithic.

- **Abri Castanet, Sergeac (Perígord), France**. Excavator. Long-term excavations of an early Upper Palaeolithic rockshelter in the southwest of France.

- **Le col de Jiboui, Haut-Diois (Drôme), France**. Excavator. Salvage excavations of an open-air Middle Palaeolithic site in the French Alps.

- **Fouilles Préhistoriques à Cagny, Cagny (Nord), France**. Excavator. Excavation of two open-air Lower Palaeolithic sites located in northern France.

- **African Meeting House, Nantucket, Massachusetts**. Excavator. Assisted with the excavation and interpretation of archaeological deposits surrounding this early nineteenth-century structure, the second constructed African Meeting House in America. Supervisor: Mary Beaudry, Boston University.

- **Spencer-Pierce-Little Farm, Newbury, Massachusetts**. Excavator. Boston University archaeological field school at a late seventeenth-century homestead. Supervisor: Mary Beaudry, Boston University.

ACADEMIC POSITIONS

Graduate Teaching Associate, Department of Anthropology, SUNY at Stony Brook. Primary Instructor: Anthropology 402, Problems in Archaeology - Landscape exploitation strategies in the Eurasian Palaeolithic.

Graduate Teaching Assistant, Department of Anthropology, SUNY at Stony Brook. Primary Teaching Assistant for Anthropology 102, Introduction to Cultural Anthropology; Primary Teaching Assistant for Anthropology 356, Urban Anthropology; Primary Teaching Assistant for Anthropology 104, Introduction to Archaeology; Primary Teaching Assistant for Anthropology 290, Ancient Science and Technology.

Graduate Teaching Assistant, Department of Anthropology, SUNY at Stony Brook. Lab Instructor for Anthropology 418, Lithic Technology; Lab Instructor for Anthropology 420, Geographic Information Systems in Environmental Analysis.

HONORS/AWARDS

- Graduate Council commendation for excellence in teaching by a graduate student, SUNY at Stony Brook
- General grant for thesis research, L.S.B. Leakey Foundation
- Grant for thesis research, Geological Society of America
- Grant for thesis related research, IDPAS, SUNY at Stony Brook
- Travel grant to the Annual Meeting of the Paleoanthropology Society, Columbus
- Travel grant to the 63rd Annual Meeting of the Society for American Archaeology, Seattle
- Travel grant for summer fieldwork, Sigma Xi Research Foundation
- General research grant, IDPAS, SUNY at Stony Brook
- Travel grant to the 62nd Annual Meeting of the Society for American Archaeology, Nashville

PUBLICATIONS

- Controlled Experiments with Middle Paleolithic Spear Points: Levallois Points, by J.J. Shea, K.S. Brown, and Z.J. Davis. In *Experimental Archaeology: Replicating Past Objects, Behaviors, and Processes*, edited by J. R. Mathieu, pp. 55-72. British Archaeological Reports, International Series 1035, Oxford. 2002.

- Experimental Test of Middle Palaeolithic Spear Points Using a Calibrated Crossbow, by J.J. Shea, Z.J. Davis, and K.S. Brown. *Journal of Archaeological Science* 28:807-816. 2001.

- Quantifying Lithic Curation: An Experimental Test of Dibble and Pelcin's Original Flake-Tool Mass Predictor. By Z.J. Davis and J.J. Shea. *Journal of Archaeological Science* 25:603-610. 1998.

PAPERS PRESENTED

- Paleoindian Lithic Foragers in the Delaware Water Gap: Integrating Lithic Resource Distribution and Lithic Technological Strategies. Paper presented at the January 2003 meeting of the Archaeological Society of New Jersey, Trenton, New Jersey. 2003.

- Costs and Benefits of Levallois Flake Production: An Economic Perspective on the Variability in Middle Palaeolithic Stone Tool Assemblages. Paper presented at the 65th Annual Meeting of the Society for American Archaeology, Philadelphia. 2000.

- Levantine Mousterian Mobility Patterns: The View from Mt. Carmel, Israel. Paper presented at the 1999 Paleoanthropology Society Meetings, Columbus. 1999.

- Experimental Test of Middle Paleolithic Hunting Weapons: Preliminary Results (with J.J. Shea and K.S. Brown). Paper presented at the 64th Annual Meeting of the Society for American Archaeology, Chicago. 1999.

- The Analytical Potential of Refitting Studies: History and Synthesis of Applications. Paper presented at the 63rd Annual Meeting of the Society for American Archaeology, Seattle. 1998.

- The PS 56R Site: A Vosburg Habitation on Staten Island, New York (with A.M. Pappalardo). Paper presented at the 62nd Annual Meeting of the Society for American Archaeology, Nashville. 1997.

CONFERENCE SYMPOSIA ORGANIZED

- Refitting Studies in New and Old World Lithic Analyses. Symposium organized for the 63rd Annual Meeting of the Society for American Archaeology, Seattle. 1998.

FISH AND BENTHIC MACROINVERTEBRATE SURVEY IN NESHAMINY CREEK BUCKS COUNTY, PENNSYLVANIA IN OCTOBER 2010

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INTRODUCTION

The Commonwealth of Pennsylvania Department of General Services (DGS), in conjunction with the Philadelphia Regional Port Authority (PRPA) is evaluating construction of a new marine cargo terminal (Southport Development Project) to be located on approximately 116 acres along the Delaware River in Philadelphia County, Pennsylvania. Weston Solutions, Inc., under contract to the PRPA, conducted and reported on a survey of the fish and benthic macroinvertebrate resources at the proposed terminal site (Weston Solutions, Inc. 2010b) in order to augment previously collected data (Normandeau Associates, Inc. 2004 and Versar, Inc. 2007).

Environmental permitting will require offsite mitigation to compensate for unavoidable impacts to aquatic habitats at the proposed terminal site. The preferred location for offsite mitigation is the downstream reach of Neshaminy Creek near Neshaminy State Park (referred to as the Jack's Marina site), approximately 20 miles upstream of the proposed terminal site.

Normandeau Associates was contracted to survey the fish and benthic macroinvertebrate resources present in the downstream reach of Neshaminy Creek and marinas/lagoons at Jack's Marina to support mitigation planning. Survey methodology similar to that employed in the Delaware River at the proposed terminal site (Weston Solutions, Inc. 2010a) was used in Neshaminy Creek for ease of data comparison between the two efforts.

The benthic macroinvertebrates and fish in Neshaminy Creek and Jack's Marina were surveyed on October 19 and 26, 2010, respectively. The survey results are contained in this report.

METHODOLOGY

Fish Sampling

A combination of sampling methods was employed to characterize the fish in Neshaminy Creek between the State Road Bridge and the Delaware River, a distance of approximately 0.9 mile. Fish sampling also was conducted in two abandoned marinas located off Neshaminy Creek and in the Delaware River just upstream, downstream, and outside the Neshaminy Creek confluence. All sample stations are shown in Figure 1.

Electrofishing was conducted at 11 locations in all existing habitats along both Neshaminy Creek shorelines, in the open water of the stream, in two abandoned marinas located off Neshaminy Creek, along both Delaware River shorelines just upstream and downstream of the confluence, and in the confluence. Electrofishing was conducted from a flat-bottom boat using pulsed DC current. A Coffelt VVP-15 electrofishing apparatus produced a field extending between boat-mounted cathodes and an anode array suspended from a T-boom attached to the bow. Sampling efforts were stopped at the terminus of each of electrofishing locations EF1 and EF2 in Abandoned Marina No. 2 when so many fish were stunned that netters could not keep up and continued electrofishing could have caused injury to the fish.

Trawling was conducted by towing an 8-foot mini-Missouri trawl for three 5-minute periods in the Neshaminy Creek channel from the State Road Bridge to just upstream of the Delaware River confluence.

The trawl was not used in the Delaware River because it filled with silt during the tow near the stream mouth. In addition, submerged trees encountered on each side of the stream mouth and which were expected to occur in the deeper water just outside the stream mouth, were snag hazards. The mini-Missouri trawl utilizes an outer mesh bag to increase the catch of smaller-bodied species relative to conventional larger mesh otter trawls and is based upon a design by Herzog *et al*. (2005). Two cable lengths were adjusted commensurate with water depth and a float was attached by a line to the cod end of the trawl to permit recovery in the event of snagging.

Seining was accomplished at only one location because most of the Neshaminy Creek and Delaware River shorelines consisted of unwadeable silt deposits or were steeply pitched into deep water. Seining was conducted near the mouth of Neshaminy Creek as the high tide rose to provide a limited narrow area of shallow water adjacent to a steep drop-off located along the stream's outside bend. A total of 12 contiguous hauls with an 8-foot flat seine was conducted, with the results treated as one composite sample.

Trotlining was conducted in three locations within Neshaminy Creek. Trotlining is an effective gear for capturing certain fish, such as channel catfish and bullheads, which may be under-sampled by other types of gear. The trotlines consisted of long heavy cordage containing between 9 and 15 hooks set at approximately 5-foot intervals. Size 1 and 1/0 trotline hooks were baited with chicken livers. Trotlines were set during daylight hours with set times ranging from 3.5 to 6.7 hours.

The fish samples were processed at the completion of each sampling effort. All efforts were made to minimize handling stress and all fish were returned to the waterbody alive, except for voucher specimens or small individuals requiring laboratory identification. All fish were identified to species, counted, and examined for anomalies such as deformities, eroded fins, lesions, and external tumors (DELTS). Total length (mm) was measured for approximately the first 25 individuals of a species collected. Subsequently, only individuals that appeared to be outside the previous range of recorded lengths were measured.

Macroinvertebrate Sampling

Single samples of benthic macroinvertebrates were collected at a total of 20 stations in Neshaminy Creek, in the two abandoned marinas, and in the nearby Delaware River. The sample stations are shown in Figure 2.

The macroinvertebrate samples were collected using a 6-inch x 6-inch Petite Ponar Grab deployed from a small boat. Each sample was washed through 0.595 mm mesh in the field and preserved with 70% isopropanol for transport to Normandeau's laboratory. In each case, the sediment collected in one Petite Ponar Grab sampling effort constituted one individual benthic macroinvertebrate sample. No compositing due to small sample volume was required.

In the laboratory, the macroinvertebrates were sorted from each sample in entirety. All of the macroinvertebrates were identified to the lowest taxonomic level possible, given their physical condition, maturity, and the availability of taxonomic keys. The resultant data were entered into Excel spreadsheets for tabulation and computation of community tolerance, taxonomic richness, diversity, evenness, and dominance metrics.

Water Quality Measurements

Water quality measurements (temperature, dissolved oxygen, pH, specific conductance, and salinity) were made using a Horiba U10 field instrument during the fish and benthic macroinvertebrate sampling efforts. These measurements were made in surface water and at the bottom at several locations.

RESULTS

Habitat and Wildlife Observations

The 0.9 mile long Neshaminy Creek survey reach is tidal, but freshwater. Both shorelines contain long narrow (20 to 30 feet wide) stands of the emergent plant yellow cowlily (*Nuphar* sp.) through much of the survey reach (Figure 3). These stands of yellow cowlily grow in largely muddy intertidal or subtidal habitat that is very shallow at low tide.

The shoreline is bulkheaded in some locations where the yellow cowlily stands are absent. There is no intertidal habitat at these locations.

Two abandoned marinas are located off Neshaminy Creek along the east shoreline in the former Jack's Marina. Both contain derelict pier structures that rise above the waterline at high tide (Figures 4 and 5). Many submerged pieces of electrical and/or steel cable were observed in these marinas and it is presumed that other material from the piers and, perhaps, derelict boats are scattered here and there.

A wildlife presence of some interest was three beaver (*Castor canadensis*) observed swimming in Abandoned Marina No. 2 during macroinvertebrate sampling (Figure 6). These beaver were sizeable, with individual animal weight estimated at 50 to 60 lbs. Brush piles (food caches) constructed by beaver as well as a potential den also were observed at this location. Lastly, another brush pile (food cache) and a confirmed den were observed along the west shoreline of Neshaminy Creek, just upstream of the opening to Abandoned Marina No. 2.

Fish Sampling

The fish data are listed by gear type and sample station in Table 1. The sample stations are shown in Figure 1. The fish data are summarized by gear type and community metrics are reported in Table 2.

A total of 1,050 fish representing 27 species was captured on October 26, 2010. Nearly all fish (1,014) and 26 of the 27 fish species were captured by electrofishing. Only 7 individuals in 4 species were captured in trawling, but one of them was the only tessellated darter recorded in the survey. The limited seining resulted in capture of very few fish (22) and species (2). Trotlining captured 7 fish in 3 species, but all were among the largest fish captured in the survey.

Pumpkinseed was the most abundant fish captured (321), followed by spottail shiner (142), bluegill (123), banded killifish (114), and Eastern silvery minnow (109). Largemouth bass (46) was the most abundant sportfish captured and black crappie (45) was the most abundant panfish captured. Striped bass (4) and channel catfish (8) also were captured.

The abundance of pumpkinseed and bluegill, as well as largemouth bass, black crappie, and white crappie (7), and a few other species, was considerably underestimated due to gear saturation which occurred while electrofishing within Stations EF1and EF2 in Abandoned Marina No. 2. Brush piles constructed by beaver were located in each of these stations and this cover was highly attractive to these sunfish. When the anode of the electrofishing boat neared these piles, many hundreds of fish were stunned and moved toward the water surface. The fish were netted as quickly as possible, but before all could be collected, some had either moved towards the bottom and back inside the brush piles or had moved out of the electric field. In addition, in order to avoid injuring fish, the electric generator was stopped after about one and one-half to two minutes of continuous shocking at the brush piles and the remaining fish were then netted. It appeared that these aggregations of sunfish, as well as the six yellow perch collected, had assumed their overwintering locations.

Other spatial distributions were revealed in the electrofishing data, as well as in the data contributed by the other gear types. Eleven eels were collected within Abandoned Marina No. 2, but this species was considerably more abundant within Abandoned Marina No. 1, where 37 were captured. No eels were captured from any other electrofishing stations. Of the remaining two eels captured, one (the largest eel captured in the survey) was captured by trotline (T3) near the mouth of Neshaminy Creek and the other (the smallest eel captured in the survey) was captured in the mini-Missouri trawl in the transect (TRL3) closest to the stream mouth. Although more eels were captured in Abandoned Marina No. 1 than in Abandoned Marina No. 2, it may be that they were easier to see in the greater area of shallow water in the former location, noting that eels usually moved along the silt bottom when they encountered the electric field.

No alosids were captured within Neshaminy Creek, even though one electrofishing station (EF7) was established in the stream specifically to enhance the possibility of capturing alosids. But this station, located in open, deeper water 100 feet from the outer edge of a shoreline stand of yellow cowlily, yielded no fish of any species in 10 minutes of electrofishing. However, five American shad and one blueback herring, all young-of-year (YOY), were captured by electrofishing in the Delaware River at Stations EF9, EF10, and EF11. It was anticipated that YOY alosids would likely not be collected within Neshaminy Creek, as these individuals should be in the process of migrating down-estuary in late October.

Although some individuals of the minnow species spottail shiner, Eastern silvery minnow, and banded killifish were captured within the abandoned marinas, they were found in greater concentration along the shorelines of Neshaminy Creek and the Delaware River. These three species, along with mummichog, were particularly concentrated within Station EF5, located along the edge of a shoreline stand of yellow cowlily. Most of the minnows collected at this station were concentrated within the mouth of a tiny tidal tributary.

A total of 32 white perch was collected in the study. Most individuals were less than 80 mm total length, but others exceeded 99 mm, and two individuals were 168 and 176 mm. Adult white perch are known to overwinter in the deeper, saline waters of Delaware Bay (Beck 1995).

A single warmouth was captured by electrofishing at Station EF2 in Abandoned Marina No. 2 (Figure 7). The warmouth is listed as endangered in Pennsylvania. It is widely distributed throughout the eastern half of the United States from southern Michigan to the Gulf Coast, but has been found only infrequently throughout the State of Pennsylvania (Cooper 1983). The single previous recorded incidence of this species in southeastern Pennsylvania as depicted in the distributional map (Cooper 1983) appears to be a fish collected by impingement at Eddystone Generating Station on the Delaware River in 1976. It has

been infrequently, but increasingly over time, collected from tidal tributaries to the Delaware River in the State of Delaware (Raasch 2007).

With exception of the warmouth, the fish captured in the survey reach are well-known in the freshwater tidal Delaware River and its tributaries. The PA Fish and Boat Commission (the Commission) provided a list of fish species captured in the Delaware River/Estuary and in the non-tidal Neshaminy Creek (Table 3). Of the 27 species captured in the present survey of the tidal Neshaminy Creek, 16 species appear on the Commission's list of fish previously captured in the non-tidal Neshaminy Creek and 11 do not. All species, with exception of the warmouth, appear on the Commission's list of fish previously captured in the Delaware River/Estuary.

Macroinvertebrate Sampling

The benthic macroinvertebrate data are listed for each sample station and summarized in Table 4. The sample stations are shown in Figure 2. Descriptions of the sediment collected in each sample and latitude/longitude for each station are listed in Table 5.

A total of 42 taxa was identified in the 20 macroinvertebrate samples collected on October 19, 2010. The great majority (38) of these taxa are adapted to soft stream/river bottom (silt and sand) conditions. Four caddisfly (Trichoptera) taxa that are adapted to rocky bottom conditions also were collected, but in total they comprised less than 0.2% of all the macroinvertebrates collected.

The macroinvertebrate samples were dominated by large numbers of oligochaete worms (85.6% in total), most of them several species in the genus *Limnodrilus* (74.0% in total). These oligochaete worms burrow and feed on bacteria that are associated with fine particulate organic matter that is present in the stream/river bottom sediment and these worms are tolerant of reduced dissolved oxygen conditions. It should be noted that much of the sediment collected in the samples consisted of clay, silt, and sand, with some detritus (fragmented decomposing vegetative matter) and empty mollusk shells also present in some samples. Only two samples contained gravel (No. 1) or gravel and cobble (No. 16).

Compared to the oligochaete worms, all other macroinvertebrate taxa were collected in much smaller numbers. The fingernail clam *Pisidium*, identified as important in the diet of the bottom-feeding federally-endangered shortnose sturgeon (*Acipenser brevirostrum*), comprised only 2.9% of the samples. The invasive introduced Asiatic clam (*Corbicula fluminea*), identified as an alternate to fingernail clams as a food resource for shortnose sturgeon, comprised a smaller (1.1%) percentage of the samples.

Although the taxonomic composition and abundance of macroinvertebrates varied among the samples, those collected in both of the abandoned marinas and in the nearby Delaware River generally were not distinguishable from the samples collected in Neshaminy Creek. However, it is noted that the greatest numbers of taxa were collected in Abandoned Marina No. 1 (Sample Nos. 6 and 7), largely because more Diptera (true flies) were collected there.

Several macroinvertebrates that were not likely to be collected in the Petite Ponar Grab samples were collected in the mini-Missouri trawl sampling for fish. One mussel, 63 mm in shell length, was collected in TRL3 in the downstream end of the Neshaminy Creek survey reach (Figure 8). This species was either alewife floater (*Anodonta implicata*) or eastern floater (*Pyganodon cataracta*), indeterminate because these species can only be reliably distinguished by viewing internal shell structures. Rather than sacrifice

the mussel in order to identify it, the survey crew returned it to the bottom. Eastern floater is somewhat more abundant than alewife floater, suggesting that the mussel likely was the former species.

Two blue crab (*Callinectes sapidus*) also were collected in TRL3. These crab were females and 25 mm and 52 mm in carapace width. Although much more abundant in lower Delaware Bay, blue crab is very tolerant of freshwater and can be found in the Delaware River as far upriver as the head of tide near Trenton, NJ during the warmer months of the year.

The benthic macroinvertebrate community present in the survey reach is not unique to this location. In fact, it is widely distributed throughout the freshwater tidal Delaware River and in the tidal reaches of its tributaries. This community, which is adapted to soft bottom (silt/sand) conditions, is described in greater detail in Ettinger (1995), a review prepared for the U.S. Environmental Protection Agency's Delaware Estuary Program.

Water Quality Measurements

The water quality measurements made on October 19 and 26, 2010 are shown in Table 6. Although the lower Neshaminy Creek survey reach is tidal, the salinity and specific conductance measurements confirm its freshwater nature. The water was well-oxygenated and near-neutral in pH, with little difference between surface and bottom measurements. The pH was slightly lower in the Neshaminy Creek/Delaware River confluence, suggesting that the Delaware River water was somewhat more acidic than Neshaminy Creek water.

SUMMARY AND CONCLUSIONS

The downstream reach of Neshaminy Creek (referred to as the Jack's Marina site) is under consideration as a mitigation site for unavoidable impacts to aquatic habitats at the proposed Southport Development Project in the Delaware River. The fish and benthic macroinvertebrate resources present in the Neshaminy Creek's downstream reach, two abandoned marinas/lagoons, and the nearby Delaware River were sampled to support mitigation planning.

Fish were sampled on October 26, 2010 using several gear types (boat-mounted electrofisher, 8-foot mini-Missouri trawl, 8-foot flat seine, and trotline). A total of 1,050 fish comprising 27 species was captured, nearly all of them in electrofishing. Pumpkinseed, spottail shiner, bluegill, banded killifish, and Eastern silvery minnow were captured in greatest abundance. Largemouth bass and black crappie were the most abundant sportfish and panfish captured, respectively.

The abundance of several species (pumpkinseed, bluegill, largemouth bass, black crappie, white crappie, and a few others) was considerably underestimated due to gear saturation during sampling near several brush piles located in Abandoned Marina No. 2. Because many hundreds of fish were stunned by the electrofisher, the fish capture effort near the brush piles was halted periodically to avoid injuring fish. The large number of fish indicates that they likely overwinter in or near these brushpiles.

The brush piles in Abandoned Marina No. 2 were constructed by beaver, which use them as food caches. A potential beaver den and three large swimming beaver also were observed at this location.

Nearly all of the eels captured were encountered in the two abandoned marinas. No alosids were captured within Neshaminy Creek. However, five American shad and one blueback herring, all young-of-the-year, were captured in the nearby Delaware River. The minnow species spottail shiner, Eastern silvery minnow, and banded killifish were captured in greatest numbers along the shorelines of Neshaminy Creek and the Delaware River, especially within the mouth of a tiny tributary located in a stand of the emergent plant yellow cowlily.

The only state-listed fish species captured was the warmouth, designated as Endangered. One individual was captured in Abandoned Marina No. 2. Found only infrequently in Pennsylvania, the single previous warmouth capture appears to be in an impingement sample at Eddystone Generating Station, located on the Delaware River.

Except for the warmouth, the fish species captured are well-known in the freshwater tidal Delaware River and its tributaries. In fact, again with exception of the warmouth, all of the species captured appear on the PA Fish and Boat Commission's list of fish previously captured in the Delaware River/Estuary.

Single Petite Ponar Grab samples of benthic macroinvertebrates were collected at 20 locations on October 19, 2010. A total of 42 taxa was identified, the great majority adapted to soft stream/river bottom (silt and sand) conditions. Most of the macroinvertebrates collected were oligochaete worms in the genus *Limnodrilus*. These worms burrow in the sediment and feed on bacteria that are associated with fine particulate organic matter that is present. They are tolerant of reduced dissolved oxygen conditions.

Small numbers of two mollusk species important in the diet of the bottom-feeding federally-endangered shortnose sturgeon were collected. They are the fingernail clam *Pisidium* and the invasive introduced Asiatic clam.

Two species not likely to be collected in Petite Ponar Grab samples were collected in the mini-Missouri trawl sampling for fish. One mussel, species indeterminate, and two small female blue crab were collected in the downstream end of the Neshaminy Creek survey reach.

The benthic macroinvertebrate community present in the survey reach is widely distributed through the freshwater tidal Delaware River and its tributaries. It is adapted to the soft bottom (silt/sand) conditions that are prevalent throughout.

Water quality measurements made during the fish and benthic macroinvertebrate sampling confirm the freshwater nature of the survey reach. The water was well-oxygenated and near-neutral in pH near the bottom and at the surface.

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FIGURES

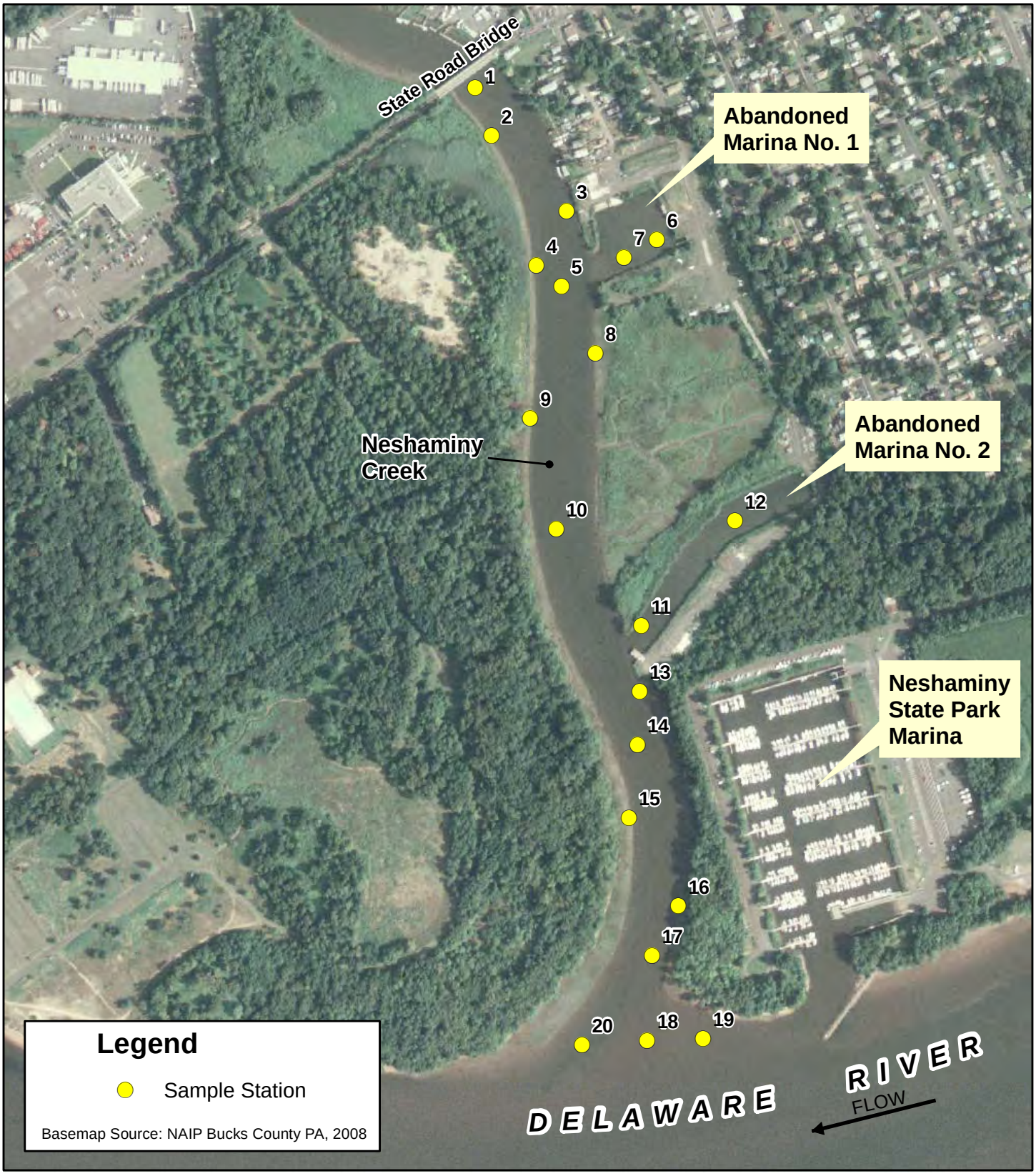
Figure 1.
Fish Sample Stations
in Neshaminy Creek
and the Nearby Delaware River.

N

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS
400 Old Reading Pike Bldg. A, Suite 101 Stowe, PA 19464

date: 11/06/10
checked by: b. ettinger
prepared by: s.sherman

rev. date:
project: 22071.001
file name: Figure1



600 300 0 600 Feet

Figure 2.
Benthic Macroinvertebrate Sample Stations in Neshaminy Creek and the Nearby Delaware River.

N

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS
400 Old Reading Pike Bldg. A, Suite 101 Stowe, PA 19464

date: 11/01/10
checked by: b. ettinger
prepared by: s.sherman

rev. date:
project: 22071.001
file name: Figure2

Figure 3. Yellow cowlily (*Nuphar* sp.) along the Neshaminy Creek shoreline.

Figure 4. Abandoned Marina No. 1 off Neshaminy Creek.

Figure 5. Abandoned Marina No. 2 off Neshaminy Creek.

Figure 6. Beaver swimming in Abandoned Marina No. 2.

Figure 7. Warmouth captured in Neshaminy Creek.

Figure 8. Alewife floater (*Anodonta implicata*) or eastern floater (*Pyganodon cataracta*) collected in Neshaminy Creek.

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TABLES

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Table 1. Fish data summary, Neshaminy Creek, Bucks County, PA - October 26, 2010.

Sample Station:	EF1				EF2			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 04' 41.6"	W74° 54' 32.6"			N40° 04' 46.9"	W74° 54' 26.7"		
End Coordinates	N40° 04' 46.7"	W74° 54' 27.0"			N40° 04' 46.3"	W74° 54' 25.8"		
Gear Type / Method:	electrofishing				electrofishing			
Date:	October 26, 2010				October 26, 2010			
Start Time:	10:07 AM				10:56 AM			
End Time:	10:25 AM				11:04 AM			
Elapsed Time:	17 minutes				8 minutes			
Tide:	low ebb				low ebb			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)	1	82	82		2	162	182	
Brown bullhead (*Ameiurus nebulosus*)	3	120	291		3	281	351	
American eel (*Anguilla rostrata*)	8	165	325		2	185	220	
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)					3	154	191	
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)	11	90	112					
Channel catfish (*Ictalurus punctatus*)	1	504	504					
Redbreast sunfish (*Lepomis auritus*)	4	48	62					
Green sunfish (*Lepomis cyanellus*)	1	52	52					
Pumpkinseed (*Lepomis gibbosus*)	163	59	168		92			
Warmouth (*Lepomis gulosus*)					1	168	168	lesion(1)
Bluegill (*Lepomis macrochirus*)	31	54	142		61		191	
Largemouth bass (*Micropterus salmoides*)	15	96	181	blackspot(6)	13	124	385	
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Golden shiner (*Notemigonus crysoleucas*)	2	121	166					
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)					6	154	218	
White crappie (*Pomoxis annularis*)	5	82	102		2		154	
Black crappie (*Pomoxis nigromaculatus*)	35	68	218		9		254	
Fallfish (*Semotilus corporalis*)								
Number of species (s)	13				11			
Number of individuals (N)	280				194			

Table 1. Continued.

Sample Station:	EF3				EF4			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 04' 46.2"	W74° 54' 26.1"			N40° 04' 57.3"	W74° 54' 33.9"		
End Coordinates	N40° 04' 42.6"	W74° 54' 30.7"			N40° 04' 56.9"	W74° 54' 33.4"		
Gear Type / Method:	electrofishing				electrofishing			
Date:	October 26, 2010				October 26, 2010			
Start Time:	11:37 AM				12:04 PM			
End Time:	11:42 AM				12:25 PM			
Elapsed Time:	5 minutes				21 minutes			
Tide:	low ebb				low slack			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	1				37	150	380	
Goldfish (*Carassius auratus*)					2	136	140	
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)	1	71	71		6	62	82	
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)	3	96	102		40	78	112	
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)	7				36			
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)					27			
Largemouth bass (*Micropterus salmoides*)	1				6			
White perch (*Morone americana*)					6	58	83	
Striped bass (*Morone saxatilis*)								
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)	1	86	86		3	75	83	
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)					1			
Fallfish (*Semotilus corporalis*)								
Number of species (s)	6				10			
Number of individuals (N)	14				164			

Table 1. Continued.

Sample Station:	EF5				EF6			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 05' 04.3"	W74° 54' 40.3"			N40° 05' 00.6"	W74° 54' 35.8"		
End Coordinates	N40° 04' 57.2"	W74° 54' 36.4"			N40° 04' 55.4"	W74° 54' 34.7"		
Gear Type / Method:	electrofishing				electrofishing			
Date:	October 26, 2010				October 26, 2010			
Start Time:	1:03 PM				1:34 PM			
End Time:	1:18 PM				1:47 PM			
Elapsed Time:	15 minutes				13 minutes			
Tide:	low flood				low flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)					3	550	620	
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)	12				81			
Mummichog (*Fundulus heteroclitus*)	4	68	86					
Eastern silvery minnow (*Hybognathus regius*)	39				3			
Channel catfish (*Ictalurus punctatus*)					1	628	628	
Redbreast sunfish (*Lepomis auritus*)					3			leech(1)
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)	13				8			
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)	3							
Largemouth bass (*Micropterus salmoides*)	2				1			
White perch (*Morone americana*)	1							
Striped bass (*Morone saxatilis*)								
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)	44	64	104		6			
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)								
Fallfish (*Semotilus corporalis*)					1			
Number of species (s)	8				9			
Number of individuals (N)	118				107			

Table 1. Continued.

Sample Station:	EF7				EF8			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 04' 55.4"	W74° 54' 35.3"			N40° 04' 40.9"	W74° 54' 35.0"		
End Coordinates	N40° 04' 49.6"	W74° 54' 35.2"			N40° 04' 32.0"	W74° 54' 32.1"		
Gear Type / Method:	electrofishing				electrofishing			
Date:	October 26, 2010				October 26, 2010			
Start Time:	1:55 PM				2:09 PM			
End Time:	2:05 PM				2:25 PM			
Elapsed Time:	10 minutes				16 minutes			
Tide:	low flood				low flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)					3	336	403	
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)					3			
Channel catfish (*Ictalurus punctatus*)					1	478	478	
Redbreast sunfish (*Lepomis auritus*)								
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)								
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)					19	57	176	
Striped bass (*Morone saxatilis*)								
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)					19			
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)								
Fallfish (*Semotilus corporalis*)								
Number of species (s)	NF				5			
Number of individuals (N)	NF				45			

Table 1. Continued.

Sample Station:	EF9				EF10			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 04' 26.7"	W74° 54' 31.5"			N40° 04' 23.7"	W74° 54' 57.0"		
End Coordinates	N40° 04' 26.9"	W74° 54' 23.3"			N40° 04' 24.1"	W74° 54' 42.2"		
Gear Type / Method:	electrofishing				electrofishing			
Date:	October 26, 2010				October 26, 2010			
Start Time:	2:42 PM				3:03 PM			
End Time:	2:54 PM				3:17 PM			
Elapsed Time:	12 minutes				14 minutes			
Tide:	high flood				high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)					1	68	68	
American shad (*Alosa sapidissima*)	3	72	85		1	65	65	
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)					1			
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)	8				2			
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)	1				1			
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)	1							
Largemouth bass (*Micropterus salmoides*)	7				1			blackspot(1)
White perch (*Morone americana*)					2			
Striped bass (*Morone saxatilis*)					3	144	173	
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)	12				47	44		
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)								
Fallfish (*Semotilus corporalis*)								
Number of species (s)	6				9			
Number of individuals (N)	32				59			

Table 1. Continued.

Sample Station:	EF11			
	Latitude	Longitude		
Start Coordinates:	N40° 04' 24.6"	W74° 54' 38.0"		
End Coordinates	N40° 04' 25.1"	W74° 54' 30.9"		
Gear Type / Method:	electrofishing			
Date:	October 26, 2010			
Start Time:	3:28 PM			
End Time:	3:38 PM			
Elapsed Time:	10 minutes			
Tide:	high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)				
American shad (*Alosa sapidissima*)	1	86	86	
Rock bass (*Ambloplites rupestris*)				
Brown bullhead (*Ameiurus nebulosus*)				
American eel (*Anguilla rostrata*)				
Goldfish (*Carassius auratus*)				
White sucker (*Catostomus commersonii*)				
Common carp (*Cyprinus carpio*)				
Tessellated darter (*Etheostoma olmstedi*)				
Banded killifish (*Fundulus diaphanus*)				
Mummichog (*Fundulus heteroclitus*)				
Eastern silvery minnow (*Hybognathus regius*)				
Channel catfish (*Ictalurus punctatus*)				
Redbreast sunfish (*Lepomis auritus*)				
Green sunfish (*Lepomis cyanellus*)				
Pumpkinseed (*Lepomis gibbosus*)				
Warmouth (*Lepomis gulosus*)				
Bluegill (*Lepomis macrochirus*)				
Largemouth bass (*Micropterus salmoides*)				
White perch (*Morone americana*)				
Striped bass (*Morone saxatilis*)				
Golden shiner (*Notemigonus crysoleucas*)				
Spottail shiner (*Notropis hudsonius*)				
Yellow perch (*Perca flavescens*)				
White crappie (*Pomoxis annularis*)				
Black crappie (*Pomoxis nigromaculatus*)				
Fallfish (*Semotilus corporalis*)				
Number of species (s)	1			
Number of individuals (N)	1			

Table 1. Continued.

Sample Station:	TRL1				TRL2			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 05' 03.7"	W74° 54' 38.4"			N40° 04' 50.8"	W74° 54' 35.8"		
End Coordinates	N40° 04' 51.2"	W74° 54' 35.7"			N40° 04' 40.9"	W74° 54' 34.0"		
Gear Type / Method:	trawl				trawl			
Date:	October 26, 2010				October 26, 2010			
Start Time:	4:44 PM				4:59 PM			
End Time:	4:49 PM				5:04 PM			
Elapsed Time:	5 minutes				5 minutes			
Tide:	high flood				high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)								
Redbreast sunfish (*Lepomis auritus*)								
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)								
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)								
Fallfish (*Semotilus corporalis*)								
Number of species (s)	NF				NF			
Number of individuals (N)	NF				NF			

Table 1. Continued.

Sample Station:	TRL3			
	Latitude	Longitude		
Start Coordinates:	N40° 04' 40.5"	W74° 54' 33.8"		
End Coordinates	N40° 04' 28.5"	W74° 54' 32.3"		
Gear Type / Method:	trawl			
Date:	October 26, 2010			
Start Time:	5:25 PM			
End Time:	5:30 PM			
Elapsed Time:	5 minutes			
Tide:	high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)				
American shad (*Alosa sapidissima*)				
Rock bass (*Ambloplites rupestris*)				
Brown bullhead (*Ameiurus nebulosus*)				
American eel (*Anguilla rostrata*)	1	80	80	
Goldfish (*Carassius auratus*)				
White sucker (*Catostomus commersonii*)				
Common carp (*Cyprinus carpio*)				
Tessellated darter (*Etheostoma olmstedi*)	1	68	68	
Banded killifish (*Fundulus diaphanus*)				
Mummichog (*Fundulus heteroclitus*)				
Eastern silvery minnow (*Hybognathus regius*)				
Channel catfish (*Ictalurus punctatus*)				
Redbreast sunfish (*Lepomis auritus*)				
Green sunfish (*Lepomis cyanellus*)				
Pumpkinseed (*Lepomis gibbosus*)				
Warmouth (*Lepomis gulosus*)				
Bluegill (*Lepomis macrochirus*)				
Largemouth bass (*Micropterus salmoides*)				
White perch (*Morone americana*)	4			
Striped bass (*Morone saxatilis*)				
Golden shiner (*Notemigonus crysoleucas*)				
Spottail shiner (*Notropis hudsonius*)	1	68	68	
Yellow perch (*Perca flavescens*)				
White crappie (*Pomoxis annularis*)				
Black crappie (*Pomoxis nigromaculatus*)				
Fallfish (*Semotilus corporalis*)				
Number of species (s)	4			
Number of individuals (N)	7			

Table 1. Continued.

Sample Station:	S1			
	Latitude	Longitude		
Start Coordinates:	N40° 04' 30.7"	W74° 54' 30.5"		
End Coordinates	N40° 04' 27.7"	W74° 54' 31.5"		
Gear Type / Method:	seine			
Date:	October 26, 2010			
Start Time:	5:30 PM			
End Time:	5:50 PM			
Elapsed Time:	20 minutes			
Tide:	high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)				
American shad (*Alosa sapidissima*)				
Rock bass (*Ambloplites rupestris*)				
Brown bullhead (*Ameiurus nebulosus*)				
American eel (*Anguilla rostrata*)				
Goldfish (*Carassius auratus*)				
White sucker (*Catostomus commersonii*)				
Common carp (*Cyprinus carpio*)				
Tessellated darter (*Etheostoma olmstedi*)				
Banded killifish (*Fundulus diaphanus*)	13	55	82	
Mummichog (*Fundulus heteroclitus*)				
Eastern silvery minnow (*Hybognathus regius*)				
Channel catfish (*Ictalurus punctatus*)				
Redbreast sunfish (*Lepomis auritus*)				
Green sunfish (*Lepomis cyanellus*)				
Pumpkinseed (*Lepomis gibbosus*)				
Warmouth (*Lepomis gulosus*)				
Bluegill (*Lepomis macrochirus*)				
Largemouth bass (*Micropterus salmoides*)				
White perch (*Morone americana*)				
Striped bass (*Morone saxatilis*)				
Golden shiner (*Notemigonus crysoleucas*)				
Spottail shiner (*Notropis hudsonius*)	9	31	75	
Yellow perch (*Perca flavescens*)				
White crappie (*Pomoxis annularis*)				
Black crappie (*Pomoxis nigromaculatus*)				
Fallfish (*Semotilus corporalis*)				
Number of species (s)	2			
Number of individuals (N)	22			

Table 1. Continued.

Sample Station:	T1				T2			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 05' 05.0"	W74° 54' 40.3"			N40° 04' 40.6"	W74° 54' 32.7"		
End Coordinates	N40° 05' 04.3"	W74° 54' 39.5"			N40° 04' 39.8"	W74° 54' 32.3"		
Gear Type / Method:	trotline				trotline			
Date:	October 26, 2010				October 26, 2010			
Start Time:	9:12 AM				9:30 AM			
End Time:	12:50 PM				4:14 PM			
Elapsed Time:	218 minutes (3.6 hours)				404 minutes (6.7 hours)			
Tide:	low flood				high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)								
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	2	429	489	lesions (1)	2	446	572	
Redbreast sunfish (*Lepomis auritus*)								
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)								
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)								
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)								
Fallfish (*Semotilus corporalis*)								
Number of species (s)	1				1			
Number of individuals (N)	2				2			

Table 1. Continued.

Sample Station:	T3				T4			
	Latitude	Longitude			Latitude	Longitude		
Start Coordinates:	N40° 04' 27.9"	W74° 54' 33.6"			N40° 05' 05.0"	W74° 54' 40.3"		
End Coordinates	N40° 04' 26.8"	W74° 54' 34.0"			N40° 05' 04.3"	W74° 54' 39.5"		
Gear Type / Method:	trotline				trotline			
Date:	October 26, 2010				October 26, 2010			
Start Time:	9:53 AM				1:00 PM			
End Time:	3:59 PM				4:30 PM			
Elapsed Time:	366 minutes (6.1 hours)				210 minutes (3.5 hours)			
Tide:	high flood				high flood			
Species:	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**	**Total No.**	**Min. Length (mm) (Total Length)**	**Max. Length (mm) (Total Length)**	**Anomalies (DELTs)**
Blueback herring (*Alosa aestivalis*)								
American shad (*Alosa sapidissima*)								
Rock bass (*Ambloplites rupestris*)								
Brown bullhead (*Ameiurus nebulosus*)								
American eel (*Anguilla rostrata*)	1	680	680					
Goldfish (*Carassius auratus*)								
White sucker (*Catostomus commersonii*)								
Common carp (*Cyprinus carpio*)								
Tessellated darter (*Etheostoma olmstedi*)								
Banded killifish (*Fundulus diaphanus*)								
Mummichog (*Fundulus heteroclitus*)								
Eastern silvery minnow (*Hybognathus regius*)								
Channel catfish (*Ictalurus punctatus*)	1	534	534					
Redbreast sunfish (*Lepomis auritus*)								
Green sunfish (*Lepomis cyanellus*)								
Pumpkinseed (*Lepomis gibbosus*)								
Warmouth (*Lepomis gulosus*)								
Bluegill (*Lepomis macrochirus*)								
Largemouth bass (*Micropterus salmoides*)								
White perch (*Morone americana*)								
Striped bass (*Morone saxatilis*)	1	431	431					
Golden shiner (*Notemigonus crysoleucas*)								
Spottail shiner (*Notropis hudsonius*)								
Yellow perch (*Perca flavescens*)								
White crappie (*Pomoxis annularis*)								
Black crappie (*Pomoxis nigromaculatus*)								
Fallfish (*Semotilus corporalis*)								
Number of species (s)	3				NF			
Number of individuals (N)	3				NF			

Table 2. Fish data summary (all sample stations), Neshaminy Creek, Bucks County, PA - October 26, 2010.

Species:	Electrofishing		Trawling		Seining		Trotlining	
	Total No.	**Percent Composition**	**Total No.**	**Percent Composition**	**Total No.**	**Percent Composition**	**Total No.**	**Percent Composition**
Blueback herring (*Alosa aestivalis*)	1	0.1						
American shad (*Alosa sapidissima*)	5	0.5						
Rock bass (*Ambloplites rupestris*)	3	0.3						
Brown bullhead (*Ameiurus nebulosus*)	6	0.6						
American eel (*Anguilla rostrata*)	48	4.7	1	14.3			1	14.3
Goldfish (*Carassius auratus*)	2	0.2						
White sucker (*Catostomus commersonii*)	6	0.6						
Common carp (*Cyprinus carpio*)	3	0.3						
Tessellated darter (*Etheostoma olmstedi*)			1	14.3				
Banded killifish (*Fundulus diaphanus*)	101	10.0			13	59.1		
Mummichog (*Fundulus heteroclitus*)	4	0.4						
Eastern silvery minnow (*Hybognathus regius*)	109	10.7						
Channel catfish (*Ictalurus punctatus*)	3	0.3					5	71.4
Redbreast sunfish (*Lepomis auritus*)	7	0.7						
Green sunfish (*Lepomis cyanellus*)	1	0.1						
Pumpkinseed (*Lepomis gibbosus*)	321	31.7						
Warmouth (*Lepomis gulosus*)	1	0.1						
Bluegill (*Lepomis macrochirus*)	123	12.1						
Largemouth bass (*Micropterus salmoides*)	46	4.5						
White perch (*Morone americana*)	28	2.8	4	57.1				
Striped bass (*Morone saxatilis*)	3	0.3					1	14.3
Golden shiner (*Notemigonus crysoleucas*)	2	0.2						
Spottail shiner (*Notropis hudsonius*)	132	13.0	1	14.3	9	40.9		
Yellow perch (*Perca flavescens*)	6	0.6						
White crappie (*Pomoxis annularis*)	7	0.7						
Black crappie (*Pomoxis nigromaculatus*)	45	4.4						
Fallfish (*Semotilus corporalis*)	1	0.1						
Number of Species (S)	26		4		2		3	
Number of Individuals (N)	1014	100.0	7	100.0	22	100.0	7	100.0
Metrics:								
Percent Dominant Taxon	31.7		57.1		59.1		71.4	
(Identity)	Pumpkinseed (*Lepomis gibbosus*)		White perch (*Morone americana*)		Banded killifish (*Fundulus diaphanus*)		Channel catfish (*Ictalurus punctatus*)	
Simpson's Dominance Index	0.16		0.39		0.52		0.55	
Shannon Diversity, base e	2.21		1.15		0.68		0.8	
Shannon Evenness, base e	0.68		0.83		0.98		0.72	

Table 3. Fish species captured in the Delaware River/Estuary and in non-tidal Neshaminy Creek by the Pennsylvania Fish and Boat Commission.

Common Name	Scientific Name	Delaware River/Estuary[1]	Non-tidal Neshaminy Creek[1]
Alewife	*Alosa pseudoharengus*	X	
American Eel	*Anguilla rostrata*	X	X
American Shad	*Alosa sapidissima*	X	
Atlantic Croaker[2]	*Micropogonias undulates*	X	
Atlantic Menhaden[2]	*Brevoortia tyrannus*	X	
Atlantic Needlefish[2]	*Strongylura marina*	X	
Atlantic Sturgeon	*Acipenser oxyrinchus*	X	
Banded Killifish	*Fundulus diaphanus*	X	X
Black Crappie	*Pomoxis nigromaculatus*	X	X
Blacknose Dace	*Rhinichthys atratulus*		X
Blueback Herring	*Alosa aestivalis*	X	
Bluegill	*Lepomis macrochirus*	X	X
Bluntnose Minnow	*Pimephales notatus*	X	
Bowfin	*Amia Calva*	X	
Brown Bullhead	*Ameiurus nebulosus*	X	X
Brown Trout[3]	*Salmo trutta*	X	
Chain Pickerel	*Esox niger*	X	
Channel Catfish	*Ictalurus punctatus*	X	
Comely Shiner[3]	*Notropis amoenus*	X	
Common Carp	*Cyprinus carpio*	X	X
Common Shiner[3]	*Luxilus cornutus*	X	X
Creek Chubsucker	*Erimyzon oblongus*	X	X
Eastern Silvery Minnow	*Hybognathus regius*	X	
Fallfish	*Semotilus corporalis*	X	
Gizzard Shad	*Dorosoma cepedianum*	X	
Golden Shiner	*Notemigonus crysoleucas*	X	X
Goldfish	*Carassius auratus*	X	X
Green Sunfish	*Lepomis cyanellus*	X	X
Hickory Shad	*Alosa mediocris*	X	
Hogchoker	*Trinectes maculates*	X	
Inland Silverside	*Menidia beryllina*	X	
Largemouth Bass	*Micropterus salmoides*	X	X
Lepomis Hybrids	*Lepomis*	X	
Margined Madtom	*Noturus insignis*	X	
Mummichog	*Fundulus heteroclitus*	X	
Muskellunge[3]	*Esox masquinongy*	X	
Naked Goby[2]	*Gobiosoma bosc*	X	

Table 3. Continued.

Common Name	Scientific Name	Delaware River/Estuary[1]	Non-tidal Neshaminy Creek
Northern Hogsucker[3]	*Hypentelium nigricans*	X	
Northern Pike[3]	*Exox lucius*	X	
Pumpkinseed	*Lepomis gibbosus*	X	X
Quillback	*Carpiodes cyprinus*	X	
Rainbow Trout	*Oncorhynchus mykiss*	X	
Redbreast Sunfish	*Lepomis auritus*	X	X
Redfin Pickerel	*Esox americanus*	X	
Rock Bass	*Ambloplites rupestris*	X	X
Satinfin Shiner	*Cyprinella analostana*	X	X
Shield Darter[3]	*Percina peltata*	X	
Shortnose Sturgeon	*Acipenser brevirostrum*	X	
Smallmouth Bass	*Micropterus dolomieu*	X	X
Smallmouth Flounder[2]	*Etropus microstomus*	X	
Spotfin Shiner	*Cyprinella spiloptera*	X	X
Spottail Shiner	*Notropis hudsonius*	X	X
Striped Bass	*Morone saxatilis*	X	
Swallowtail Shiner	*Notropis procne*	X	X
Tessellated Darter	*Etheostoma olmstedi*	X	X
Tiger Muskellunge	*Esox lucius x Esox masquinongy*	X	
Walleye	*Sander vitreus*	X	
White Bass X Striped Bass	*Morone chrysops* X *Morone Saxatalis*	X	
White Catfish	*Ameiurus catus*	X	
White Crappie	*Pomoxis annularis*	X	
White Perch	*Morone americana*	X	
White Sucker	*Catostomus commersonii*	X	X
Yellow Bullhead[3]	*Ameiurus natalis*	X	X
Yellow Perch	*Perca flavescens*	X	

[1] Source: PA Fish and Boat Commission (John T. Buzzar) email to Weston Solutions, Inc. (Sonny Rutkowski) on October 19, 2010.

[2] Fish found in the estuary, but outside the project scope.

[3] Fish more of the freshwater variety, but may wander into the estuary, depending on ratio of fresh to saltwater

Table 4. Benthic macroinvertebrate data (numbers per Petite Ponar Grab sample) collected in Neshaminy Creek, Bucks County, PA - October 19, 2010.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 1 No.	Sample No. 1 Percent	Sample No. 2 No.	Sample No. 2 Percent	Sample No. 3 No.	Sample No. 3 Percent	Sample No. 4 No.	Sample No. 4 Percent	Sample No. 5 No.	Sample No. 5 Percent	Sample No. 6 No.	Sample No. 6 Percent
Amphipoda														
Gammarus fasciatus	4	CG					1	2.3					1	0.3
Leptocheirus plumulosus	5	CG	1	2.6										
Coleoptera														
Stenelmis sp.	5	SC												
Diptera														
Chironomus sp.	6	CG	1	2.6			1	2.3			1	1.7	6	1.6
Clinotanypus sp.	6	CG												
Coelotanypus sp.	6	CG											3	0.8
Cryptochironomus fulvus gr.	6	CG	2	5.3			1	2.3			1	1.7	5	1.3
Culicoides sp.	10	PR			2	0.4								
Dolichopodidae	4	PR			1	0.2								
Einfeldia sp.	6	CG											8	2.1
Orthocladius sp.	6	CG												
Polypedilum halterale gr.	6	CG	1	2.6					5	7.7				
Probezzia sp.	6	PR												
Procladius sp.	6	CG	2	5.3			2	4.7	2	3.1			14	3.7
Rheotanytarsus sp.	6	CG												
Sphaeromias sp.	6	PR												
Tanypus sp.	6	CG			1	0.2							1	0.3
Tanytarsus sp.	6	CG											1	0.3
Hirudinida														
Gloiobdella elongata	8	PR	1	2.6	1	0.2							2	0.5
Helobdella stagnalis	8	PR	1	2.6										
Hydracarina	7	PR											2	0.5
Isopoda														
Caecidotea sp.	6	CG					1	2.3						
Mollusca														
Corbicula fluminea	4	FC	9	23.7			1	2.3			2	3.4		
Musculium sp.	8	FC												
Pisidium sp.	8	FC							21	32.3			1	0.3
Nematoda	9	CG			16	3.4							1	0.3
Nemertea														
Prostoma graescence	6	PR												
Oligochaeta														
Arcteonias lomondi	10	CG												
Bothrioneurum vejdovskyanum	10	CG			8	1.7								
Branchiura sowerbyi	10	CG			32	6.7	1	2.3	10	15.4			20	5.2
Ilyodrilus templetoni	10	CG					3	7.0			1	1.7	48	12.5
Limnodrilus claparedeanus	10	CG									4	6.8		

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 1 No.	Sample No. 1 Percent	Sample No. 2 No.	Sample No. 2 Percent	Sample No. 3 No.	Sample No. 3 Percent	Sample No. 4 No.	Sample No. 4 Percent	Sample No. 5 No.	Sample No. 5 Percent	Sample No. 6 No.	Sample No. 6 Percent
Oligochaeta (continued)														
Limnodrilus hoffmeisteri	10	CG									8	13.6	51	13.3
Limnodrilus udekemianus	10	CG			37	7.8								
Limnodrilus sp.	10	CG	18	47.4	379	79.5	32	74.4	27	41.5	42	71.2	205	53.5
Nais sp.	10	CG												
Quistadrilus multisetosus	10	CG											12	3.1
Trichoptera														
Chimarra obscura	4	FC											1	0.3
Hydropsyche sp.	5	FC	1	2.6										
Nectopsyche sp.	3	SH											1	0.3
Oecetis sp.	8	PR	1	2.6										
Turbellaria														
Dugesia tigrina	9	PR												
Total Number			38	100.0	477	100.0	43	100.0	65	100.0	59	100.0	383	100.0
Metrics														
Taxa Richness			11		9		9		5		7		19	
Modified Hilsenhoff Biotic Index			7.5		9.9		9.3		8.9		9.7		9.5	
Percent Dominant Taxon			47.4		79.5		74.4		41.5		71.2		53.5	
(Identity)			*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*	
Menhinick's Diversity Index			1.78		0.41		1.37		0.62		0.91		0.97	
Simpson's Dominance Index			0.29		0.64		0.56		0.31		0.53		0.33	
Shannon Diversity, base e			1.68		0.81		1.75		1.32		1.02		1.65	
Shannon Evenness, base e			0.70		0.37		0.98		0.82		0.52		0.56	

[1] Petite Ponar Grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection.

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 7 No.	Sample No. 7 Percent	Sample No. 8 No.	Sample No. 8 Percent	Sample No. 9 No.	Sample No. 9 Percent	Sample No. 10 No.	Sample No. 10 Percent	Sample No. 11 No.	Sample No. 11 Percent	Sample No. 12 No.	Sample No. 12 Percent
Amphipoda														
Gammarus fasciatus	4	CG									1	0.6		
Leptocheirus plumulosus	5	CG												
Coleoptera														
Stenelmis sp.	5	SC									1	0.6		
Diptera														
Chironomus sp.	6	CG	1	0.9	9	5.5	1	0.4	1	2.3	3	1.8	23	28.0
Clinotanypus sp.	6	CG												
Coelotanypus sp.	6	CG	1	0.9										
Cryptochironomus fulvus gr.	6	CG	2	1.8							5	3.1		
Culicoides sp.	10	PR					1	0.4						
Dolichopodidae	4	PR												
Einfeldia sp.	6	CG	14	12.4							3	1.8	1	1.2
Orthocladius sp.	6	CG							1	2.3				
Polypedilum halterale gr.	6	CG	1	0.9	3	1.8	1	0.4	1	2.3				
Probezzia sp.	6	PR												
Procladius sp.	6	CG	10	8.8	10	6.1			1	2.3	20	12.3		
Rheotanytarsus sp.	6	CG												
Sphaeromias sp.	6	PR	1	0.9	2	1.2								
Tanypus sp.	6	CG	2	1.8			3	1.1					1	1.2
Tanytarsus sp.	6	CG	2	1.8										
Hirudinida														
Gloiobdella elongata	8	PR												
Helobdella stagnalis	8	PR												
Hydracarina	7	PR	1	0.9										
Isopoda														
Caecidotea sp.	6	CG												
Mollusca														
Corbicula fluminea	4	FC					3	1.1	1	2.3				
Musculium sp.	8	FC												
Pisidium sp.	8	FC	11	9.7	1	0.6	21	7.8	2	4.5	8	4.9	11	13.4
Nematoda	9	CG												
Nemertea														
Prostoma graescence	6	PR												
Oligochaeta														
Arcteonias lomondi	10	CG	2	1.8										
Bothrioneurum vejdovskyanum	10	CG	1	0.9										
Branchiura sowerbyi	10	CG	5	4.4	12	7.3	10	3.7	1	2.3	3	1.8	7	8.5
Ilyodrilus templetoni	10	CG	11	9.7	8	4.8	42	15.6	1	2.3	12	7.4	2	2.4
Limnodrilus claparedranus	10	CG											4	4.9

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 7 No.	Sample No. 7 Percent	Sample No. 8 No.	Sample No. 8 Percent	Sample No. 9 No.	Sample No. 9 Percent	Sample No. 10 No.	Sample No. 10 Percent	Sample No. 11 No.	Sample No. 11 Percent	Sample No. 12 No.	Sample No. 12 Percent
Oligochaeta (continued)														
Limnodrilus hoffmeisteri	10	CG	37	32.7	17	10.3			8	18.2	26	16.0		
Limnodrilus udekemianus	10	CG												
Limnodrilus sp.	10	CG	8	7.1	99	60.0	187	69.3	27	61.4	77	47.2	33	40.2
Nais sp.	10	CG			4	2.4								
Quistadrilus multisetosus	10	CG	3	2.7							4	2.5		
Trichoptera														
Chimarra obscura	4	FC					1	0.4						
Hydropsyche sp.	5	FC												
Nectopsyche sp.	3	SH												
Oecetis sp.	8	PR												
Turbellaria														
Dugesia tigrina	9	PR												
Total Number			113	100.0	165	100.0	270	100.0	44	100.0	163	100.0	82	100.0
Metrics														
Taxa Richness			18		10		10		10		12		8	
Modified Hilsenhoff Biotic Index			8.6		9.4		9.7		9.4		9.1		8.5	
Percent Dominant Taxon			32.7		60.0		69.3		61.4		47.2		40.2	
(Identity)			*(Limnodrilus hoffmeisteri)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*	
Menhinick's Diversity Index			1.7		0.78		0.61		1.51		0.94		0.88	
Simpson's Dominance Index			0.16		0.39		0.49		0.42		0.27		0.27	
Shannon Diversity, base e			2.25		1.45		1.05		1.35		1.73		1.55	
Shannon Evenness, base e			0.78		0.63		0.45		0.59		0.69		0.74	

[1] Petite Ponar Grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection.

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 13 No.	Sample No. 13 Percent	Sample No. 14 No.	Sample No. 14 Percent	Sample No. 15 No.	Sample No. 15 Percent	Sample No. 16 No.	Sample No. 16 Percent	Sample No. 17 No.	Sample No. 17 Percent	Sample No. 18 No.	Sample No. 18 Percent
Amphipoda														
Gammarus fasciatus	4	CG	4	2.8									1	0.6
Leptocheirus plumulosus	5	CG												
Coleoptera														
Stenelmis sp.	5	SC												
Diptera														
Chironomus sp.	6	CG					2	1.3						
Clinotanypus sp.	6	CG					3	2.0						
Coelotanypus sp.	6	CG												
Cryptochironomus fulvus gr.	6	CG			1	0.7								
Culicoides sp.	10	PR												
Dolichopodidae	4	PR												
Einfeldia sp.	6	CG												
Orthocladius sp.	6	CG												
Polypedilum halterale gr.	6	CG	7	4.9	1	0.7	2	1.3					3	1.7
Probezzia sp.	6	PR			1	0.7								
Procladius sp.	6	CG	2	1.4									3	1.7
Rheotanytarsus sp.	6	CG			1	0.7								
Sphaeromias sp.	6	PR					14	9.3						
Tanypus sp.	6	CG					9	6.0	1	1.3				
Tanytarsus sp.	6	CG												
Hirudinida														
Gloiobdella elongata	8	PR			4	3.0			1	1.3				
Helobdella stagnalis	8	PR												
Hydracarina	7	PR												
Isopoda														
Caecidotea sp.	6	CG												
Mollusca														
Corbicula fluminea	4	FC	2	1.4	8	6.0					4	4.0		
Musculium sp.	8	FC			2	1.5								
Pisidium sp.	8	FC			8	6.0	7	4.6			4	4.0		
Nematoda	9	CG					3	2.0	1	1.3				
Nemertea														
Prostoma graescence	6	PR			4	3.0								
Oligochaeta														
Arcteonias lomondi	10	CG												
Bothrioneurum vejdovskyanum	10	CG							9	11.7				
Branchiura sowerbyi	10	CG					4	2.6	4	5.2				
Ilyodrilus templetoni	10	CG			4	3.0	12	7.9	1	1.3	1	1.0	4	2.3
Limnodrilus claparedianus	10	CG												

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 13 No.	Sample No. 13 Percent	Sample No. 14 No.	Sample No. 14 Percent	Sample No. 15 No.	Sample No. 15 Percent	Sample No. 16 No.	Sample No. 16 Percent	Sample No. 17 No.	Sample No. 17 Percent	Sample No. 18 No.	Sample No. 18 Percent
Oligochaeta (continued)														
Limnodrilus hoffmeisteri	10	CG							9	11.7				
Limnodrilus udekemianus	10	CG							9	11.7				
Limnodrilus sp.	10	CG	128	89.5	100	74.6	83	55.0	39	50.6	90	90.9	158	90.8
Nais sp.	10	CG												
Quistadrilus multisetosus	10	CG					12	7.9	3	3.9			4	2.3
Trichoptera														
Chimarra obscura	4	FC												
Hydropsyche sp.	5	FC												
Nectopsyche sp.	3	SH												
Oecetis sp.	8	PR												
Turbellaria														
Dugesia tigrina	9	PR											1	0.6
Total Number			143	100.0	134	100.0	151	100.0	77	100.0	99	100.0	174	100.0
Metrics														
Taxa Richness			5		11		11		10		4		7	
Modified Hilsenhoff Biotic Index			9.5		9.2		9.1		9.9		9.7		9.8	
Percent Dominant Taxon			89.5		74.6		55.0		50.6		90.9		90.8	
(Identity)			*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*		*(Limnodrilus* sp.*)*	
Menhinick's Diversity Index			0.42		0.95		0.90		1.14		0.40		0.53	
Simpson's Dominance Index			0.80		0.57		0.33		0.30		0.83		0.83	
Shannon Diversity, base e			0.47		1.08		1.63		1.60		0.39		0.46	
Shannon Evenness, base e			0.29		0.45		0.68		0.70		0.28		0.24	

[1] Petite Ponar Grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection.

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	No. Collected in Sample[1] Sample No. 19 No.	Sample No. 19 Percent	Sample No. 20 No.	Sample No. 20 Percent	All Samples Mean No.	Mean No./m^2	Percent
Amphipoda									
Gammarus fasciatus	4	CG			28	4.6	1.8	78.3	1.1
Leptocheirus plumulosus	5	CG					0.1	2.2	0.0
Coleoptera									
Stenelmis sp.	5	SC			1	0.2	0.1	4.3	0.1
Diptera									
Chironomus sp.	6	CG					2.5	106.5	1.4
Clinotanypus sp.	6	CG					0.2	6.5	0.1
Coelotanypus sp.	6	CG					0.2	8.7	0.1
Cryptochironomus fulvus gr.	6	CG	1	0.9	1	0.2	1.0	41.3	0.6
Culicoides sp.	10	PR					0.2	6.5	0.1
Dolichopodidae	4	PR					0.1	2.2	0.0
Einfeldia sp.	6	CG	1	0.9			1.4	58.7	0.8
Orthocladius sp.	6	CG					0.1	2.2	0.0
Polypedilum halterale gr.	6	CG	2	1.8	10	1.6	1.9	80.4	1.1
Probezzia sp.	6	PR					0.1	2.2	0.0
Procladius sp.	6	CG	1	0.9	5	0.8	3.6	156.5	2.1
Rheotanytarsus sp.	6	CG					0.1	2.2	0.0
Sphaeromias sp.	6	PR					0.9	37.0	0.5
Tanypus sp.	6	CG					0.9	39.1	0.5
Tanytarsus sp.	6	CG					0.2	6.5	0.1
Hirudinida									
Gloiobdella elongata	8	PR	2	1.8	10	1.6	1.1	45.7	0.6
Helobdella stagnalis	8	PR			3	0.5	0.2	8.7	0.1
Hydracarina	7	PR					0.2	6.5	0.1
Isopoda									
Caecidotea sp.	6	CG					0.1	2.2	0.0
Mollusca									
Corbicula fluminea	4	FC			6	1.0	1.8	78.3	1.1
Musculium sp.	8	FC					0.1	4.3	0.1
Pisidium sp.	8	FC	2	1.8			4.9	210.9	2.9
Nematoda	9	CG			1	0.2	1.1	47.8	0.6
Nemertea									
Prostoma graescence	6	PR					0.2	8.7	0.1
Oligochaeta									
Arcteonias lomondi	10	CG					0.1	4.3	0.1
Bothrioneurum vejdovskyanum	10	CG					0.9	39.1	0.5
Branchiura sowerbyi	10	CG	2	1.8			5.6	241.3	3.3
Ilyodrilus templetoni	10	CG	4	3.7			7.7	334.8	4.5
Limnodrilus claparedianus	10	CG					0.4	17.4	0.2

Table 4. Continued.

Taxon	Tolerance Value[2]	Functional Feeding Category[3]	Sample No. 19 No.	Sample No. 19 Percent	Sample No. 20 No.	Sample No. 20 Percent	All Samples Mean No.	All Samples Mean No./m^2	All Samples Percent
Oligochaeta (continued)									
Limnodrilus hoffmeisteri	10	CG					7.8	339.1	4.6
Limnodrilus udekemianus	10	CG					2.3	100.0	1.4
Limnodrilus sp.	10	CG	92	84.4	480	78.8	115.2	5,008.7	67.8
Nais sp.	10	CG					0.2	8.7	0.1
Quistadrilus multisetosus	10	CG	2	1.8	64	10.5	5.2	226.1	3.1
Trichoptera									
Chimarra obscura	4	FC					0.1	4.3	0.1
Hydropsyche sp.	5	FC					0.1	2.2	0.0
Nectopsyche sp.	3	SH					0.1	2.2	0.0
Oecetis sp.	8	PR					0.1	2.2	0.0
Turbellaria									
Dugesia tigrina	9	PR					0.1	2.2	0.0
Total Number			109	100.0	609	100.0	169.9	7,387.0	100.0

Metrics	Sample No. 19	Sample No. 20	All Samples
Taxa Richness	10	11	42
Modified Hilsenhoff Biotic Index	9.7	9.5	9.5
Percent Dominant Taxon	84.4	78.8	67.8
(Identity)	(*Limnodrilus* sp.)	(*Limnodrilus* sp.)	(*Limnodrilus* sp.)
Menhinick's Diversity Index	0.96	0.45	3.22
Simpson's Dominance Index	0.72	0.64	0.47
Shannon Diversity, base e	0.76	0.84	1.54
Shannon Evenness, base e	0.33	0.35	0.41

[1] Petite Ponar Grab samples sorted in entirety, except for subsampling of abundant taxa.
[2] Modified Hilsenhoff Biotic Index. Source is the Pennsylvania Department of Environmental Protection.
[3] PR=Predator; CG=Collector/Gatherer; FC=Filterer/Collector; SC=Scraper; SH=Shredder. Source is the Pennsylvania Department of Environmental Protection.

Table 5. Benthic macroinvertebrate sample (Petite Ponar Grab) descriptions, Neshaminy Creek, Bucks County, PA - October 19, 2010.

Sample No.	Latitude	Longitude	Date	Time (PM)	Depth (ft)	Description
1	N 40° 05' 04.6"	W 74° 54' 39.9"	October 19, 2010	12:05	14.0	Primarily sand and gravel with a thin layer of brown silt on top. Contained some empty Asiatic clam shells.
2	N 40° 05' 02.6"	W 74° 54' 39.1"	October 19, 2010	12:15	7.0	Primarily clay with a thin layer of brown silt on top. Contained some fine detritus.
3	N 40° 04' 59.4"	W 74° 54' 35.2"	October 19, 2010	12:25	20.0	Primarily silty sand with a thin layer of brown silt on top. Contained some fine detritus.
4	N 40° 04' 57.2"	W 74° 54' 36.9"	October 19, 2010	12:35	9.0	Primarily silty sand with a thin layer of brown silt on top. Contained some fine detritus.
5	N 40° 04' 56.3"	W 74° 54' 35.6"	October 19, 2010	12:45	14.0	Primarily sand with a thin layer of brown silt on top. Contained some empty Asiatic clam shells.
6	N 40° 04' 58.1"	W 74° 54' 30.4"	October 19, 2010	1:07	7.0	Primarily gray/black silt. Contained a moderate amount of detritus. Had a distinct organic odor.
7	N 40° 04' 57.4"	W 74° 54' 32.2"	October 19, 2010	1:22	7.0	Primarily gray/black silt with a thin layer of brown silt on top. Contained a moderate amount of detritus.
8	N 40° 04' 53.5"	W 74° 54' 33.9"	October 19, 2010	1:35	8.0	Primarily gray/black silt with a think layer of brown silt on top.
9	N 40° 04' 50.9"	W 74° 54' 37.5"	October 19, 2010	1:50	7.0	Primarily brown clay with a thin layer of brown silt on top.
10	N 40° 04' 46.3"	W 74° 54' 36.3"	October 19, 2010	2:02	13.0	Primarily sand with a thin layer of brown silt on top.
11	N 40° 04' 42.2"	W 74° 54' 31.9"	October 19, 2010	2:10	9.0	Primarily gray/black silt.
12	N 40° 04' 46.4"	W 74° 54' 26.7"	October 19, 2010	2:25	10.0	Primarily gray/black silt. Had a distinct organic odor.
13	N 40° 04' 39.5"	W 74° 54' 32.1"	October 19, 2010	2:45	13.0	Primarily sand. Contained a moderate amount of detritus.
14	N 40° 04' 37.3"	W 74° 54' 32.3"	October 19, 2010	2:52	15.0	Primarily sand. Contained some detritus and some empty Asiatic clam shells.
15	N 40° 04' 34.3"	W 74° 54' 32.9"	October 19, 2010	2:56	6.0	Primarily gray silt with a thin layer of brown silt on top. Had a slight organic odor.
16	N 40° 04' 30.6"	W 74° 54' 30.4"	October 19, 2010	3:03	3.5	Primarily gravel and cobble with some clay.
17	N 40° 04' 28.6"	W 74° 54' 31.9"	October 19, 2010	3:10	20.0	Primarily sand. Contained some detritus and some empty Asiatic clam shells.
18	N 40° 04' 25.1"	W 74° 54' 32.3"	October 19, 2010	3:15	11.0	Primarily dark brown silt with some gray silt.
19	N 40° 04' 25.1"	W 74° 54' 29.3"	October 19, 2010	3:20	6.0	Primarily dark brown silt with some gray silt.
20	N 40° 04' 25.0"	W 74° 54' 35.8"	October 19, 2010	3:30	8.0	Primarily leafy detritus with some brown/gray silt.

Table 6. Water quality measurements, Neshaminy Creek, Bucks County, PA - October 19 and 26, 2010.

Location	Time	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH (Standard Units)	Specific Conductance (µsiemens/cm)	Salinity (ppt)
Measurements made during macroinvertebrate survey on October 19, 2010						
Neshaminy Creek confluence						
- Surface	11:37 AM	14.0	12.2	6.4	180	0.0
- 6 feet deep	11:40 AM	14.0	11.7	6.6	180	0.0
State Road Bridge						
- Surface	11:56 AM	14.0	13.4	7.1	184	0.0
- 6 feet deep	12:00 PM	12.3	13.9	7.1	182	0.0
Marina No. 1 Interior						
- Surface	1:15 PM	14.4	13.1	7.4	192	0.0
- 6 feet deep	1:18 PM	13.7	12.3	7.4	295	0.0
Petite Ponar Sample Station No. 9						
- Surface	1:58 PM	14.0	11.6	7.4	183	0.0
- 6 feet deep	2:00 PM	14.0	11.5	7.4	183	0.0
Petite Ponar Sample Station No. 12						
- Surface	2:32 PM	14.6	11.5	7.4	206	0.0
- 6 feet deep	2:35 PM	13.9	10.5	7.3	260	0.0
Measurements made during fish survey on October 26, 2010						
Neshaminy Creek confluence						
- Surface	8:55 AM	14.3	9.5	6.3	259	
- 10 feet deep		14.1	9.5	6.7	265	
Entrance to Marina No. 2						
- Surface	9:00 AM	14.4	9.8	7.3	306	
- 10 feet deep		14.1	9.6	7.1	310	
State Road Bridge						
- Surface	9:10 AM	14.6	10.1	7.5	342	
- 10 feet deep		14.5	9.9	7.3	432	
Marina No. 1 Interior						
- 3.5 feet deep	9:20 AM	14.6	9.8	7.5	255	
Marina No. 2 Interior						
- 4 feet deep	9:37 AM	14.8	9.8	7.5	251	

RESPONSE TO REGULATORY AGENCY CONCERNS ABOUT SHADING OF AQUATIC HABITAT AT THE PROPOSED SOUTHPORT DEVELOPMENT PROJECT
DECEMBER 2010

The loss of aquatic habitat from shading created by the wharfs proposed for construction at the Southport Development Project is among the regulatory agency concerns about the project. However, the degree of aquatic habitat loss resulting from construction of the wharfs in this part of the Delaware River may be limited for a number of reasons.

The National Marine Fisheries Service (NMFS), in its 22 October 2010 comments on the proposed Southport Marine Terminal project references research that attributes a negative effect to shading caused by piers also evaluates the effects of other man-made structures on the abundance, diversity, growth, and ingestion of prey by fish. The work took place at three locations in the New York-New Jersey Harbor estuary (Arthur Kill, Kill Van Kull, and the lower Hudson River). It is documented in a series of publications by Rutgers University's Dr. Ken Able and colleagues dating from 1993 to 2003.

The attributed negative effect of shading within these publications is the reduced ability of fish to locate and capture prey organisms. The various authors found that fish species abundance and diversity, as measured by benthic trap catch, was depressed under piers relative to habitats near wrecks, in pile fields, and in open water areas. In separate caging experiments, they found that mean growth rates of winter flounder and tautog were negative under piers, greatest in open water areas, and intermediate at pier edges. In addition, dry weight of ingested food as determined by stomach contents analysis of these two species reflected the same relationship. However, in contrast to earlier studies, Metzger *et al.* (2001) found that caged young-of-the-year Atlantic tomcod can grow in under-pier areas, although there was a slight trend toward lower growth compared with edge or open water habitats. No significant difference was found in dry weight of stomach contents across habitats for this species.

In addition to the differences noted above and far more importantly, conclusions based upon this body of evidence also need to be tempered by consideration of a number of other factors. The authors admit that non-caged fish can simply leave the underpier areas when they wish to and take advantage of edge and open water habitat. They can then return to the underpier to take advantage of resting habitat, etc. In fact, Duffy-Anderson and Able (1999) state that "the pier edge, the transitional zone between the pier interior and the outside, may be an important ecological zone, providing an abundance of prey items while at the same time offering increased refuge from predation".

There are two characteristics of the New York- New Jersey Harbor estuary studies that limit the applicability of inferences to the Southport site and its position on the Delaware River in Philadelphia. First, the salinities of the bodies of water examined in the New York-New Jersey Harbor estuary were much higher than in the Delaware River near the Southport Development Site. The Delaware River at Philadelphia is freshwater and supports a different fish assemblage than the three areas examined in the New York-New Jersey Harbor estuary. Secondly, in the New York-New Jersey studies the authors examined almost exclusively the characteristics of juvenile fish in both the caged fish experiments and the results of the trapping experiments. In evaluating the potential effects of piers on Delaware River fishes in Philadelphia, a different group of species and an aggregation that includes many older and larger fishes should be considered. For example, predator species in the upper tidal Delaware River such as striped bass, largemouth bass, and channel catfish take advantage of current breaks and differentials in light intensity provided by pier edges to ambush prey.

Conclusions about the deleterious effects of shading produced by piers in terms of abundance and diversity of captured fish were drawn from the Hudson River study alone, based upon a very small number of fish (270 individuals). Furthermore, the Hudson River studies evaluated the quality of habitat under the platforms of large piers (>20,000 m^2, equal to about 5 acres). As shaded areas become smaller, the ratio of edge habitat to shaded area increases, and there are many ecological advantages to edge habitats.

The net effects of shading plus the associated pier structures (pilings) that emerge from the shading research projects are not clear. Duffy-Anderson *et al.* (2003) indicated that in the Arthur Kill, Kill Van Kull, and the Hudson River, significantly lower numbers of fish were trapped in open water areas, compared to near wrecks or pile fields. "Results suggest that fish assemblage patterns may be a function of structural complexity, though other factors such as shading or water depth may also have measurable effects". The low numbers of fish trapped in open water areas existed even though the authors postulated that abundance at the open water sites may have been artificially inflated due to the attraction of fish to the traps (which provided structural complexity to areas essentially devoid of it). Pilings by themselves appear to confer advantage relative to open water.

Duffy-Anderson and Able (2001) stated that young winter flounder and tautog caged under piers lost weight in spite of sufficient prey available for consumption and presumably growth. In fact, "invertebrate prey were more abundant under piers than at the edge or outside". Metzger *et al.* (2001) also found greater prey densities underneath the pier. Given prey organisms at higher densities under piers and lower exploitation rates, piers could serve as refuges for higher productivity of benthic macroinvertebrates that can then be exported to areas outside the pier.

Even if one accepts the hypothesis that fish that feed by sight are impeded by shade in under-pier areas, there are many additional trade-offs. The shaded areas under piers could provide slight thermal refuges in areas where current is minimal for species such as striped bass during time periods in which upper thermal tolerances may normally be exceeded. The Hudson River studies indicate that a favorable habitat for American eel, a species of increasing concern, is created by large shaded areas. Species possessing alternative feeding mechanisms may benefit from piers, which are areas that provide refuge for survival and growth of benthic macroinvertebrates. Examples of these species in the vicinity of the Southport Development site would be channel catfish, brown bullheads and the aforementioned eels. The pilings of the piers also provide substrate for attached algal growth, which is utilized as food by small fish such as eastern silvery minnow and spottail shiner, which, in turn, can be utilized as prey by predator fish.

Note: The following statement's importance is based upon the projected height of the wharf to be constructed.
[Another important consideration is the height and width of the piers or wharfs to be constructed. Most of the piers evaluated in the New York-New Jersey Harbor Studies are inundated at MHW, and thus have a greater shading effect than higher piers have. Depending upon orientation, a sufficiently high pier or wharf will allow greater penetration of sunlight at more times of the day. If the wharfs constructed at the Southport Development Project are built sufficiently high then negative effects of shading will be reduced. As previously mentioned, as shaded areas become smaller and more linear, the ratio of edge habitat to shaded area increases.]

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A COMPARISON OF FISH ASSEMBLAGE AND HABITAT: SOUTHPORT DEVELOPMENT PROJECT AND LOWER TIDAL NESHAMINY CREEK

PREPARED FOR:

WESTON SOLUTIONS, INC.

PREPARED BY:

NORMANDEAU ASSOCIATES, INC.

DECEMBER 2010

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INTRODUCTION

The Commonwealth of Pennsylvania, in conjunction with the Philadelphia Regional Port Authority, is proposing construction of a new marine cargo terminal to be located on approximately 116 acres along the Delaware River in Philadelphia, Pennsylvania. Weston Solutions, Inc. conducted and reported on a survey of the fish and benthic macroinvertebrate resources at the proposed terminal site (Weston Solutions, Inc. 2010).

Environmental permitting may require offsite mitigation to compensate for unavailable impacts to aquatic habitats at the proposed terminal site. One location under consideration for offsite mitigation is the downstream reach of Neshaminy Creek near Neshaminy State Park, approximately 20 miles upstream of the proposed terminal site. Normandeau Associates, Inc. conducted and reported on a survey of the fish and benthic macroinvertebrate resources present in the downstream reach of Neshaminy Creek, using methodology similar to that used in the survey at the Southport Project site (Normandeau Associates, Inc. 2010).

The objective of this report is to compare the fish and habitat data acquired at the proposed Southport Project site and in the downstream reach of Neshaminy Creek. In addition, the Southport fish assemblage is assessed as a food resource for 14 Federally-managed fish species. These 14 species were identified by the National Marine Fisheries Service as potentially having Essential Fish Habitat present at the Southport Project site (National Marine Fisheries Service 2010).

SOUTHPORT DEVELOPMENT PROJECT

Fishes present during April and June 2010 within the waters of the Southport Development Project area were collected with a combination of techniques which included boat-mounted and backpack electrofishing, seining, and trotlining in the April sampling period, to which sampling with a mini-Missouri trawl was added during the June sampling period (Weston Solutions, Inc. 2010).

A total of approximately 6,000 fish representing 27 taxa was collected during the study. When all three sampling areas (stormwater channel, interpier area, and river) were treated as a whole, the most common taxa collected were young of year (YOY) alosids (n = 4006), banded killifish (n = 1112), mummichog (n = 377), white perch (n = 140), channel catfish (n = 90), eastern silvery minnow (n = 81), American eel (n = 68), and striped bass (n = 46).

The river area yielded the greatest number of fish (n = 4165), which represented 14 taxa. In June sampling in the river area, a single beach seine haul conducted at a gravel beach area along the southeastern shoreline yielded approximately 4,000 young of year (YOY) alosids. Although preserved in the field in 70% isopropanol, a subsample of the alosids could not be identified due to deterioration, and could have been blueback herring, alewife, American shad, or hickory shad. The remainder of fish sampled from the river area was predominated by channel catfish (n = 53), eastern silvery minnow (n = 29), striped bass (n = 24), tessellated darter (n = 13), and white perch (n = 13). Minus the 4,000 YOY alosids, this area yielded only 165 fish in other species.

Of the three areas sampled, the stormwater channel yielded the second largest number of fish - a total of 1,214 individuals in 13 taxa. This area was greatly predominated by two species, banded killifish (n = 921) and mummichog (n = 179). Together these two species comprised 88.4% of the total number of fish collected in the stormwater channel.

Fish collected in the interpier area (614 individuals in 19 taxa) were predominated by mummichog (n = 198), banded killifish (n = 191), white perch (n = 111), channel catfish (n = 36), and striped bass (n = 22).

NESHAMINY CREEK

A combination of sampling methods was employed in order to characterize the fish in Neshaminy Creek between the State Road Bridge and the Delaware River, a distance of approximately 0.9 mile, in October 2010 (Normandeau Associates, Inc. 2010). Fish sampling also was conducted in the Delaware River just upstream, downstream, and outside the Neshaminy Creek confluence. Boat electrofishing was conducted at 11 locations in all existing habitats along both Neshaminy Creek shorelines, in the open water of the stream, in two abandoned marinas located off Neshaminy Creek, along both Delaware River shorelines just upstream and downstream of the confluence, and in the confluence. Trawling was conducted by towing an 8-foot mini-Missouri trawl for three 5-minute periods in the Neshaminy Creek channel from the State Road Bridge to just upstream of the Delaware River confluence. Seining was conducted near the mouth of Neshaminy Creek as the high tide rose to provide a limited narrow area of shallow water adjacent to a steep drop-off located along the stream's outside bend. Trotlining was conducted in three locations in Neshaminy Creek.

A total of 1,050 fish representing 27 species was collected in Neshaminy Creek and the Delaware River adjacent to the confluence. Pumpkinseed was the most numerous fish collected (n = 321), followed by spottail shiner (n = 142), bluegill (n = 123), banded killifish (n = 114), and eastern silvery minnow (n = 109). Additional fish species collected worth noting included striped bass and American eel.

The abundance of pumpkinseed and bluegill, as well as largemouth bass (n = 46), black crappie (n = 45) and white crappie (n = 7), and a few other species, were considerably underestimated due to gear saturation which occurred while electrofishing at two locations in Abandoned Marina 1. Beaver-constructed brush piles at both locations were highly attractive to these centrarchid fishes. When the anode of the electrofishing boat neared these piles, many hundreds of fish were stunned and moved toward the surface. The fish were netted as quickly as possible, but before all could be collected, some had either moved toward the bottom and back inside the brush piles or out of the electric field. In addition, after about one and one-half to two minutes of continuous shocking at the brush piles, the generator was stopped in order to avoid injuring fish and the remaining fish were then netted. It appeared that these aggregations of fish, as well as the six yellow perch collected, had assumed their overwintering locations in these brush piles.

Other spatial distributions were revealed in the electrofishing data, as well as in data contributed by the other collection methods. Eleven eels were collected within Abandoned Marina 2, but this species was considerably more abundant within Abandoned Marina 1, where 37 were collected. No eels were

collected at any electrofishing stations located outside the abandoned marinas. Of the remaining two eels collected, one (the largest eel collected in the survey) was collected by trotline near the stream mouth and the other (the smallest eel collected in the survey) was collected in the mini-Missouri trawl in the transect closest to the stream mouth. Although it was clear that eels were more abundant within Abandoned Marina 1 than in Abandoned Marina 2, they may also have been easier to collect due to enhanced visibility resulting from the greater area of shallower water within Abandoned Marina 1, as the eels would usually move along the silt bottom when they encountered the electric field, rather than move upwards toward the anode, as other species of fish would.

Although some individuals of minnow species (spottail shiner, Eastern silvery minnow, and banded killifish) were collected within the abandoned marinas, they were found in greater concentration along the banks of Neshaminy Creek and the Delaware River. These three species and mummichog were particularly concentrated along the edge of a stand of yellow cow lily (*Nuphar* sp.), but which also contained a tiny tidal tributary. Most of the minnows collected at this location were concentrated within the mouth of this tributary.

No alosids were collected in Neshaminy Creek. However, a total of five American shad and one blueback herring, all young-of-year (YOY), was collected by electrofishing along the shoreline of the Delaware River on either side of the confluence and within the Delaware River just outside the confluence. A single electrofishing station within Neshaminy Creek, located 100 feet from the outer edge of a yellow cow lily stand in open, deeper water, was established specifically to enhance the possibility of collecting alosids. However, no fish of any species were collected in ten minutes of electrofishing, not unexpected because YOY alosids likely were migrating downestuary in late October.

COMPARISON BETWEEN FISHES COLLECTED AT THE SOUTHPORT DEVELOPMENT PROJECT SITE AND IN NESHAMINY CREEK

A comparison of the fish taxa collected at the Southport Project site and those collected in Neshaminy Creek is presented in Table 1. Of the 27 taxa that were collected at the Southport Project site, only five were not collected in Neshaminy Creek (not considering the YOY *Morone* and *Alosa* , whose presence in the data at the Southport Project site is an artifact of the inability to differentiate species at small sizes due to deterioration of specimens). These species were gizzard shad (n = 6), hogchoker (n = 3), yellow bullhead (n = 3), alewife (n = 1), and white catfish (n = 1). Gizzard shad in the tidal Delaware River move from tributaries to the mainstem with decreasing temperatures in the fall (Smith 1971) and, therefore, would likely have departed from Neshaminy Creek. All three hogchoker were collected in a single trawl conducted off the end of Pier 124. All three yellow bullhead were collected by a single trotline set in April. White catfish is a species that is becoming increasingly rare in the Delaware and Schuylkill Rivers, probably a function of increased competition and predation produced by the increase of channel catfish, facilitated by improving water quality which favors channel catfish (Boyer 1995). Increased predation by flathead catfish may also be occurring.

Of the 27 species collected in Neshaminy Creek, a total of seven species was not collected at the Southport Project site. These species were white crappie (n = 7), American shad (n = 5), rock bass (n = 3), golden shiner (n = 2), green sunfish (n = 1), warmouth (n = 1), and fallfish (n = 1). It is unlikely

that the five American shad would have been collected in Neshaminy Creek if sampling had occurred simultaneously with sampling at the Southport Project site, as individuals of this species would either not be present (April) or too small to collect by electrofishing (June). The rock bass and fallfish are stream species that would likely be found in much greater abundance upstream in Neshaminy Creek.

A single type of habitat feature appeared to greatly influence the species composition of each of the two locations. Although a remarkable overlap of species occurred between them (20), indicating the similarity of the two assemblages, the relative abundance of the predominant species at each location differed.

At the Southport Project site, the stormwater channel appeared to support large numbers of banded killifish and mummichog. Not only did the these two species comprise 88.4% of the fish collected in the stormwater channel, but excluding the approximately 4,000 YOY *Alosa* individuals collected in a single seine haul, these two species in the stormwater channel comprised 54.5% of all fish collected at the Southport Project site. In addition to banded killifish and mummichog, 46 of the 51 American eels collected at this location were collected in the stormwater channel. There may be many potential explanations for the attraction of these three species to the stormwater channel, but the higher conductivity present there or the presence of detrital organic matter used directly as food by these *Fundulus* spp. are two possibilities. Banded killifish are nearly always the most abundant fish collected in the relatively higher conductivity water found within sewage treatment plant effluents in parts of the non-tidal Schuylkill River watershed (G.Waterfield, Normandeau Associates, personal observation). Baker-Dittus (1978), cited in Smith (1995), states that mummichog may consume detritus when the availability of other food is low, and opportunistically great amounts of organic detritus may be attractive. It also is noted that a stone weir located near the stormwater channel's confluence with the Delaware River appears to exclude most large predator fish, thus providing a refuge for smaller fish species.

In Neshaminy Creek, the two brush piles in association with the deep water refuge provided by Abandoned Marina 2 supported large numbers of sunfish (predominately pumpkinseed, black crappie, bluegill, and largemouth bass) which apparently had assumed their overwintering locations. Because the number of fish encountered at these brush piles was so great, gear saturation occurred, fish could not be netted as fast as they appeared, and electrofishing was halted to avoid injuring them. A total of 255 sunfish was collected at one brush pile and possibly another 150 to 200 sunfish could have been collected. At the second brush pile, a total of 180 sunfish was collected, including the only yellow perch (6) collected at this location. Possibly another 100 to 125 sunfish could have been collected at the second brush pile. Bluegill comprised a greater proportion of the fish collected at the second brush pile than at the first. Assuming collection of these additional fish, sunfish collected at the brush piles might have comprised about 58% (or 800 of 1,370 fish collected) of all fish collected in the Neshaminy Creek sampling.

GENERAL CHARACTERIZATION OF HABITATS AND COMPARISON OF HABITAT TYPES BETWEEN THE TWO LOCATIONS

The Southport Project site and vicinity is characterized by three distinct habitat types: the stormwater channel, the interpier area, and the river area (the intertidal zone and slightly offshore). The

stormwater channel, which yielded 60.3% of all fish collected (1,214 of 2,014) at the Southport Project site when excluding the estimated 4,000 YOY alosids collected in a single seine haul in the river, is the habitat which most attracts and supports fish. In addition to large numbers of banded killifish and mummichog, 46 of 51 American eels were collected in the stormwater channel. This attraction may be due to some combination of flow characteristics, conductivity, substrate, and/or particulate matter present in the flow. Because the storm channel contains such important fish habitat, particularly for eels, lost eel habitat will be replicated within the new section of the realigned channel.

The interpier area (located between Packer Terminal and the north shore of the Navy Yard) yielded (when excluding the estimated 4,000 YOY alosids) 30.5% of fish collected at the Southport Project site. The attributes of the interpier areas included refuges from tidal flow, edge characteristics related to differences in flow and light intensity, and presence of pilings and bulkheads providing substrate for attachment of algal growth. The river shoreline, which yielded 165 individuals or 8.2% of fish collected exclusive of the 4,000 YOY alosids, contains overhanging brush and coarse rubble, which provides structure for the fish.

The Neshaminy Creek survey reach is greatly predominated by two habitat types from which nearly all the fish were collected - the abandoned marinas and the stream shorelines vegetated by yellow cow lily (*Nuphar* sp).

The abandoned marinas yielded 62.1% (652 of 1,050) of the total fish collected in Neshaminy Creek. Together, these marinas constitute 5.7 acres of water surface. In Abandoned Marina 2, the greatest factor involved in the collection of large numbers of predominately sunfish in the marina samples was the combination of complex woody cover provided by beaver–constructed brush piles, relatively deep water refuge from tidal flow, and the time of year. These factors act in unison to not only provide overwintering habitat, but also refuge from flood events. The shallow, silty bottom in Abandoned Marina 1 appeared particularly attractive to American eel.

Collection of relatively large numbers of spottail shiner, banded killifish, eastern silvery minnow, and mummichog tended to be concentrated near the edge of the yellow cow lily stands, and some of these species were particularly abundant at the mouth of a small tidal tributary. Had seining been possible at this location, the number of individuals of these minnow species collected likely would have been much greater. There are a number of such tributaries that exist within the survey reach that were not sampled. The yellow cow lilies provide complex cover for the minnows and also provide potential substrate for minnow food items such as periphyton and invertebrates. The small tributaries may be providing other favored habitat factors such as refuge from tidal flow in the main stream, suspension and movement of prey items in relatively clear water, and/or favored substrate such as sand.

RELATION BETWEEN FEDERALLY-MANAGED SPECIES AND FISH SPECIES AT THE SOUTHPORT PROJECT SITE POTENTIALLY UTILIZED AS PREY BY THESE SPECIES

The National Marine Fisheries Service (NMFS) submitted a response letter dated October 22, 2010 to the Regulatory Branch of the Philadelphia District, U.S. Army Corps of Engineers, commenting on the District's Public Notice (CENAP-OP-R-2009-0933-1) for the Southport Project (National Marine

Fisheries Service 2010). In this letter, the NMFS stated that the mixing zone of the Delaware River has been designated as EFH for 14 Federally-managed fish species. Analysis of EFH source documents and other references established that each of these 14 fish species consumes fish as a portion of its diet. This characteristic varied among species, from bluefish, king mackerel, and Spanish mackerel for which fish is a major portion of the diet to windowpane and Atlantic herring for which fish larvae are listed as an extremely minor portion of the diet. Only a small number of the 27 taxa present at the Southport Project site are among the many fish taxa (possibly exceeding 70 in total) listed as established prey items for the 14 Federally-managed species. These are herring (Spanish and king mackerel), mummichog (summer flounder), white perch, striped bass, American shad, and *Fundulus* spp. (juvenile bluefish), alewife/herring (little skate), and eel, alewife, and blueback herring (winter skate). The reason that few of the taxa appear as listed prey items, although any small fish could be consumed, is that many of the species present at the Southport Project site are restricted to fresh water or waters of low salinity and, therefore, never encounter these Federally-managed species, which are normally found at salinities exceeding 20 ppt. Conversely, several of the taxa that are listed are anadromous (American shad), semi-anadromous (white perch), or euryhaline (mummichog), and, therefore, may encounter these marine species during movements to the Delaware Bay or Atlantic Ocean. Because herring and American shad are open water inhabitants, they will not be impacted by deep water dredging. The mummichog primarily utilizes intertidal areas and will be similarly free from impact. Of the above potential prey fish species, only white perch, striped bass, and eel, which may at times be deep water bottom foragers, are likely to be temporarily impacted by dredging activities.

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Table 1. Fish species captured in surveys conducted at the Southport Development Project Site and in Neshaminy Creek and Jack's Marina near Neshaminy State Park.

Common Name	**Species**	**Southport[1]**	**Neshaminy Creek[2]**
Blueback herring	*Alosa aestivalis*	X	X
Alewife	*Alosa pseudoharengus*	X	
American shad	*Alosa sapidissima*		X
Alosid Young of Year	*Alosa* sp. YOY[3]	X	
Rock bass	*Ambloplites rupestris*		X
White catfish	*Ameiurus catus*	X	
Yellow bullhead	*Ameiurus natalis*	X	
Brown bullhead	*Ameiurus nebulosus*	X	X
American eel	*Anguilla rostrata*	X	X
Goldfish	*Carassius auratus*	X	X
White sucker	*Catostomus commersonii*	X	X
Common carp	*Cyprinus carpio*	X	X
Gizzard shad	*Dorosoma cepedianum*	X	
Tessellated darter	*Etheostoma olmstedi*	X	X
Banded killifish	*Fundulus diaphanus*	X	X
Mummichog	*Fundulus heteroclitus*	X	X
Eastern silvery minnow	*Hybognathus regius*	X	X
Channel catfish	*Ictalurus punctatus*	X	X
Redbreast sunfish	*Lepomis auritus*	X	X
Green sunfish	*Lepomis cyanellus*		X
Pumpkinseed	*Lepomis gibbosus*	X	X
Warmouth	*Lepomis gulosus*		X
Bluegill	*Lepomis macrochirus*	X	X
Largemouth bass	*Micropterus salmoides*	X	X
White perch	*Morone americana*	X	X
Striped bass	*Morone saxatilis*	X	X
Morone sp. YOY	*Morone* sp. YOY	X	
Golden shiner	*Notemigonus crysoleucas*		X
Spottail shiner	*Notropis hudsonius*	X	X
Yellow perch	*Perca flavescens*	X	X
White crappie	*Pomoxis annularis*		X
Black crappie	*Pomoxis nigromaculatus*	X	X
Fallfish	*Semotilus corporalis*		X
Hogchocker	*Trinectes maculatus*	X	

[1] Surveys conducted in April and June 2010.

[2] Survey conducted in October 2010.

[3] Alosid Young-of-Year may be blueback herring, alewife, American shad, or hickory shad.

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ESSENTIAL FISH HABITAT ASSESSMENT AT THE SOUTHPORT DEVELOPMENT PROJECT

PREPARED FOR:

WESTON SOLUTIONS, INC.

PREPARED BY:

NORMANDEAU ASSOCIATES, INC.

DECEMBER 2010

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INTRODUCTION

This Essential Fish Habitat (EFH) assessment evaluates the potential impacts on EFH associated with development and operation of the proposed Southport Development Project. This project involves construction of a new marine terminal for containerized freight on 116 acres of vacant land located at the eastern end of the former Philadelphia Navy Yard along the Delaware River.

The Magnuson-Stevens Act of 1976 was established to promote conservation of marine fishery (shellfish and finfish) resources. This included establishment of eight regional fishery management councils (FMCs) that develop fishery management plans to properly manage fishery resources within their jurisdictional waters. The 1986 and 1996 amendments to the Magnuson Act, renamed the Sustainable Fisheries Act, recognized that many fisheries are dependent on nearshore and estuarine habitats for at least part of their lifecycles and included evaluation of habitat loss and protection of critical habitat. The marine environments important to marine fisheries are referred to as EFH and are defined to include "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity". The act further mandates the National Marine Fisheries Service (NMFS) to coordinate with other federal agencies to avoid, minimize, or otherwise offset adverse effects on EFH that could result from proposed activities.

The National Marine Fisheries Service (NMFS) submitted a response letter dated October 22, 2010 to the Regulatory Branch of the Philadelphia District, U.S. Army Corps of Engineers, commenting on the District's Public Notice (CENAP-OP-R-2009-0933-1) for the Southport Project. In this letter, the NMFS stated that the mixing zone of the Delaware River has been designated as EFH for 14 - managed fish species and that the mixing zone is considered to be those areas of the river where the salinities range from 25 ppt to 5 ppt. The letter also stated that the mixing zone generally extends to just above the confluence of the Schuylkill River. The implication is that the Southport Project site is located within the mixing zone because of its proximity to the Schuylkill River confluence and, therefore, EFH is present there.

In this EFH assessment, it is shown that the Delaware River is freshwater at the Southport Project site and that the 14 fish species require saline water as the preferred condition. Furthermore, survey data are presented that show that these 14 species were either collected only in small numbers or were absent from survey collections made 10 to 36 miles downstream of the Southport Project area. Therefore, the Southport Project site should not be considered EFH for these species.

SOUTHPORT PROJECT POTENTIAL IMPACTS

The NMFS response letter identified the following Southport Project actions that could impact aquatic or other ecological resources:

- Construction of a 100 foot wide and 2,128 linear foot long pile supported wharf along the shoreline of the Delaware River to provide two ship berthing areas resulting in the shading of 4.89 acres of intertidal and subtidal shallows;

- Dredging of approximately 1,008,000 cubic yards of material from 35 acres of the Delaware River along the proposed berthing area to a depth of -40 feet MLW, with 2 foot allowable over-dredge, via hydraulic pipeline dredge. Dredged material would be placed at the existing Fort Mifflin Disposal Site;

- Filling of approximately 12.3 acres of aquatic habitat, including 3.46 acres of intertidal habitat and mudflats, 5.2 acres of shallow water habitat including 1.08 acres vegetated with wild celery (*Vallisneria americana*) and 3.62 acres of deep water (> 2 meters) habitat along the northeastern side of the site;

- Filling of 3.75 acres of non-tidal wetlands within the Navy Yard property;

- Placement of 2,400 linear feet of riprap along the shoreline and intertidal zone of the Delaware River along the southern portion of the site; and

- Filling and relocating of 1,000 linear feet of a tidal drainage channel.

Potential impacts to EFH due to development of the Southport Project include permanent habitat loss from new structures and dredging and temporary disturbance during construction. Operation of the Southport Project will not significantly impact EFH because vessels will be moored in the dredged berthing areas.

Habitat surrounding the proposed project site also will be temporarily disturbed due to construction activities. Rehabilitation of the pier and construction of mooring facilities will entail installation of pilings using diesel impact hammers. Sources of impact will include disturbance of the river bottom, resuspension of sediments, and vibration during installation of pilings. Such disturbances could temporarily affect both benthic (demersal) and pelagic EFH species. Any secondary impacts that may occur, such as reduced invertebrate prey or metabolic stress, are likely to be insignificant. Over much of the area included in this assessment, impacts will be restricted to temporary particulate suspension throughout the water column.

DESCRIPTION OF AFFECTED ENVIRONMENT

Particle size of sediments and salinity present within the project area are the two factors that are commonly used to determine the suitability of habitat in EFH evaluations. These factors are examined for the managed species in this document.

Sixty-two sediment cores were collected from March 9 through April 9, 2010 by Weston Solutions, Inc. Grain size was classified using the ASTM Method on all split-spoon samples and all individual cores collected at the Southport Project site. Southport sediments were predominantly comprised of clay, sand, and silt with some concentrations of gravel. The grain size analysis indicated that the average clay concentration was 51%, the average sand concentration was 36%, the average silt concentration was 12%, and the average gravel concentration was ~1.0%.

The Southport Project site is located at the interface of the Delaware Estuary freshwater tidal zone and the mixing zone. However, because salinity varies markedly at many points in the upper estuary as a function of freshwater discharge, the position of the salt line will vary markedly. The term "salt line" refers to the 7-day average location of the 250 mg/l (ppm), or 0.25 ppt, isochlor, and is used as an approximate indicator of the upstream penetration of ocean-derived salinity.

Figure 1 is a histogram of the daily salt line location for the period January 1, 1998 through November 30, 2008 (U.S. Army Corps of Engineers 2009). For the entire 10.9 years, the salt line was as far upstream as River Mile (RM) 90 in late summer 2005, and at or below RM 40 during multiple high-flow periods in 2006, a range that exceeds 50 miles along the axis of the estuary. The average location over this period is about RM 71, just upstream of the Delaware Memorial Bridge and near the mouth of the Christina River in Wilmington, Delaware. Based on monthly averages, the maximum salt line penetration occurs in October (RM 81) with the minimum in April (RM 61), reflecting the typical seasonal pattern of freshwater discharge to the estuary. Therefore, a general observation is that location of the salt line varies directly with the volume of freshwater discharge, and is located in the twenty-mile long zone between RM 61 and RM 81 during an "average" year.

Of greatest importance, however, is that the 7-day average 250 mg/l isochlor did not move upstream of RM 90 throughout the 10.9 year period. This location is approximately five miles downstream of the Southport Project site. Therefore, water conditions at the Southport Project site should be considered freshwater.

DETERMINATION OF EFH SPECIES

The Southport Development Project is located within a heavily developed urban environment. This section of the Delaware River estuary is variously considered either tidal freshwater or mixing zone, depending upon the source. The NMFS response letter listed the various lifestages of 14 Federally-managed fish species for which EFH has been established in the Delaware River Mixing Zone (Table 1).

In preparation of this report, the primary sources of information for the habitat requirements of the EFH species were the Essential Fish Habitat Source Documents produced by NMFS. These documents provide information on the life histories and habitat requirements of many of the species for which the area surrounding Southport Project has been designated EFH. These documents are the best available data source for habitat requirements of these species, although the habitat requirements of many of them are not well-known. The EFH documents provide descriptions of the habitat for locations where these species have been found in some degree of abundance because mere occurrence of fish in a particular habitat is not an indication that it is essential or even preferred habitat. Occurrence is only a statement that the fish was found in a particular habitat when sampling occurred. However, the fact that few, if any, individuals of a species have been collected near the Southport Project site, or even within a distant radius of the Southport Project site, is confirmation that the

habitat requirements discussed are valid. Regardless of any data limitations, the EFH Source Documents provide the best available descriptions of the habitat requirements for these species.

CHARACTERIZATION OF EFH AND EFH SPECIES AFFECTED BY THE SOUTHPORT DEVELOPMENT PROJECT

The life history and habitat requirements of the 14 fish species with designated EFH within the area surrounding the Southport Marine Terminal Project are discussed in this section. Some emphasis is placed on the substrate requirements, as this habitat will be directly affected by the Southport Project. The known substrate requirements of the various fishes are compared with the results of sediment characterization based on particle size analyses of samples obtained in collection of sediment cores and split spoon samples that occurred from March 9 to April 9, 2010.

Of greatest importance, however, is the fact that all of the 14 fish species are excluded from the Southport Project site by salinity requirements or preferences, which is reinforced by distance from the spawning grounds. This finding is supported by Table 2, which contains salinity data available for 8 of the 14 -managed species. Table 2 is adapted from a table presented in the Essential Fish Habitat Assessment prepared for the Crown Landing LNG and Logan Lateral Projects, proposed for another location on the Delaware River.

Atlantic butterfish (*Peprilus triacanthus*); Primary reference: Cross *et al.* (1999).

Atlantic butterfish is a fast-growing, short-lived pelagic fish that ranges from the Gulf of Saint Lawrence to Florida. EFH has been designated for the juvenile lifestage of Atlantic butterfish in the Southport Project area (Table 1).

Atlantic butterfish larvae are pelagic and occur from the outer continental shelf to high salinity estuarine areas. The larvae are often found near the surface, and larger larvae are commonly associated with jellyfish and flotsam. Juveniles and adults are pelagic and often form loose schools near the surface. Juveniles, similar to the larvae, are often found near the surface in association with jellyfish. Juveniles and adults feed primarily on pelagic prey. Food items include thaliaceans, squid, copepods, amphipods, decapods, jellyfish, and ctenophores. Although this fish does not appear to be closely associated with demersal habitat, juveniles and adults have been reported over soft sediments.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of Atlantic butterfish. This unsuitability of habitat is supported by the following fish survey data:

- No Atlantic butterfish were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No Atlantic butterfish were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No Atlantic butterfish were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a).

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for Atlantic butterfish.

Atlantic sea herring (*Clupea harengus*); Primary reference: Stevenson and Scott (2005).

Atlantic sea herring is a schooling, pelagic, commercially important coastal species ranging from northern Labrador to North Carolina in North America. EFH has been designated for the juvenile lifestage of Atlantic sea herring in the Southport Project area (Table 1).

Atlantic sea herring larvae are pelagic and free-floating and have no known association with any particular substrate. Larvae metamorphose into juveniles at 40 to 50 millimeters total length. Juvenile Atlantic herring are pelagic and schooling behavior begins at metamorphosis. Adults also are pelagic and undergo extensive migrations associated with feeding, spawning, and overwintering. Adults are most common in the Hudson River estuary during winter. Both the juvenile and adult lifestages are plankton feeders in the water column. Prey items include zooplankton, copepods, euphausiids, decapods, and bivalve larvae.

Neither the juvenile nor the adult lifestage of Atlantic sea herring has any documented association with a particular substrate, and it is not anticipated that any of the river bottom impacts associated with the Southport Project could affect EFH for juvenile Atlantic sea herring.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of Atlantic herring. This unsuitability of habitat is supported by the following fish survey data:

- Only 39 Atlantic sea herring were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No Atlantic sea herring were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No Atlantic sea herring were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a).

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for Atlantic sea herring.

Black sea bass (*Centropristis striata*); Primary reference: Steimle *et al.* (1999a).

The black sea bass occurs from southern Nova Scotia to the Gulf of Mexico and is common in the Middle Atlantic Bight. EFH has been designated for the juvenile lifestage of black sea bass in the Southport Project area (Table 1).

Juvenile black sea bass typically find their way into estuarine nurseries soon after settlement in coastal areas during the summer months. Older juveniles and adults migrate seasonally, spending spring through fall in nearshore habitats, and then overwintering in outer coastal areas. Juveniles feed on benthic and epibenthic invertebrates. Adults feed on a wide variety of invertebrates and small fishes, becoming increasingly piscivorous as they grow. Black sea bass are sequential hermaphrodites; they typically enter adulthood as females and then change into males with additional growth.

Both juvenile and adult black sea bass are often associated with structured habitats, such as pilings and jetties. Although stray adults may occur in the lower Delaware River Estuary, larger adults prefer coastal areas with rocky reefs or similar structure.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of black sea bass. This unsuitability of habitat is supported by the following fish survey data:

- Only 1 black sea bass was collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No black sea bass were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No black sea bass were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for black sea bass.

Bluefish (*Pomatomus saltatrix*); Primary reference: Fahay (1999).

The bluefish is a highly-migratory, recreationally-important sportfish, ranging from Nova Scotia to Argentina. EFH has been designated for juvenile and adult lifestages of bluefish in the Southport Project area (Table 1).

Bluefish are pelagic fish that become piscivorous soon after transformation from the larval stage. Juvenile bluefish are found in nearshore areas and estuaries and are abundant in the lower Delaware River Estuary during the summer and fall of some years. Juvenile bluefish apparently prey on available food items, which can range from crustaceans and polychaetes to fish. They are not known to be associated with any particular river bottom substrate. Adult bluefish may be found in low numbers in the lower Delaware River Estuary during the spring. They are not known to be associated with any particular substrate, and are almost completely piscivorous. While adult bluefish are largely oceanic, juveniles are typically collected in salinities ranging from 23 to 33 ppt.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of bluefish. This unsuitability of habitat is supported by the following fish survey data:

- Only 189 bluefish were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No bluefish were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- Only 152 juvenile bluefish were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). However, impingement and entrainment studies conducted in 1976 and 2005-2006 at Schuylkill Generating Station (Waterfield *et al.* 2008b), located on the tidal Schuylkill River several miles upstream of the confluence of the Schuylkill and Delaware Rivers, as well as in-river studies conducted throughout the tidal Schuylkill River (Normandeau 1997) failed to collect any bluefish.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for bluefish.

Clearnose Skate (*Raja eglanteria*); Primary reference: Packer *et al.* (2003a).

Clearnose skate is found in the western Atlantic Ocean from the Nova Scotian Shelf to the northern Gulf of Mexico. EFH has been designated for all lifestages of clearnose skate in the Southport Project area (Table 1).

North of Cape Hatteras, clearnose skate migrates seasonally, moving northward and inshore during spring and summer, and southward and offshore during autumn and winter. They are most abundant in the Hudson River estuary during summer. Juveniles and adults of this species feed on a variety of prey items including various invertebrates and small fishes. Clearnose skate can be found over many different substrates including mud, sand, gravel, and rock.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of clearnose skate. This unsuitability of habitat is supported by the following fish survey data:

- No clearnose skate were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No clearnose skate were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No clearnose skate were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for clearnose skate.

Cobia (*Rachycentron canadum*); Primary reference: Shaffer, R.V. and E.L. Nakamura (1989).

Cobia is a highly-migratory, coastal pelagic fish, found in all tropical and subtropical waters, except in the eastern Pacific Ocean. In the western North Atlantic Ocean, they occur south of Massachusetts. EFH has been designated for all lifestages of cobia in the Southport Project area (Table 1).

The eggs and larvae are pelagic and are primarily found in offshore waters. Juveniles move to inshore coastal habitats including beaches, bays, and relatively high salinity regions of estuaries. Adults can be found in a variety of habitats and are most commonly encountered in coastal and shelf regions. Cobia are voracious predators, feeding on crustaceans, other invertebrates, and fish.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of cobia. This unsuitability of habitat is supported by the following fish survey data:

- No cobia were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No cobia were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No cobia were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in

the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a).

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for cobia.

King mackerel (*Scomberomorus cavalla*); Primary reference: Collette and Klein-MacPhee (2002).

King mackerel is a highly migratory, pelagic species found in warm waters of the western Atlantic Ocean. Its primary range extends from Brazil to North Carolina, with strays collected as far north as the southern Gulf of Maine. EFH has been designated for all lifestages of king mackerel in the Southport Project area (Table 1).

King mackerel spawns in coastal waters of the northern Gulf of Mexico and off the south Atlantic coast. All lifestages of this species are pelagic and independent of benthic habitats (Godcharles and Murphy, 1986).

The freshwater nature of the Southport Project site precludes the presence of any lifestage of king mackerel. This unsuitability of habitat is supported by the following fish survey data:

- No king mackerel were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No king mackerel were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No king mackerel were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a).

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for king mackerel.

Little Skate (*Leucoraja erinacea*); Primary reference: Packer *et al.* (2003b).

Little skate is found in the western Atlantic Ocean from Nova Scotia to Cape Hatteras. The northern Mid-Atlantic Bight and Georges Bank is the center of abundance for this species. EFH has been designated for all lifestages of little skate in the Southport Project area (Table 1).

Little skate move onshore and offshore seasonally along the inshore edge of its range. Juveniles are generally absent from estuaries such as the Hudson River during summer months, but are common throughout the remainder of the year. Juvenile little skate are opportunistic benthic predators, with

prey items including decapods, amphipods, polychaetes, isopods, bivalves, hydrozoans, and to a lesser extent fishes. Diet of adult little skate is similar to juveniles, although larger skates consume more decapods, polychaetes and fish and less amphipods. Depth and substrate preferences are similar for juveniles and adults. Little skate can be found on a variety of substrates including gravel, sand, and mud.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of little skate. This unsuitability of habitat is supported by the following fish survey data:

- No little skate were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No little skate were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No little skate were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for little skate.

Scup (*Stenomus chrysops*); Primary reference: Steimle *et al.* (1999b).

Scup is a temperate, demersal species that is common in the Middle Atlantic Bight. EFH has been designated for the juvenile lifestage of scup in the Southport Project area (Table 1).

Scup eggs are small, buoyant and ephemeral, requiring only two to three days to hatch. Larvae are also pelagic, and found in coastal waters during the summer months. Scup migrate seasonally, spending summer months in estuaries and wintering on the outer continental shelf. Although this species can be found throughout the water column, scup are primarily demersal and dependent on benthic habitat. Juvenile scup have been collected over sand, silty-sand, shell, mud, and eelgrass. Adults use a similar habitat including soft, sandy substrates and structure. Mixed sand and mud sediments that provide opportunity for preying on small benthic invertebrates are also important habitats. Both juvenile and adult scup prey on invertebrates such as polychaetes, epibenthic amphipods, and other small crustaceans.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of scup. This unsuitability of habitat is supported by the following fish survey data:

- No scup were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No scup were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No scup were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for scup.

Spanish mackerel (*Scomberomorus maculatus*); Primary reference: Collette and Klein-MacPhee (2002).

Spanish mackerel is a highly migratory, coastal pelagic species. It most commonly occurs from the Gulf of Mexico to Chesapeake Bay, with strays collected as far north as Nova Scotia. All lifestages of this species are pelagic and independent of benthic habitats (Godcharles and Murphy 1986). EFH has been designated for all lifestages of Spanish mackerel in the Southport Project area (Table 1).

The freshwater nature of the Southport Project site precludes the presence of any lifestage of Spanish mackerel. This unsuitability of habitat is supported by the following fish survey data:

- No Spanish mackerel were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No Spanish mackerel were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No Spanish mackerel were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a).

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for Spanish mackerel.

Summer flounder (*Paralicthys dentatus*); Primary reference: Packer *et al*. (1999).

Summer flounder range from Nova Scotia to Florida, in estuarine waters to the outer continental shelf. They are most abundant in the Middle Atlantic Bight. EFH has been designated for the juvenile and adult lifestages of summer flounder in the Southport Project area (Table 1).

Spawning occurs over the open ocean areas of the continental shelf. The largest concentrations of eggs have been reported within 45 km of shore off New Jersey and New York. Larval summer flounder are planktonic and found in highest numbers during fall, winter, and spring. Smaller larvae occur offshore, while larger larvae move to coastal and estuarine nursery grounds prior to transformation.

Metamorphosis from the larval to juvenile stages occurs at a size range of 8-18 mm. During or shortly after transformation, juveniles settle onto the bottom where they typically bury themselves in the sediments. Juveniles are found in inshore and estuarine soft-bottom habitats, and seem to prefer sandy sediments. Juvenile summer flounder make use of various estuarine habitats including marsh creeks, seagrass beds, mud flats, and open bays. In the Hudson River estuary, they are present in small numbers throughout the year. Smaller juveniles feed mostly on benthic invertebrates, and fish become increasingly important in the diet of summer flounder as they grow. Larger juveniles and adult summer flounder migrate seasonally from inshore areas during spring through fall, to the outer continental shelf during winter. Throughout the warmer months of the year adults are found in shallow coastal and estuarine habitats.

Adult summer flounder are opportunistic feeders on fish and various invertebrates. Fish prey items include windowpane, winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silverside, American sand lance, bluefish, weakfish, and mummichog. Summer flounder are found on a variety of substrates, but appear to prefer sandy substrate. They are also found on muddy substrates and can use vegetation for cover. Although many authors report that summer flounder exhibit a preference for sandy substrates, the clay, sand, and silt sediments in the Southport Project area could be considered EFH for juvenile and adult summer flounder, were it not for exclusion by salinity preference. Throughout the range of summer flounder, recently settled juveniles may occupy waters of either high or low salinity, but as they reach lengths of 20 to 100 mm they often move to waters of salinities greater than 10 ppt. Therefore, due to the distance from spawning areas on the continental shelf, it is extraordinarily unlikely that larvae or small juveniles could reach the Southport Project area prior to selection for higher salinities.

The freshwater nature of the Southport Project site and distance from spawning areas on the continental shelf precludes the presence of any lifestage of summer flounder. This unsuitability of habitat is supported by the following fish survey data:

- Only 74 summer flounder were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No summer flounder were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- Only three summer flounder were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site, the distance from spawning areas on the continental shelf, and the fish survey data presented above, the Southport Project site should not be considered EFH for summer flounder.

Windowpane flounder (*Scopthalmus aquosus*); Primary reference: Chang *et al.* (1999).

Windowpane flounder is a coastal flatfish ranging from the Gulf of Saint Lawrence to South Carolina. EFH has been designated for all lifestages of this species in the Southport Project area (Table 1).

Windowpane flounder eggs are buoyant and pelagic and are most common at depths less than 70 meters (230 feet). In the Middle Atlantic Bight, eggs are present in the water column throughout most of the year, with peak densities in May and October. Larvae also are pelagic up to a length of about 10 millimeters (total length) after which they settle on the bottom and develop into juveniles. Eggs and larvae are not associated with the bottom.

Juveniles are found on muddy and fine sandy sediment at depths less than 100 meters (328 feet). Amphipods, mysids, and decapod shrimp are primary food items for juveniles. Adults occur on muddy and fine sandy sediment, and primary food items consist of small crustaceans and fish larvae.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of windowpane flounder. This unsuitability of habitat is supported by the following fish survey data:

- No windowpane flounder were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No windowpane flounder were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No windowpane flounder were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location

in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for windowpane flounder.

Winter flounder (*Pseudopleuronectes americanus*); Primary reference: Pereira *et al.* (1999).

Winter flounder is an economically important flatfish occurring in coastal waters from Labrador to Georgia. Winter flounder are ubiquitous in inshore areas from Massachusetts to New Jersey (Briggs and Waldman 2002). EFH has been designated for all lifestages of winter flounder in the Southport Project area (Table 1).

Eggs of winter flounder are demersal and adhesive and are generally deposited in depths of less than five meters (16 feet) on sandy substrates that have been described as sand, muddy sand, and mud and gravel. Spawning occurs in late winter to early spring and eggs hatch in two to three weeks. Larvae are initially planktonic, but they are negatively buoyant and increasingly associated with the bottom as metamorphosis approaches. Winter flounder larvae do not often disperse far from egg habitat.

Juvenile winter flounder do not appear to have a well-defined preference for substrate, but they are reported to be most abundant on mud and sand substrate and disperse to depths of 18 meters (59 feet). Juvenile winter flounder prey on sand dollars, bivalve siphons, polychaetes, amphipods and shrimp. Adult winter flounder typically migrate inshore in the fall or early winter and offshore during summer months. Some may remain inshore year round. Adults can occur on mud, sand, cobble, rocks, and boulder substrates. This description appears to cover almost all possible habitats. However, it appears that they are more common on soft substrate such as muddy sand. Prey items for adult winter flounder include amphipods, polychaetes, bivalves, fish eggs, and crustaceans.

The winter flounder in Delaware Bay are part of the Mid-Atlantic population that migrate inshore in the fall and early winter and spawn in late winter and early spring. In Delaware Bay, spawning takes place during January, February and March, with early lifestages present in April and May. Trawl surveys by the State of Delaware indicate that they are not abundant and that they occur in the lower portion of Delaware Bay where there are higher salinity levels, extending from the mouth of the bay to River Mile 35.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of winter flounder. This unsuitability of habitat is supported by the following fish survey data:

- No winter flounder were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No winter flounder were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No winter flounder were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for winter flounder.

Winter Skate (*Leucoraja ocellata*); Primary reference: Packer *et al.* (2003c).

Winter skate is found in the western Atlantic Ocean from southern Newfoundland to Cape Hatteras. The northern Mid-Atlantic Bight and Georges Bank is the center of abundance for this species. EFH has been designated for all lifestages of winter skate in the Southport Project area (Table 1).

Juvenile winter skate are opportunistic benthic feeders; prey items include polychaetes, amphipods, decapods, isopods, bivalves, hydroids, and fishes. Adult diets are similar although larger skates consume more polychaetes and fish and less crustaceans. Winter skate range from shore to 371 meters (1,217 feet), but are most abundant shallower than 111 meters (364 feet). Although this species has been collected over mud bottoms, winter skate are generally associated with sand and gravel substrates. Juveniles migrate onshore and offshore seasonally. They are generally absent from estuaries during summer months, but are common in some throughout the remainder of the year. Adults apparently are not common in the Delaware River Estuary at any time of year.

A total of 1,956 bottom trawls collected from 1968 to 2002 for which salinity was recorded [Figure 19 in Packer *et al.* (2003c)] indicates that no winter skates were ever collected in waters of less than 31 ppt salinity.

The freshwater nature of the Southport Project site precludes the presence of any lifestage of winter skate. This unsuitability of habitat is supported by the following fish survey data:

- No winter skate were collected in State of Delaware trawl surveys conducted over a 19 year period between 1990 and 2009 at six stations located in a 15 mile length of the Delaware River extending from the mouth of the Salem River (RM 59) to 5 miles downstream of the Delaware/Pennsylvania state line (RM 74) (Michels 2010).

- No winter skate were collected in surveys of the Delaware Estuary conducted by the PA Fish and Boat Commission (Buzzar 2010).

- No winter skate were collected in an impingement census (638,017 fish identified in 54 taxa) conducted during the 6 year period 1987-1992 at Eddystone Generating Station, located in the Delaware River approximately 10 miles downstream of the Southport Project site (Waterfield, *et al.* 2008a). This result does not appear to be an artifact of intake location in

the water column which might be expected to restrict collection of demersal fish because a total of 31,344 hogchoker, a demersal species, was collected.

Based on the freshwater nature of the Southport Project site and the fish survey data presented above, the Southport Project site should not be considered EFH for winter skate.

FINDINGS

For the 14 managed species examined in this assessment, all lifestages are restricted, either by preference or functionally by distance from spawning areas, or a combination of both, to water of greater salinity than that present in the project area. This conclusion is confirmed by the fact that no lifestage of these 14 species has been collected by the Pennsylvania Fish and Boat Commission in the Delaware Estuary. Additionally, intensive collections of fish 10 to 36 miles downstream of the Southport Project site in waters of much greater salinity over long periods of time have yielded only small numbers of only four of the 14 species (Atlantic sea herring, black sea bass, bluefish, and summer flounder). In the case of black sea bass, only one individual was collected. In these same collections, no lifestage of any of the other 10 species was collected. Based on the above, it is determined that the Southport Project site should not be considered EFH for any of the 14 -managed species.

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Table 1. Summary of species and life stages with designated Essential Fish Habitat in the Southport Development Project area[1].

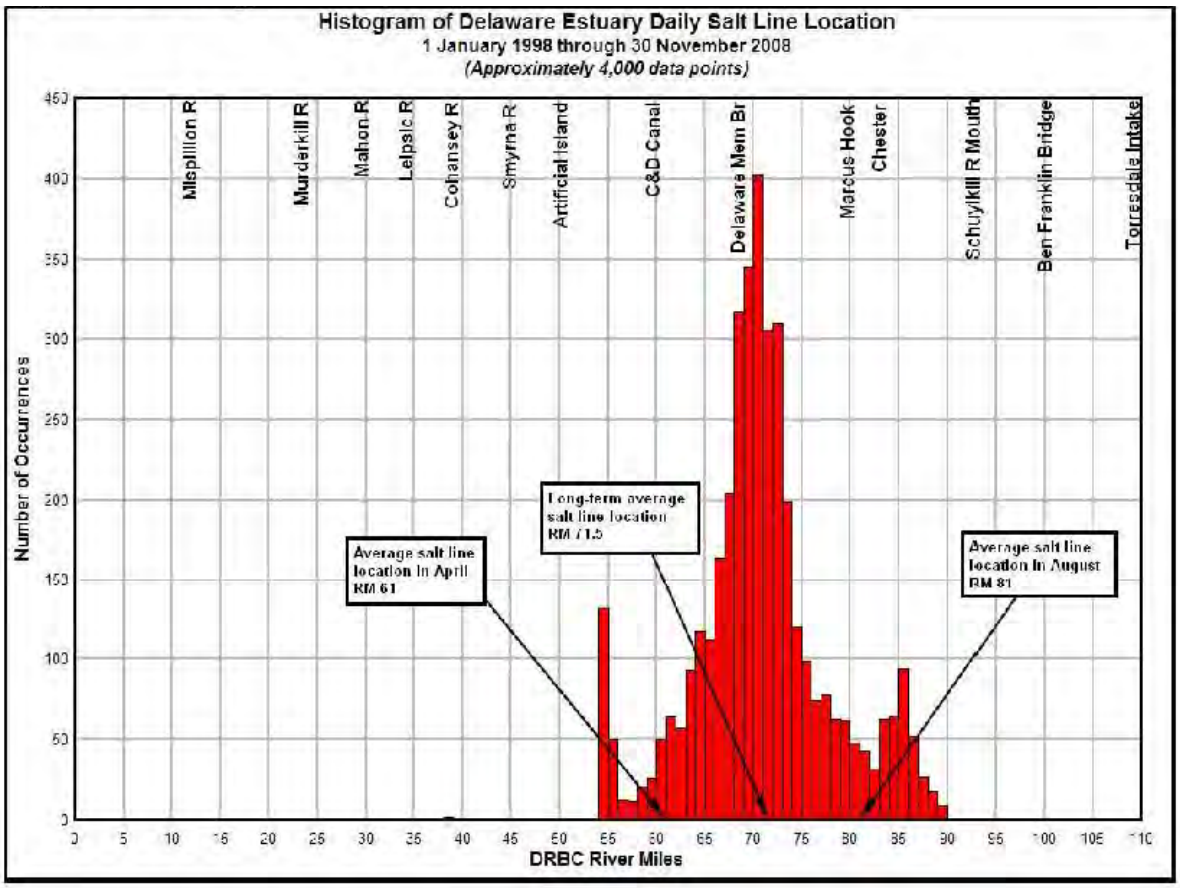
Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Atlantic butterfish *(Peprilus triacanthus)*			√		
Atlantic sea herring *(Clupea harengus)*			√		
Black sea bass *(Centropristus striata)*			√		
Bluefish (*Pomatomus saltatrix*)			√	√	
Clearnose skate (*Raja eglanteria*)	√	√	√	√	√
Cobia *(Rachycentron canadum)*	√	√	√	√	√
King mackerel *(Scomberomorus cavalla)*	√	√	√	√	√
Little skate (*Leucoraja erinacea*)	√	√	√	√	√
Scup *(Stenotomus chrysops)*			√		
Spanish mackerel *(Scomberomorus maculatus)*	√	√	√	√	√
Summer flounder *(Paralicthys dentatus)*			√	√	
Windowpane flounder *(Scopthalmus aquosus)*	√	√	√	√	√
Winter flounder *(Pleuronectes americanus)*	√	√	√	√	√
Winter skate (*Leucoraja ocellata*)	√	√	√	√	√

[1] This list of species taken from the National Marine Fisheries Service response letter dated October 22, 2010 to the Regulatory Branch of the Philadelphia District, U.S. Army Corps of Engineers, commenting on the District's Public Notice (CENAP-OP-R-2009-0933-1) for the Southport Development Project.

Table 2. Salinity ranges for the life stages of managed fish species potentially occurring in the Mixing Zone within the Delaware River Estuary[1]

	Typical Salinity Range of Occurrence (ppt[2])			
Managed Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic sea herring *(Clupea harengus)*	—	—	26 — 32	—
Black sea bass *(Centropristus striata)*	—	—	>18	—
Bluefish *(Pomatomus saltatrix)*	—	—	23 — 33	>25
Butterfish *(Peprilus triacanthus)*	—	—	3.0 — 37	—
Scup *(Stenotomus chrysops)*	—	—	>15	—
Summer flounder *(Paralicthys dentatus)*	—	—	22 — 35	18 — 35
Windowpane flounder *(Scopthalmus aquosus)*	—	—	15 — 33	5.5 — 36
Winter flounder *(Pleuronectes americanus)*	10 — 32	3.2 — 30	19 — 21	15 — 33

[1] This table is adapted from Table 3-1. Salinity Ranges for the Life Stages of Managed Fish Species Potentially Occurring in the Mixing Zone within the Delaware River Estuary, appearing on page E-2 in Appendix E, Essential Fish Habitat Assessment for the Crown Landing LNG Project, Draft Environmental Impact Statement for the Crown Landing LNG and Logan Lateral Projects. Docket Nos. CP04-411-000 and CP04-416-000, FERC/EIS-0179D. February 2005.
[2] ppt = parts per thousand



Source: U.S. Army Corps of Engineers, 2009.

Figure 1.
Histogram of Salt Line Location from 1998 to 2008.

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A BIOLOGICAL ASSESSMENT OF SHORTNOSE STURGEON (*ACIPENSER BREVIROSTRUM*) AND ATLANTIC STURGEON (*ACIPENSER OXYRHYNCHUS*) POPULATIONS IN THE UPPER TIDAL DELAWARE RIVER: POTENTIAL IMPACTS OF THE SOUTHPORT DEVELOPMENT PROJECT

PREPARED FOR:

WESTON SOLUTIONS, INC.

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INTRODUCTION

Section 7 of the Endangered Species Act, as amended 10 November 1978, requires that a Biological Assessment be prepared on all major Federal actions involving construction when Federally-listed or proposed endangered or threatened species may be affected.

The Delaware River has been identified as supporting a population of shortnose sturgeon (*Acipenser brevirostrum*), a Federally-listed endangered species. The shortnose sturgeon was placed on the original Endangered Species List pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.).

The Delaware River has been identified as supporting a remnant population of Atlantic sturgeon (*Acipenser oxyrhynchus*). On January 6, 2010 the National Marine Fisheries Service (NMFS) announced that it will consider listing Atlantic sturgeon as threatened or endangered under the Endangered Species Act. On October 6, 2010, NOAA issued a Federal Register Notice (75 FRN 618) that identified the Hudson River and Delaware River Atlantic sturgeon stocks as a distinct population segment (DPS) called the New York Bight DPS. This DPS has been proposed as endangered.

As such, there is a need to consider potential impacts of the Southport Development Project on the Delaware River populations of shortnose and Atlantic sturgeons.

RELEVANT LIFE HISTORY INFORMATION

SHORTNOSE STURGEON

The shortnose sturgeon is a small sturgeon and a Federally-listed endangered species. It is found in coastal waters from the St. Johns River, Florida to the St. John River, New Brunswick. In the Delaware Estuary, shortnose sturgeon historically occurred from the lower bay to at least as far upstream as New Hope, Pennsylvania (RM 148). Masnik and Wilson (1980) maintained that the species appeared to use the entire mainstem estuarine complex. However, Brundage and Meadows (1982a), in reviewing recorded captures of shortnose sturgeon during the period 1954 through 1979, listed only two captures of shortnose sturgeon between Pea Patch Island (RM 59) and just above Burlington Island (RM 121).

Some adults that will spawn during the following spring migrate upstream to the spawning grounds (Dadswell 1979). Dadswell *et al.* (1984), in reviewing data from multiple sources, indicated that most spawning occurred at temperatures of 9 to 12°C. They also reported that northern spawning areas examined were in areas of fast flow (46 to 60 cm/sec) with gravel or rubble bottoms, and were generally well upriver from the summer foraging and nursery grounds. Buckley and Kynard (1985) suggested that water velocity and depth may be more critical than type of substrate in determining the specific spawning locations of shortnose sturgeon. When velocity is too great, eggs may not adhere to bottom substrates. When velocity is too low, eggs may clump and possibly suffer from respiratory stress, fungal growth, or increased predation. Gilbert (1989), in a review of many sources, indicated that the length of the river utilized for spawning by shortnose sturgeon varies from river to river and that these specific areas in most rivers have not yet been well-defined. The ratio of males to females on the spawning grounds appears to vary from 2.5 to 3.5 to 1. Spent fish appear to move downriver after spawning.

Shortnose sturgeon appear to have a compressed spawning period for each individual, perhaps no more than three to five days (Taubert 1980). Eggs are broadcast into flowing water and become wide spread after fertilization. The eggs are demersal, and after 20 minutes, become strongly adhesive and attach to rocks, weeds, and other objects, occasionally in stringy clusters of ribbons. Buckley and Kynard (1985) described active vertical swimming movement in newly hatched shortnose sturgeon larvae, which may be an adaptation for downriver transport. In northern populations, first spawning of males appears to occur at five to seven years of age and at seven to ten years for females. Spawning of individuals may be non-annual.

Individual shortnose sturgeon may produce from 27,000 to over 200,000 eggs (Gilbert 1989). Ripe eggs of the shortnose sturgeon average about 3 mm in diameter. Little is known about shortnose sturgeon larval development, but it may parallel that of the Atlantic sturgeon, which appears to be an actively swimming predator for a short period of time before settling to the bottom to become a benthic feeder.

Feeding habits of adult and juvenile shortnose sturgeon also are little known. Shortnose sturgeon apparently feed mostly at night or on windy days when turbidity is high (Dadswell *et al.* 1984). During these periods, adults feed on the bottom in shallow water and in weedy backwaters of one to five meters in depth. Juveniles feed primarily in river channels 10 to 20 m deep containing sandy-mud or gravel-mud bottoms (Pottle and Dadswell 1979). To date, attempts to locate juvenile shortnose sturgeon in the upper tidal Delaware River have been unsuccessful. Most captures of adult shortnose sturgeon in the Delaware River, however, are made from channel areas.

Molluscan bivalves form a large part of the diet of shortnose sturgeon. In the Delaware River, its main food appears to be the introduced clam *Corbicula*, which is an abundant mollusk in the upper tidal river. Horwitz (1986) speculated that the current perceived increase in the Delaware River shortnose sturgeon population may be the result of increased food resources provided by the presence of *Corbicula*, which were introduced into the Delaware River between 1965 and 1971.

Relatively recent studies have collected numerous shortnose sturgeon in the tidal freshwater region of the Delaware River. A total of 1,371 shortnose sturgeon was collected between RM 102 and 133 (Philadelphia to Trenton) during 1981 to 1984 (Hastings *et al.* 1987). The Florence to Trenton (RM 124 to 132) segment of the river yielded the great majority of the fish (98.3%). Virtually all (98.9%) were collected in the channel. Shortnose sturgeon were collected throughout the year in the freshwater tidal zone, with lower catches from December to April. These lower catches may be due to low catchability during this period rather than reduced abundance. Multiple techniques were utilized to estimate the population in the Trenton-Florence area, and estimates ranged from approximately 6,000 to 14,000. The higher number is more likely, as two of the three techniques yielded results near 14,000. More recent efforts to estimate the shortnose sturgeon population have indicated abundance between 10,757 and 13,589 (Environmental Research and Consulting, Inc. and O'Herron Biological and Environmental Consulting 2006).

Data from sonic tracking during the period 1983 through 1987 enabled O'Herron *et al.* (1993) to further define the areas used and the seasonal pattern of movement of adult shortnose sturgeon in the Delaware River (Figure 1). Shortnose sturgeon that overwintered in the upper tidal river near Trenton, New Jersey, began traveling upstream in late March to the non-tidal river where spawning

presumably occurred from late March through April. After spawning, sturgeon travelled rapidly downstream into the tidal portion of the river near Philadelphia, where they remained through the end of May. Before the end of June, most sturgeon moved upstream to the non-tidal river near Trenton, where most apparently remained for the summer and winter. In general, the same pattern was apparent for both sexes.

ATLANTIC STURGEON

The Atlantic sturgeon is an anadromous fish species found in Atlantic coastal waters of the United States from Labrador to Port Canaveral and Hutchinson Island, Florida (Van den Avyle 1984). Atlantic sturgeon are long-lived and use a variety of habitats. Much of the habitat information on Atlantic sturgeon remains incomplete. Due to the relatively low numbers of fish in many river basins, habitat utilization patterns have been difficult to establish with certainty (Collins et al. 2000).

Atlantic sturgeon distribution in the Delaware Estuary appears to be dependent upon the season. Brundage and Meadows (1982b) reported 130 recorded captures of Atlantic sturgeon in the Delaware Estuary between November 1958 and July 1980. Atlantic sturgeon were collected in the Delaware Bay region (RM 0 to 34) during most months, although catch was greatest from March through May (14 to 23 fish per month) and lowest from July through August (1 fish per month). A migration from the Delaware Bay region to the lower tidal river (RM 35 to 79) and the upper tidal river (RM 79 to 135) is suggested by peak captures in these areas from June to September, which is coincident with the period of least abundance in the Delaware Bay. Subsequently, (after September) abundance declined in the tidal river and increased in the Delaware Bay region, suggesting a return to overwintering areas.

Borodin (1925), cited in Greene (2009), reported that running-ripe sturgeon were captured near Delaware City, Delaware adjacent to Pea Patch Island, although this reference may be to females that possessed eggs capable of being harvested for caviar, rather than ready for spawning. This area currently is brackish and presumably would not be suitable for larval development. Lazzari *et al.* (1986) suggested that the Roebling-Trenton stretch of the Delaware River (RM 124 to 135) may be an important nursery area for the species. Eighty-nine juvenile Atlantic sturgeon were collected in the upper tidal region of the Delaware Estuary (RM 125 to 132) during 1981 to 1984.

Much of the recent knowledge of the status of the Atlantic sturgeon population in the Delaware Estuary has been developed through the efforts of Dewayne Fox and Philip Simpson of Delaware State University (Simpson and Fox 2007). In addition to determining the status of the population, these researchers have attempted to identify the temporal and spatial characteristics of spawning in the estuary, identify critical habitats, and determine the duration of freshwater residency.

Results of telemetry studies indicated that adult Atlantic sturgeon move upriver in late spring and early summer, followed by a more quiescent period during August and September, and an outmigration during October and November. Contrary to the findings of Lazzari et al. (1986), Simpson and Fox (2007) found that juvenile Atlantic sturgeon concentrated in three specific areas: Artificial Island, Cherry Island Flats, and the Marcus Hook Anchorage. During the summer months, the juveniles, like adults, displayed little movement compared to spring and fall months. Although no Atlantic sturgeon eggs were collected, based upon gonadal biopsies of captured Atlantic sturgeon, Simpson and Fox (2007) concluded that the lower limit of spawning appeared to be near Tinicum

Island while the upper limit is likely to be near the fall line at Trenton, New Jersey. They also postulated that the substrate composition between Marcus Hook and Tinicum Island represent suitable spawning habitat for the Atlantic sturgeon.

The telemetry studies of Simpson and Fox (2007) also identified two important characteristics of Atlantic sturgeon movement. These studies suggested that Atlantic sturgeon utilized tidal currents for passive transport as well as active swimming, and that Atlantic sturgeon do not appear to be using shallow water habitats at night.

Today, the capture of young-of-year and spawning adults within the Delaware River is sporadic, and the majority of sub-adults captured in the Delaware Bay are thought to be of Hudson River origin, based on genetic analysis (NMFS 2007). Population estimates based on mark and recapture of juvenile Atlantic sturgeon (declined from 5,600 juveniles in 1991 to less than 1,000 in 1995) and voluntary logbook reporting (declined from 32 fish/effort hr in 1991 to only 2 fish/effort hr in 2004) indicate that the Delaware subpopulation has been declining rather rapidly over the last 20 years (NMFS 2007).

SITE SPECIFIC INFORMATION AND CONCLUSIONS

No shortnose sturgeon were collected by multiple collection gear at the Southport Project site during spring and summer of 2010 (Weston Solutions 2010). Several factors appear to limit any excursion of shortnose sturgeon into areas such as the Southport Project site. First, tracking studies indicate that few shortnose sturgeon move below RM 106, and, therefore, be available to enter the Southport Project site located at approximately RM 95. All spawning and nursery areas exist in the non-tidal and upper tidal reaches of the Delaware River, above approximately RM 124. Second, the few adult individuals that do move downriver of RM 106 remain there for less than a month in late spring after spawning. Third, the Southport Project site includes some, but not a large amount of the one to five meter deep weedy area backwaters preferred as feeding areas. Last, bivalve mollusks, the preferred food item for shortnose sturgeon, were determined to be present in low numbers in benthic macroinvertebrate sampling conducted in spring 2010. This makes the Southport Project site and immediate area relatively unattractive as feeding grounds. Thus, it is likely that the Southport Project will have no significant effect on shortnose sturgeon either directly or upon those habitats utilized by this species.

No Atlantic sturgeon were collected by multiple collection gear at the Southport Project site during spring and summer of 2010 (Weston Solutions, Inc. 2010). The postulated, but not substantiated, spawning grounds of Atlantic sturgeon are thought to possibly occur either near the head of tide at Trenton, New Jersey (based upon telemetry studies and gonadal biopsies) and/or between Tinicum Island and Marcus Hook (based upon telemetry studies, gonadal biopsies, and substrate characteristics). Nearly all previous collections of juveniles throughout the Delaware River have occurred either above RM 125 (Lazarri *et al.* 1986) or between RM 60 and 80 (Simpson and Fox 2007). Based upon the telemetry studies of Simpson and Fox (2007), it can be conservatively stated that adults would only be present in the river near the Southport Project site between the months of June and October, and that they likely would only be present in the channel areas, and moving quickly through the area on the way to upstream spawning areas or returning from them. Telemetry studies indicated that Atlantic sturgeon do not use shallow river margins for feeding, as do the

shortnose sturgeon. Therefore, it is unlikely that any life stage of Atlantic sturgeon will enter the area of the Southport Project site.

Because there are some uncertainties about Atlantic sturgeon movements due to scarcity of the fish, observations relative to dredging and to ship strikes are presented in the following paragraphs (modified from U.S. Army Corps of Engineers 2009):

> To protect Atlantic sturgeon, the Delaware Basin Fish and Wildlife Cooperative has recommended various windows for hopper dredging, cutterhead pipeline dredging, and bucket dredging. Observers are required for monitoring hopper dredge activity and potential impacts to Atlantic sturgeon. Dredging provides safe passage for commercial shipping and recreational boat traffic in many river systems where sturgeon occur.
>
> Sturgeon encounters with boating traffic is common, particularly in high traffic rivers like the Delaware River. Ten adult Atlantic sturgeon were found in the Delaware River in 2004, six in 2005, and six in 2006 that were clearly struck by a passing ship or boat (NMFS 2007). The fish were usually 120 cm to 240 cm in length. Based on the external injuries observed, it is suspected that these strikes were from ocean-going vessels and not smaller boats, although at least one fisherman reported hitting a large sturgeon with his small craft. Three carcasses of mature fish have been documented from the lower river and upper Bay during the spawning season, including two gravid mature females and one male (NOAA 1998). An eight-foot female Atlantic sturgeon was found dead on June 14, 1994, adjacent to Port Penn. A pectoral spine was used to age it at approximately 25 years old. A second female sturgeon was found in late spring/early summer of 1997 adjacent to Port Penn, just south of the eastern end of the C&D Canal. The third sturgeon, a male, was located on May 19, 1997, just north of the mouth of the Cohansey River, on Beechwood Beach. This fish appeared to have been cut in half by the propeller of a large vessel.
>
> Similarly, five Atlantic sturgeon were reported to have been struck by commercial vessels within the James River, VA in 2005, and one strike per five years is reported for the Cape Fear River, North Carolina. Subpopulations may be affected by these incidental strikes. It is unknown what the overall impact of boat strikes is to Atlantic sturgeon subpopulations, but in small subpopulations the loss of any spawning adults could have a substantial impact on recovery. Locations that support large ports and have relatively narrow waterways seem to be more prone to ship strikes.

It would be prudent to restrict dredging to months during which Atlantic sturgeon or shortnose sturgeon are not likely to be present in the project area, which would be November through May.

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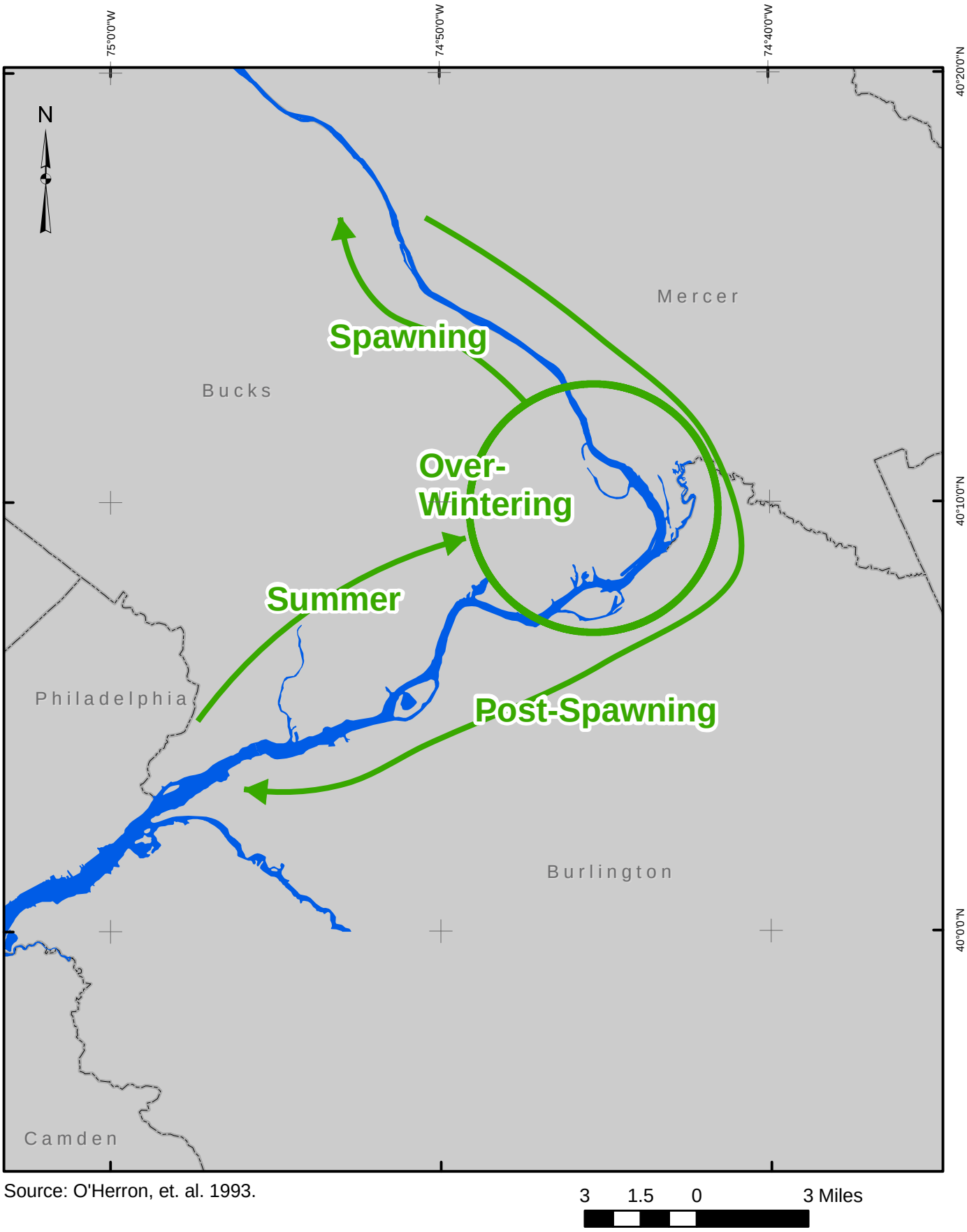

Source: O'Herron, et. al. 1993.

Figure 1.
Generalized movement pattern
of shortnose sturgeon in the Delaware River

ATTACHMENT 1.J

MITIGATION

DRAFT

DRAFT
WETLAND, OPEN WATERS, AND SENSITIVE SPECIES MITIGATION PLAN

SOUTHPORT DEVELOPMENT PROJECT
PHILADELPHIA, PA

Presented to:

PHILADELPHIA REGIONAL PORT AUTHORITY
3460 N. Delaware Avenue
Philadelphia, PA 19134

AND

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF GENERAL SERVICES
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JULY 2010

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LIST OF ACRONYMS

AST	aboveground storage tank
bgs	below ground surface
CDF	confined disposal facility
CENAP	U.S. Army Corps of Engineers, Philadelphia District
CWA	Clean Water Act
cy	cubic yard
DCNR	Department of Conservation and Natural Resources
DGS	Department of General Services
DRCC	Delaware River City Corporation
DRWC	Delaware River Waterfront Corporation
EA	Environmental Assessment
ECP	Environmental Condition of Property
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	floor area ratio
FEMA	Federal Emergency Management Agency
ft	feet, foot
ft^2	square feet, foot
GIS	geographic information system
GPS	global positioning system
JD	jurisdictional determination
JM	Jack's Marina
JPA	Joint Permit Application
KIPC	Keystone Industrial Port Complex
MHW	mean high water
MLW	mean low water
MLLW	mean lower low water
MTBE	methyl tert-butyl ether
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSP	Neshaminy State Park
PADEP	Pennsylvania Department of Environmental Protection

LIST OF ACRONYMS (CONTINUED)

PDE	Partnership for the Delaware Estuary
PEC	Pennsylvania Environmental Council
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PHL	Philadelphia International Airport
PHMC	Pennsylvania Historical and Museum Commission
PIDC	Philadelphia Industrial Development Corporation
PNDI	Pennsylvania Natural Diversity Inventory
PRPA	Philadelphia Regional Port Authority
PWD	Philadelphia Water Department
RMG	rail-mounted gantry
RMP	Resource Management Plan
RTE	rare, threatened, or endangered species
RTG	rubber-tire gantry
SAV	submerged aquatic vegetation
SSA	sole source aquifer
TEU	twenty-foot equivalent unit
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
WRD	Waterfront Redevelopment District

1. INTRODUCTION

1.1 SITE LOCATION AND PROPOSED PROJECT DESCRIPTION

The Commonwealth of Pennsylvania ("Commonwealth"), acting through its Department of General Services (DGS) and in conjunction with the Philadelphia Regional Port Authority (PRPA), is proposing to develop a new marine terminal (Southport) to be located in the City of Philadelphia, PA. The proposed Southport Terminal site (Figure 1) extends along the Delaware River, from the east end of the former Philadelphia Naval Shipyard to just north of Pier 122 at the southern edge of the Packer Avenue Marine Terminal.

The proposed containerized cargo terminal would be constructed on approximately 116 acres and would have capacity for 1.34 million containers annually, creating thousands of new, family-sustaining jobs and injecting substantial new business and tax revenue into the regional economy. The project would provide the Port of Philadelphia with the necessary capacity to handle increasing container traffic on the East Coast, including growth associated with the Asian shipping market and the widening of the Panama Canal, as well as alleviate congestion and impending capacity constraints at competing East Coast port facilities. The project would also generate substantial employment and economic opportunities. The Commonwealth has already committed funding toward this project; however, obtaining federal permits necessary for proceeding with certain parts of the project is dependent on completing the National Environmental Policy Act (NEPA) process. It is anticipated that the terminal would be completed during fall 2013, and in 2014, would be fully operational.

The proposed project includes construction of two berthing areas, the container yard, new access roadway and existing roadway improvements, installation of utilities, various buildings to support the operations of the terminal, dredging of the Delaware River from the new bulkhead line to the limits of the federally maintained navigational channel, and the placement of dredged material in the Fort Mifflin confined disposal facility (CDF). Specific components of the proposed project are listed below:

- Construction of a 2,128-foot (ft) marginal wharf, a utility trench, and pile-supported crane rails to provide two 1,064-ft berths for containerized cargo ships.

- Installation of six electric-powered, post-Panamax container cranes.
- Construction of a container yard that provides approximately 116 acres of developed surfaces (paved and permeable) for the loading, offloading, and storage of containers and trailer chassis.
- Construction/installation of the necessary infrastructure and utilities for a fully operational container yard that can accommodate a planned throughput of approximately 1.34 million twenty-foot equivalent units (TEUs) per year.
- Construction of various buildings and structures to include an administration building, maintenance and repair building, yard operations/crane maintenance and roadability canopy, driver service building, and gate pedestals and guard booth.
- Relocation of approximately 1,000 ft of an existing stormwater conveyance ditch.
- Extension of Columbus Boulevard to provide dedicated access to the terminal site.
- Dredging of the Delaware River to -42 ft (40 ft + 2-ft optional overdredge) mean lower low water (MLLW) from the new bulkhead line to the limits of the federally maintained navigation channel. Initially, approximately 1,008,000 cubic yards (cy) of material would be removed from the river bottom, and placement would be at the existing Fort Mifflin CDF. The surface area for project dredging is approximately 34 acres with existing depths ranging from -0 to -42 ft MLLW.
- The site developer could dredge to-47 ft (45 ft + 2-ft optional overdredge) MLLW if the Delaware River deepening project is completed and deeper vessels call at the Port of Philadelphia to take advantage of future navigation infrastructure improvements. This additional dredging of the berths require the removal of approximately 298,000 cy of material.

1.2 OBJECTIVES

The objective of this mitigation plan is to demonstrate that the federal and state standards for determining mitigation and compensation for impacts to wetlands and waterways have been met. In addition, a detailed compensation plan is provided that offsets the unavoidable loss of regulated wetlands and waters and sensitive habitats and species. This plan was prepared following the format prescribed in the U.S. Army Corps of Engineers, Philadelphia District (CENAP) and USEPA guidance “Compensatory Mitigation for Losses of Aquatic Resources; Final Rule.”

1.3 PROJECT SITE SELECTION

To assure compliance with NEPA, a project alternatives analysis was undertaken during the preparation of an Environmental Assessment (EA) to evaluate all practicable alternatives. This analysis was undertaken during the permit application processes associated with Section10 of the Rivers and Harbors Act and 404 of the Clean Water Act (CWA). The analysis is based on the overall purpose of the project and ensures that every attempt has been made to avoid and/or minimize environmental impacts.

Over the years, the Commonwealth, through PRPA, has conducted a series of comprehensive studies to examine the suitability of lands along the Delaware River for future port development. The purpose of these studies was to provide for the necessary expansion of Port facilities and to enhance the Port's ability to respond to economic opportunities present in the international shipping community. These studies have guided PRPA's master planning process through the identification of specific properties for acquisition and subsequent use. The proposed project site was required to be on the Pennsylvania side of the Delaware River and on land either owned or able to be acquired by PRPA. Additionally, the site needed to be located south of the Walt Whitman Bridge due to the vertical clearance restrictions.

The alternatives analyses, which are described in detail in Chapter 2 of the EA (WESTON, 2010a) prepared for the permit application, considered potential locations, project footprints, and terminal layouts before arriving at a preferred option at the proposed site. After evaluating the existing development along this length of the Delaware River shoreline, it was determined that the proposed Southport project site is the only location that meets the size requirements and is suitable for the development of a marine terminal. Furthermore, the proposed site provides the following benefits:

- Easy deep-water access (with limited dredging) to the existing federal navigation channel (-40 MLLW);
- Two- to four-berth capability;
- Highway connectivity (I-95/ I-76);

- National rail connectivity (adjacent to two intermodal rail yards and three Class I rail operators);
- Consistent with adjacent land use, including the Packer Avenue Marine Terminal;
- Proposed operations would not interfere with the Philadelphia International Airport (PHL); and
- Site development is consistent with the Philadelphia Navy Yard Master Plan, "East Yard" area, prepared by the Philadelphia Industrial Development Corporation (PIDC) in 2004 (PIDC, 2004).

1.4 AVOIDANCE AND MINIMIZATION OF IMPACTS

After selection of the proposed project location, a comprehensive planning and formulation process was conducted in an attempt to minimize impacts to sensitive resources and habitats while optimizing the use of the site. Property boundary constraints, wetlands, intertidal and subtidal habitat, open-water fill, dredging, shoreline limits, road access, and access to the nearby interstate highways were among the factors considered in developing the conceptual site plan. Since container terminals are most efficient when the container yard is the same width as the berthing areas and as deep as possible, it was important to maximize the distance away from the river and toward the Norfolk Southern property.

The overall planning analysis ultimately concluded that a two-berth terminal layout, rather than a three- or four-berth layout, would meet the project throughput goal of exceeding 1 million TEUs per year, and have significantly fewer in-water environmental impacts.

In 2009, the Commonwealth contracted the services of Weston Solutions, Inc., to further refine the potential alternatives and prepare the necessary environmental documentation and applications required to obtain permits for the construction and operation of the proposed terminal. Early informal consultations with federal, state, and local regulators discussed potential environmental impacts, from constructing the then-preferred alternative, including the amount of in-water fill that would adversely impact intertidal/subtidal habitat along the northern end of the proposed project footprint. Because this type of habitat is now less common along the developed shores of the Delaware River, alternatives were reevaluated using different container alignment and berthing configurations to maximize throughput and reduce the amount of in-water fill. A

new preferred alternative (Option B, Environmental Assessment Figure 1-2; Figure 1 in this document) was developed that reduced the number of berths from three to two, changed the stacked container alignment to a diagonal arrangement, and used rail-mounted gantry (RMG) cranes instead of rubber-tire gantry (RTG) cranes during yard operations, which resulted in significantly less in-water fill. The planning process, which was initiated in 2003, resulted in the selection of Option B (two-berth alternative) as the final preferred alternative. Option B demonstrates that all efforts have been undertaken to avoid and minimize the proposed project's environmental impacts to the maximum extent practicable.

The two-berth preferred alternative reduces impacts to deep water, subtidal, and intertidal areas by approximately 40%. Nontidal/isolated wetland impacts would be the same regardless of whether the two- or three-berth alternatives were selected. Additionally, the construction of the proposed terminal wharves on pilings along the northern and eastern site boundaries would increase the area of deep (>6.6 ft below MLLW) water habitat when compared to existing conditions.

The proposed action would require the dredging of approximately 1,008,000 cy of material from the Delaware River to a depth of -47 ft (40 ft + 2-ft optional overdredge) MLLW with the potential that an additional 298,000 of material could be dredged as discussed in 1.1. The dredging surface area is approximately 35 acres and extends from the federal navigation channel to the wharf face of the terminal. The dredged area would provide sufficient space for maneuvering and berthing Panamax container ships. All reasonable dredged material placement alternatives were considered during the project planning process. This process has included consultation with CENAP and Pennsylvania Department of Environmental Protection (PADEP) to formulate the project alternatives, including dredged material placement at the Fort Mifflin CDF or other permitted or approved dredged material disposal facility.

2. EXISTING SITE CONDITIONS - SOUTHPORT PROJECT LOCATION

All premises on the Southport project site formerly consisted of marshlands or were part of the Delaware River (WESTON, 2010b). The land was created through filling of the site footprint in the 1900s, altering the entire site's topography and drainage pattern. The western portion of the site contains the buildings and infrastructure used at the former Philadelphia Navy Yard for housing, which is now abandoned. The area to the east of the housing area has been filled to elevations of up to 15 ft in some areas with dredged material, construction rubble, and blasting grit (WESTON, 2009). The area west of the interpier area (Piers 122 and 124) includes a former pistol range and was also filled.

The site is mostly vegetated and has several distinct vegetation communities that contain species compositions common to disturbed areas:

- Areas of both wetland and upland dominated by common reed (Phragmites australis);
- Upland fields;
- Scattered areas of forest that are mostly associated with shoreline areas;
- Once landscaped, and now overgrown areas within the former Navy Yard housing; and
- Mostly unvegetated intertidal and shallow water habitat.

The following summarizes existing site conditions for the Southport project site. More detailed information is found in Section 3 and the appendices of the EA.

2.1 SURFACE WATER AND SITE DRAINAGE

The proposed Southport project is located within the Delaware River watershed. The total drainage area for the project (including upgradient lands) is approximately (TBD) acres. The project site does not contain any natural streams or other drainage features associated with the project footprint. Based on existing site topography, surface runoff in undeveloped areas drains via sheet flow into the Delaware River or infiltrates groundwater within on-site depressions. In the former Navy Yard housing area, sheet flow stormwater collects in a series of stormwater inlets that are a component of the engineered collection and conveyance system. This system

discharges to the Delaware River via three outfalls along the southern site boundary. Other sheet flow from positive drainage may discharge directly to the Delaware River.

A stormwater channel traverses the property (conveying stormwater from the Norfolk Southern property) to the north of the former Mustin Field runway and discharges into the Delaware River at the north boundary of the Navy Yard property (Figure 2). The portion of the channel traversing the site is approximately 0.73 acre and tidal with flows restricted by a weir located at the eastern end. Two 10- to 12-inch plastic pipes allow flow though the weir during low tide; the weir is overtopped during high tide.

2.1.1 Deep Water Habitat

Approximately 3.62 acres of deep water habitat exist within the project footprint (Figure 2). Deep water is defined as depths greater than -6.6 ft MLLW. These areas exist within waters of the Delaware River, both within the inner-berth area and to the east and south along the project site shoreline. The area of deep water within the project footprint would be dredged and/or filled and covered by the terminal; however, the construction of the proposed terminal wharves on pilings along the northern and eastern site boundaries would increase the area of deep (>6.6 ft below MLLW) water habitat when compared to existing conditions.

2.2 WETLANDS

The on-site wetlands/waters are associated with the Delaware River watershed and are part of a much larger wetland/water complex on the former Navy Yard and Norfolk Southern property. In general, waters from the site (intrastate waters) flow directly into the Delaware River (interstate waters). The boundaries of the project site wetlands were delineated, surveyed, and a jurisdictional determination (JD) of these wetland and water areas was completed by CENAP in April 2010 (Figure 2). In addition to this report, these wetlands are characterized in the *Wetland and Other Waters Investigation Report* (WESTON, 2010b) and the EA (WESTON, 2010a) provided with the project's Joint Permit Application (JPA).

2.2.1 Nontidal Freshwater Wetlands

The project site is characterized by a history of land use activities that resulted in the creation of isolated depressions where ponded water and vegetation common to disturbed areas (e.g., common reed) are present. These depressions are assumed to have been formed by the fill placement and site grading, which resulted in a perched water table. During site investigations, six isolated depressions having wetland characteristics were identified and delineated (flagged) (Figure 2). The presence of hydrophytic vegetation and evidence of wetland hydrologic conditions (standing water, water-stained leaves, adventitious roots) indicate that the areas function as wetlands. All are considered to be the result of historic site disturbance (fill and grading) related to historic land use. None of the nontidal wetland areas are associated with surface water features, including stormwater management systems. Vegetation consists of primarily dense stands of common reed with soft rush (*Juncus effusus*), silky dogwood (*Cornus amomum*), and black willow (*Salix nigra*) present in some areas (particularly Wetland E, see EA Appendix F) where the size and density of common reed is generally less robust.

2.2.2 Emergent Tidal Freshwater Wetland

An area of emergent intertidal wetland, measuring approximately 0.2 acre, was identified between the northern boundary of the Navy Yard property and a sheet pile area south of Pier 124 (EA Appendix F). The dominant vegetation in this low-marsh area was spatterdock (*Nuphar luteum var. advena*). The intertidal area in this portion of the site extends into mudflats.

2.2.3 Other Intertidal Habitat

The mean high water (MHW) elevation (Section 10 Rivers and Harbors Act jurisdiction) is 3.04 ft North American Vertical Datum (NAVD) 1988. The spring high water elevation (Section 404 Clean water Act jurisdiction) is 4.48 ft NAVD 1988. The tide elevations were derived from National Oceanic and Atmospheric Administration (NOAA) data for the gauging station closest to the site [Philadelphia U.S. Coast Guard (USCG) Station, Station ID: 8545240), located approximately 3 miles upstream. Shallow water zones (extending to 6.6 ft below the MLLW water elevation of -3.15 NAVD 1988) are present along the Delaware River at the north, east, and south edges of the Southport project site.

North of the Navy Yard the shoreline is a combination of bulkheads and narrow, steep areas characterized by minimal vegetation and construction rubble. There is a larger intertidal zone, primarily characterized by mudflats, between the north end of the Navy Yard and an area of sheet piles south of Pier 124. The intertidal zone along the east and south boundary of the Navy Yard is narrow, consisting of construction rubble and well-graded stone.

The Delaware River along the Southport project site provides a range of habitats for numerous aquatic species, including benthic invertebrates, finfish, and submerged aquatic vegetation (SAV). The substrate within the affected environment of the Southport project site consists mainly of soft sediments, sand, and cobbles depending on location within the project area. A benthic investigation was conducted by Normandeau Associates, Inc., in October 2003 to evaluate the benthic infaunal community in the vicinity of the Southport project site. The study areas consisted of four interpier areas between the Packer Avenue Marine Terminal and the land that was formerly part of the Philadelphia Naval Shipyard. The eastern edge of the study area ended at the pier lines. Most of the macroinvertebrates present were oligochaete worms. Others included fingernail clams (*Musculium transfersium*), aquatic insects, and the Asiatic clam (*Corbicula fluminea*). The benthic macroinvertebrate found in these interpier areas is nearly identical to communities found throughout the freshwater tidal areas of the Delaware River (Normandeau, 2004). WESTON conducted additional benthic studies in late spring 2010; results have been incorporated into the Southport project EA as Appendix C.

Fish habitats in the vicinity of the proposed Southport project include the following:

- Subtidal and intertidal zones along the eastern and southern boundary of the Navy Yard;
- Intertidal marsh, and subtidal areas, with shallow to deep water south of existing Pier 124 and immediately north of the east end of the former Philadelphia Naval Shipyard; and
- The stormwater channel.

The intertidal marsh and subtidal areas in the interpier areas may be considered ecologically important due to the presence of emergent and SAV along the shoreline, which may be used by macroinvertebrates as a substrate and by small fish for cover, and the plants are a source of

dissolved oxygen for the water. In addition to the emergent vegetation and SAV, the man-made embayment in this location provides calm water for fish common to this habitat type. Refer to the Southport project EA for additional information regarding potential finfish in the vicinity of the project site.

Approximately 1.08 acres of SAV have been identified and mapped in the interpier area. The dominant vascular plant species is *Vallisneria americana* (water celery). An algae, *Chara vulgaris* (musk grass) was also common in this location.

2.3 SOIL

The Web Soil Survey (USDA, 2010) shows Urban Land for the entire Southport area. Urban Land, in general, is soil material that has been disturbed, filled over, or otherwise destroyed prior to construction. The disturbed material is fill that consists of river sediments, gravel, ash, concrete, brick, and sandblast grit (WESTON, 2005). The Urban Land was described by Gannett Fleming (2007) as very gravelly medium- to coarse-grained sand with clay, silt loam, and sandy loam. Most of this land was marsh or open water, but filling operations by the Navy extended the original League Island eastward to its present configuration. This fill material is deeper in the northeastern and eastern portions of the site where tidal marsh and muck soils originally existed and in areas that were previously marshlands, back channels, or part of the river. At depth, the predominant soil type (muck) ranges from 40 to 50 ft below ground surface (bgs). A hard pan layer beneath the muck constitutes the upper confining layer of the PRM[1]. This was confirmed during the 2009 soil boring effort (WESTON, 2009).

The observed soils in both wetland and upland areas illustrate the history of filling and grading at the site. The site has been used for disposal of dredged material, construction debris, and blasting

[1] The proposed Southport project site falls within the source zone of the New Jersey Coastal Aquifer area. The PRM is recognized by the U.S. Environmental Protection Agency (USEPA) as the "sole or principal source of drinking water" (SSA or sole source aquifer) for much of central and southern New Jersey. USEPA has determined that the aquifer, if contaminated, would create a significant hazard to public health. The aquifer is highly susceptible to contamination through its recharge and streamflow source zones.

grit (WESTON, 2009, 2010b). Subsequent to this filling, the Navy developed a portion of the area for family housing and its associated infrastructure.

2.4 UPLAND HABITAT

2.4.1 Wooded Habitat

Upland communities consist of woodlands and old fields. Limited woodland areas consist of primarily thin stands of young trees with varying undercover species. These wooded areas are primarily limited to the river's edge. The more common tree species include box elder (*Acer negundo*), mulberry (*Morus* spp.), black cherry (*Prunus serotina*), tree of heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*), and black locust (*Robinia pseudoacacia*). Common shrub species include blackberry (*Rubus allegheniensis*), false indigo (*Amorpha fruticosa*), and silky dogwood (*Cornus amomum*).

The old field areas are characterized by a diversity of species mixes consisting of both native and invasive species. Some upland areas are dominated by common reed (*Phragmites australis*) in varying density. Common in these areas are dense stands of Asiatic tearthumb (*Polygonum cuspidatum*). There are fields lacking common reed dominated by areas of warm-season grasses with mixtures of native and invasive species. This includes broomsedge (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), common wormwood (*Artemisia vulgaris*), black knapweed (*Centaurea nigra*), camphor weed (*Heterotheca subaxillaris*), and bush clover (*Lespedeza* spp.). It is within one of these recovering areas where two Pennsylvania endangered species were found by Arsenault, velvety panic-grass *(Panicum scoparium)* and forked rush (*Juncus dichotomus).* For more detailed information, refer to the EA (WESTON, 2010a), JD, and photographs included with the JPA.

2.4.2 Sensitive Species and Habitat

Certain species of plants and animals are protected by federal and state regulations under the Endangered Species Act (ESA) of 1973, and the Pennsylvania Natural Heritage Program. Lists of the federally and state-designated Rare, Threatened, and Endangered (RTE) species potentially present in the project area (Philadelphia County) are presented in the EA (Table 3-

11). These species occur in a wide variety of habitats, including habitat types not present within the project area. The following summarizes the results of RTE surveys for the Southport project site. Detailed results of RTE surveys and agency correspondence relating to RTE are presented in Section 3 of the EA and its appendices.

Federally listed species potentially occurring in Philadelphia County include the threatened bog turtle (*Glyptemys muhlenbergii*), endangered shortnose sturgeon (*Acipenser brevirostrum*), endangered dwarf wedgemussel (*Alasmidonta heterodon*), and threatened small-whorled pogonia (*Isotria medeoloides*). The National Marine Fisheries Service (NMFS) also expressed concern over the Atlantic sturgeon (*Acipenser oxyrhynchus*), which is a federal species of concern. The bog turtle, shortnose sturgeon, dwarf wedgemussel, and small-whorled pogonia are also listed as endangered in the Commonwealth of Pennsylvania.

A Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review was used to search for potential impacts to RTE species within the project footprint. The PNDI search (search ID 20090901208135) results indicated that actions within the Southport project site may impact RTE species. Further review was required, due to potential impacts, with a number of state agencies. Below is a summary of the PNDI results and the correspondence with those agencies regarding potential RTE species present within each site. The results of the PNDI search as well as the correspondence between WESTON and the agencies are presented in EA Appendix G.

Further consultation with the following agencies was required due to potential impacts to state-listed RTE species within the Southport project area: Pennsylvania Game Commission (PGC), Pennsylvania Department of Conservation and Natural Resources (DCNR), and Pennsylvania Fish and Boat Commission (PFBC). These agencies were contacted to obtain further information on RTE species potentially present within the project footprint. Aquatic, wetland, and terrestrial surveys have been conducted (and in some instances are ongoing) to assess the Southport project area for RTE species. Based on these surveys and agency coordination, the following federal and state RTE species have been either identified on the Southport project site or are potentially utilizing the site and adjacent waters seasonally: bald eagle (*Charadrius melodus* [state threatened]), endangered shortnose sturgeon (*Acipenser brevirostrum* [federal and state endangered]), redbelly turtle (*Pseudemys rubriventris* [threatened]), eastern mudminnow [*Umbra*

pygmaea (potential candidate)], field dodder [*Cuscuta pentagona* (proposed threatened)], bugleweed [*Lycopus rubellus* (endangered)], velvety panic-grass [*Panicum scoparium* (endangered)], and forked rush [*Juncus dichotomus* (endangered)]. The National Marine Fisheries Service (NMFS) also expressed concern over the Atlantic sturgeon (*Acipenser oxyrhynchus*), which is a federal species of concern.

2.5 COMPENSATION AND MITIGATION REQUIREMENTS

Pursuant to federal and state regulatory programs and policies, compensatory mitigation is required to offset unavoidable impacts to wetlands and other waters of the United States, and documented sensitive species and habitats. A compensatory mitigation plan for the filling of wetlands and other waters, and disturbance of upland habitats for sensitive species is required to be submitted with the JPA, and would be a component of the project's wetland permit approval process. The determination of compensatory mitigation requirements was made following significant efforts to avoid and minimize impacts to wetlands and other waters (refer to Subsection 1.4).

Sections 3 and 4 of the EA provide information regarding the Southport project site's environmental resources. Habitats and regulated areas within the Southport project footprint requiring mitigation include the following:

- Nontidal freshwater wetlands, which are primarily dominated by common reed;
- Intertidal wetlands, mudflat, and subtidal habitat that contain some SAV;
- A tidally influenced stormwater channel;
- Deep water habitat;
- Upland fields containing state-listed plant species; and
- Sensitive species' habitats including bald eagle nest, redbelly turtle breeding habitat, etc.

Table 1 summarizes the loss of regulated wetlands and other waters from the Southport project. Approximately 3.62 acres of deep water habitat would be impacted. These areas exist within waters of the Delaware River, both within the inner-berth area and to the east, along the project

site shoreline. In total, approximately 8.68 acres of subtidal (5.22 acres) and intertidal (3.46 acres) areas would also be impacted. Impact areas are primarily located within the existing inner-berth area to the north, and to the east along the project site shoreline. Approximately 3.75 acres of nontidal wetlands would also be impacted. In addition, sensitive habitats (0.20 acre of tidal emergent wetland and 1.08 acre of SAV) and species would be impacted from the Southport project. Consultation with federal and state agencies has provided the mitigation framework needed to compensate for the unavoidable loss of these valuable resources as well as other sensitive habitats and biota. Compensatory mitigation for the Southport project is provided in a variety of methods: establishment, which includes relocation and creation; restoration; enhancement; and preservation. Based on preliminary discussions with federal and state regulatory and resource agencies, compensatory mitigation ratios (replacement to loss) for impacts to designated wetland/water areas have been initially determined.

U.S. Army Corps of Engineers (USACE) – USACE has identified acceptable replacement-to-loss mitigation ratios for impacts to waters of the United States (Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act) from the Southport project. This can include the following:

- Deep water [depths greater than 6.6 ft (NAVD88) below MLLW] (1:1).
- Subtidal [water depths between mean low water (MLW) and 6.6 ft (NAVD88) below MLLW] (1:1).
- Vegetated tidal (1:1).
- Mudflat (1:1).
- SAV (1:1).
- Tidal stormwater channel (1:1).
- Nontidal emergent (common reed dominated) (1:1).

Other methods of mitigation, including enhancement and preservation, would be negotiated during the permit review process. Compensation for the filling of nontidal, isolated wetlands can include enhancements or the creation of desirable upland buffers in the selected mitigation site.

Mitigation for impacts to federally protected species (bald eagle, short-nosed sturgeon, and Atlantic sturgeon) would be coordinated with the appropriate federal agency (see below).

PADEP – PADEP has identified acceptable mitigation for impacts to waters of the Commonwealth (Chapter 105). The mitigation requirements are similar to the USACE guidance (see above) with the following additional considerations: Impacts to documented redbelly turtle habitat shall be at a minimum 1:1 creation-to-loss ratio with additional mitigation required, which can consist of basking platforms, nesting areas, and other enhancements to the mitigation site. Impacts to other state-listed species and sensitive habitats need to be mitigated. The determination of suitable mitigation shall be coordinated with the applicable Pennsylvania resource agency (see below).

U.S. Fish and Wildlife Service (USFWS) and PGC – In efforts to mitigate potential impact to the existing bald eagle nest, DGS has prepared and submitted to the USFWS, an application for the take of the inactive eagle nest in the Southport project footprint under the Bald and Golden Eagle Protection Act. This application includes proposed measures to provide a net benefit to eagles.

NMFS – NMFS recommends that the filling of tidal and deep water areas is mitigated at a minimum 1:1 replacement-to-loss ratio. Mitigation for the loss of SAV areas would be required at a higher ratio, which is yet to be determined. The selected mitigation site and plan would include providing suitable habitat for the impacted (or closely related) fish species. Consultation may be required to assess impacts and mitigation for the shortnose sturgeon and Atlantic sturgeon.

PFBC – Fish surveys have been conducted at the Southport project site and adjacent areas; and no state-listed species have been positively identified. PFBC concerns include the presence of striped bass breeding habitat along the Southport project site's southern and eastern shores. The PFBC has indicated that the selected mitigation site should provide suitable habitat for the species impacted from the proposed action or closely related species present in other areas of the Delaware River.

The redbelly turtle has been observed within the intertidal areas at the north end of the Southport site. Compensatory mitigation would provide redbelly turtle habitat, which can include suitable intertidal habitat and additional features such as basking platforms and nesting habitat. A turtle nesting survey being conducted during summer 2010 has provided no evidence of upland nesting by redbelly turtles. The surveys will continue through July and the results will be summarized in a report, which will be included with the JPA.

DCNR – Four state-listed plant species have been identified and mapped on the Southport project site. DCNR has provided input regarding mitigation for impacting these species. The DCNR recommends collecting and preserving available seed from the on-site species for planting at the approved mitigation site. Suitable habitat for these species would need to be provided at the mitigation site.

Table 1 also summarizes the proposed mitigation for the Southport, Neshaminy State Park (NSP), and Jack's Marina (JM) sites. Mitigation at the Southport site consists of relocating the existing tidal stormwater channel to a location parallel to the existing footprint. Similar habitat would be provided to compensate for this loss. The wharf along the northern and eastern edge of the project footprint is proposed to be placed on pilings, providing open-water habitat under the wharves. The open-water area under the wharves would total approximately 5.7 acres. This area exceeds the 3.62 acres of deep water (deeper than -9.75 ft NAVD88) and is considered compensation for impacts to this regulated area.

The remaining mitigation would be provided at the NSP and JM sites. Figure 3 illustrates the proposed location and types of mitigation at the NSP and JM sites. Table 1 provides information on the size and kind of mitigation by area.

Table 1
Southport Development Project
Draft Resource Impact Calculations and Preliminary Mitigation Credits

Non-Tidal Wetlands			**Tidal/Subtidal Areas**			**Deep Water**		
	Acres taken from Southport	**Acres of Mitigation Required**		**Acres taken from Southport**	**Acres of Mitigation Required**		**Acres taken from Southport**	**Acres of Mitigation Required**
Wetland A	0.05	0.05	Subtidal	5.22	5.22	Deep Water	3.62	3.62
Wetland B	0.57	0.57	Intertidal	3.46	3.46			
Wetland C	0.13	0.13	Stormwater Channel	0.73	0.73			
Wetland D	1.21	1.21						
Wetland E	1.66	1.66						
Wetland F	0.13	0.13						
Total	**3.75**	**3.75**	**Total**	**9.41**	**9.41**	**Total**	**3.62**	**3.62**
			Mitigation Options					
Non-Tidal Wetlands			**Tidal/Subtidal Areas**			**Deep Water**		
Southport Project Site								
			• Relocation		**0.73**	**• Preservation**		**3.62**
			Relocation of impacted stormwater channel onsite		0.73	Preserved under wharf at project location		3.62
Neshaminy State Park								
• Creation	**(1:1)**	**1.14**	**• Creation**	**(1:1)**	**5.5**			
Area B		1.14	Area C		5.50			
• Enhancement			**• Enhancement**	**(3:1)**	**0.80**			
Area A - Sand Area (Upland) Soil Factory		TBD	Area A		2.38			
Jack's Marina/TH Properties								
• Enhancement			**• Creation**	**(1:1)**	**7.14**			
Upland Buffer		TBD	Intertidal		7.14			
			• Enhancement	**(3:1)**	**1.76**			
			Subtitdal (SAV)		3.24			
			Red-bellied turtle, Nesting		2.04			
			• Preservation	**(4:1)**	**3.09**			
			Intertidal Wetland		12.34			
			Lagoon/Open Water		0.00			
Preliminary Mitigation Credits								
Non-Tidal Wetlands		**1.14**	**Tidal/Subtidal Areas**		**19.02**	**Deep Water**		**3.62**

Notes:

1. Mitigation for impacts to terrestrial resources and threatened and endangered species will be incorporated into the mitigation plan. This may include mitigation for impacts to the bald eagle, state-listed plant species, and red-bellied turtle nesting habitat as applicable.

2. Impacted intertidal areas will be mitigated at a minimum of 1:1 replacement ratio plus enhancements (e.g., red-bellied turtle basking platforms and nesting habitat).

3. Impacted areas with submerged aquatic vegetation (1.08 acres) will be mitigated - initial replacement ratio of 3:1 using lagoons at Jack's Marina.

4. Pile construction of Southport wharf on north and east boundaries will provide approximately 5.7 acres of open water habitat under wharf. Allowable mitigation credit assumed to be 3.62 acres at this time.

3. MITIGATION SITE SELECTION CRITERIA

To accompany the component of mitigation that is proposed for implementation at the Southport project site, Weston Solutions, Inc., contracted by DGS and PRPA, searched for suitable mitigation sites within the Pennsylvania coastal zone in Delaware, Philadelphia, and Bucks counties, which comprise Pennsylvania's Delaware River shoreline between the Pennsylvania-Delaware state line and the Trenton-Morrisville (Route 1) toll bridge. The search for appropriate mitigation included the identification of sites located along tidally influenced sections of the Delaware and Schuylkill rivers and their tributaries. Large sites that could accommodate all mitigation needs and are primarily undeveloped or vacant with minimal structures and infrastructure were preferred over small and highly developed parcels. To accommodate up to 19.02 total acres of a combination of tidal and nontidal wetland and open-water habitat, DGS and PRPA searched for sites between 30 and 40 acres in size, or those where open water, subtidal and intertidal habitat, and nontidal wetlands existed or could be created. Smaller sites were initially cataloged with the precaution that should a large site not be identified, DGS and PRPA could acquire multiple small sites to achieve the required mitigation.

The Federal Aviation Administration (FAA) encourages landowners and communities supporting restoration or enhancement efforts for wetland types that do not increase aircraft-wildlife strike potentials to contact the affected airports to develop cooperative programs to prevent the attraction of any hazardous wildlife and to monitor the sites for any hazardous wildlife attraction or activity (FAA, 2010). Per FAA guidance, potential mitigation sites with specific land uses, including wetlands and mitigation areas located within 5 miles of an airport, are discouraged and require evaluation and coordination per FAA Advisory Circular 150/5200-33B (Hazardous Wildlife Attractions on or Near Airports).

3.1 MITIGATION SITE IDENTIFICATION

During a comprehensive search of available aerial photography and various resources available in formats compatible with Geographic Information Systems (GIS), a database containing a total of 46 potential mitigation sites were initially identified within the following four areas:

- Schuylkill River shoreline in Philadelphia - 7 sites;

- Delaware River shoreline from the Pennsylvania-Delaware state line to the Betsy Ross Bridge in Philadelphia - 6 sites;
- Delaware River shoreline from the Betsy Ross Bridge in Philadelphia to the Philadelphia-Bucks County line - 26 sites; and
- Delaware River shoreline in Bucks County - 7 sites.

Each of the seven sites along the Schuylkill River shoreline was eliminated from the analysis. Three of the sites exist within 5 miles of PHL. Four of the sites exist above the Fairmount Dam, and therefore, are not subject to tidal influence. In addition to being nontidal, two of the nontidal sites are too small to satisfy the project's mitigation requirements.

Each of the six sites along the Delaware River shoreline from the Pennsylvania-Delaware state line to the Betsy Ross Bridge in Philadelphia was also eliminated from the analysis. Three of the sites exist within 5 miles of PHL. Two of the sites are slated for future development by the Delaware River Waterfront Corporation (DRWC) and the Sugar House Casino (Forkin, 2010). The sixth site is privately owned and is not available for consideration.

Twenty-four of the 26 sites located along the Delaware River shoreline from the Betsy Ross Bridge in Philadelphia to the Philadelphia-Bucks County line were eliminated from the analysis. Nine of the sites were too small to be considered individually for the required mitigation needs. Six of the sites are properties owned by various departments of the City of Philadelphia; all city property that could potentially provide opportunities for mitigation are currently being reserved to satisfy the upcoming needs for the anticipated PHL expansion project (Forkin, 2010). Prior to implementing mitigation plans, six of the sites would require significant site clearing or could potentially require site cleanup; and therefore, are less attractive to DGS and PRPA. Two of the sites are slated for future plans; and therefore, are not available to satisfy the mitigation needs for the Southport project. The last of the 24 sites eliminated contains functional and valuable intertidal wetland habitat that would potentially be lost as a result of constructing Southport's specific mitigation needs; therefore, it too was eliminated.

The two sites located along the Delaware River shoreline from the Betsy Ross Bridge in Philadelphia to the Philadelphia-Bucks County line that were retained for further investigation

include the National Grid property, which is located in the city's Bridesburg section, and the property located at 7777 State Road.

Two of the seven sites located along the Delaware River shoreline in Bucks County were eliminated from the analysis. One of the sites is slated for future plans; and therefore, is not available to satisfy the mitigation needs for the Southport project. The second of the sites is too small to achieve Southport's specific mitigation needs.

The five sites located along the Delaware River shoreline in Bucks County that were retained for further investigation included the following:

- NSP, which is composed of two parcels located in both Bensalem and Bristol Townships;
- 7777 State Road, which is the location of the former Northern Shipping Company;
- The former Jack's Marina (JM), which is adjacent to the NSP property in Bristol Township and is now owned by Newport Landing and referred to in this document as "Jack's Marina";
- Dow Chemical (formerly Rohm & Haas) property, which is also located in Bristol Township; and
- U.S. Steel Property in Falls Township.

3.1.1 National Grid

3.1.1.1 Site Description

The National Grid property is bounded by Richmond, Orthodox, and Buckius Streets, and the Delaware River. This is the location of the former Philadelphia Coke Company, which ceased operations in 1982. The property has since been rezoned as part of the City of Philadelphia's Waterfront Redevelopment District (WRD)[2].

[2] In 2005, the City of Philadelphia passed the Waterfront Redevelopment District (WRD—Philadelphia Zoning Code, Chapter 14-216), which s a zoning provision for the express purpose of facilitating the projects identified in the North Delaware Riverfront study. The WRD is a floating residential zone that can be applied to sites near the waterfront that are larger than 1 acre. It permits great flexibility. Instead of the specific requirements of the more conventional zones, it works on the basis of a plan filed for the site—that can include a variety of housing and

3.1.1.2 Availability

The Pennsylvania Environmental Council (PEC) and its partners [Delaware River City Corporation (DRCC), Philadelphia Water Department (PWD), NOAA, Partnership for the Delaware Estuary (PDE), and USEPA] have initiated a project to develop a viable conceptual design for a new wetland, riparian habitat, and restored upland forest habitat on the neighboring parcel, which will also address opportunities to enhance riparian habitat, existing tidal wetlands, and upland forest habitat on the National Grid property.

In addition, the PEC project will provide a working green buffer alongside a future walking and biking trail that will be a part of the future North Delaware River Greenway system, which will eventually connect to additional trail and greenway segments in Bucks County and in the Central Philadelphia riverfront, thus also completing a major segment of the 3,000-mile East Coast Greenway through Pennsylvania.

The National Grid property, or a portion of this site, has sufficient undeveloped land to potentially satisfy all mitigation needs for the Southport project. However, the proposed extension of Delaware Avenue will divide the site close to the Delaware River, at the approximate location of the railroad, thereby requiring the inclusion of one or several culverts or a bridge to facilitate sufficient tidal exchange to support intertidal wetlands north of Delaware Avenue. Based on the PEC's plans for this site, mitigation would be primarily located in the area south of the proposed Delaware Avenue extension and consist primarily of restoration and enhancement. Furthermore, due to various state, local, and federal agencies and organizations involved with the future restoration plans for the National Grid property, the site was eliminated as a mitigation option to the Southport project.

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related commercial uses. The maximum floor area ratio (FAR) for the WRD is 2.5. The zone requires a minimum 50-foot setback on the waterfront side to provide for a public greenway and recreation right-of-way.

3.1.2 7777 State Road

3.1.2.1 Site Description

The property located at 7777 State Road consists of 72 acres bounded by State Road, the Delaware River, and Pennypack Park. This is the location of the former Northern Shipping Company; however, in 2005, the property was rezoned as part of the City of Philadelphia's WRD[2].

3.1.2.2 Availability

The property at 7777 State Road is available for purchase (Gable, 2010). The property, or a portion of this property, has sufficient undeveloped land to satisfy all mitigation needs for the Southport project. Specifically, following the removal of the 180,000-square-foot (ft^2) building, terminal office building, and the remaining rail car storage and marshalling yard, this site could provide sufficient land (40 acres) along the Delaware River to satisfy required mitigation. Consideration could be given to "linking" the site to the abutting Pennypack Park (incorporate into Park, access to shoreline bulkhead for fishing, etc.), including assessing the potential to connect the tidal mitigation to the Delaware River via the southwest corner of the park. Similarly, incorporating the site into the planned North Delaware River Greenway could be considered.

Based upon the acquisition, site preparation and associated costs that would be required prior to the construction of the mitigation, as well as the potential for encountering additional site contamination during excavation, this site was eliminated as a mitigation option for the Southport project.

3.1.3 The Dow Chemical Property

3.1.3.1 Site Description

The Dow Chemical Bristol Complex, formerly Rohm & Haas Chemical Plant, is located in Bristol, PA, and bounded by Bristol Pike, Railroad Avenue, the Delaware River, and NSP. The northern portion of the site is an industrial chemical plant, which is zoned for manufacturing. The south-central portion of the site directly west of the Burlington-Bristol Bridge consists of a

mixture of tidal emergent wetlands and nontidal wetlands consisting of former treatment lagoons, and emergent and forested wetlands. The majority of the wetland areas are zoned for manufacturing use. An undeveloped area, known as Maple Beach, is located in the southeastern section of the property. This area is primarily vacant but contains some small areas that are zoned for residential use.

Maple Beach and other portions of the Dow Chemical site are bounded by 10-ft-high levees to separate the shoreline from the remainder of the property. Federal Emergency Management Agency (FEMA) maps identify this area as being protected from the 100-year flood by levees; however, the maps also note that the levees could be overtopped by a very large flood or fail in other circumstances (Draft Bristol Township Comprehensive Plan, April 2008).

Two creeks with hydrologic connections to the Delaware River are located on-site: Otter Creek (also referred to as Mill Creek) in the east section of the property and Hog Run Creek in the southwest section of the property. Otter Creek flows for approximately 1 mile from the dam at Silver Lake; under Route 13, Otter Street, and Railroad Avenue; through the property; and into the Delaware River. The tributaries of Hog Run Creek emanate in the area between State and River Roads and join to form Hog Run Creek just north of River Road. Hog Run Creek flows southward through the property and discharges into the Delaware River.

The facility has an approximately 111-acre parcel consisting of a system of former treatment lagoons and wetlands (tidal and nontidal) located west of the Burlington-Bristol Bridge. Mitigation in this area would primarily consist of converting (enhancing) the former treatment lagoons to tidal wetlands. The bottom of these lagoons is at elevations close to the upper tidal range of the Delaware River. Enhancement of these wetlands would involve breaching the dikes and excavation to appropriate depths, a potential low-cost solution given existing elevations. However, a portion of the levee protecting the facility from the 100-year flood would need to be relocated.

3.1.3.2 Availability

The property has sufficient undeveloped land to satisfy all mitigation needs for the Southport project; however, the areas adjacent to Hog Run contain closed landfills on both sides and are

not considered suitable for mitigation. Additionally, a portion of the levee protecting the facility from the 100-year flood would need to be relocated. Because of the need to reconstruct new levees, and the potential for encountering additional site contamination during excavation, DGS and PRPA will pursue satisfying mitigation needs at another location, or locations, where there is less risk.

3.1.4 The U.S. Steel Property

3.1.4.1 Site Description

U.S. Steel owns property along the Delaware River in Falls Township and seeks to sell it (Keystone Industrial Port Complex; KIPC). This includes significant areas of undeveloped property adjacent to the Delaware River. Much of the shoreline is forested and appears to be forested wetlands. There are also unknown environmental concerns associated with portions of the property.

3.1.4.2 Availability

The KIPC has sufficient undeveloped land to potentially satisfy most of the mitigation needs for the Southport project inclusive of wetland enhancement, tidal marsh construction, and other required mitigation. Based on unknown environmental concerns and the time it would take to fully investigate for suitable mitigation site(s), this property was eliminated from further consideration. Therefore, DGS and PRPA will not pursue implementing the Southport project mitigation at the U.S. Steel site.

3.1.5 Neshaminy State Park and Jack's Marina—Preferred Mitigation Sites

While some mitigation is proposed at the Southport project site (refer to Sections 5 and 7), the preferred site(s) for the implementation of the majority of the mitigation components consists of sections of NSP and an adjacent former (now abandoned) marina referred to as Jack's Marina (JM; Figure 3). As presented in this report, these sites in combination have adequate available locations to implement mitigation to compensate for all of the impacts to wetlands, waters, and sensitive habitats and species from the Southport project.

3.1.5.1 Neshaminy State Park Site Description

NSP is located on both sides of Neshaminy Creek adjacent to the Delaware River, and is referred to in this document as Neshaminy State Park (NSP)-West and NSP-East. NSP-West is bounded to the north by State Road, to the south by the Delaware River, to the west by Dunks Ferry Road, and to the east by Neshaminy Creek. NSP-East is bounded to the north by River Road, to the south by the Delaware River, to the west by Neshaminy Creek, and to the east by a residential area along Minot Avenue. In its entirety, NSP measures 339 acres and contains two picnic pavilions, two swimming pools, a river walk trail, and several fishing locations. Boating access to the Delaware River is provided at the marina, located in NSP-East and managed by a concessionary under an agreement with the DCNR.

3.1.5.2 Jack's Marina Site Description

JM abuts NSP along the east bank of Neshaminy Creek. It is the former site of a boat yard and marina, which was locally referred to as Jack's Marina. JM is a 34-acre parcel that consists of a mixture of land types, including disturbed uplands, tidal wetlands, and open water. State-listed species, several species of vegetation and redbelly turtle, are found on the site.

3.1.5.3 Availability

The NSP and adjacent JM parcel have sufficient undeveloped land to potentially satisfy all mitigation needs for the Southport project. Since the site encompasses part of the freshwater intertidal zone along the shores of the Delaware River and Neshaminy Creek, mitigation methods shall include establishment (creation), restoration, enhancement, and preservation of wetlands and shallow water areas that are tidally connected to these water bodies. Implementing at least a portion of the required mitigation at the NSP for the Southport project is a value-added investment for the Commonwealth. The use of Commonwealth-owned lands requires no acquisition costs and yields direct benefits to natural resources that are already owned and controlled by the Commonwealth. However, inclusion of the JM site is required to satisfy all of the mitigation requirements for the Southport project.

4. EXISTING CONDITIONS AT MITIGATION SITES

4.1 NESHAMINY STATE PARK

NSP is located on both sides of Neshaminy Creek at the confluence of the creek and the Delaware River, and is referred to in this document as NSP-West and NSP-East. The larger of the two areas, NSP-West, is located in the Town of Bensalem (Bucks County); and NSP-East is located in the Town of Bristol (Bucks County). The following provides general information on NSP, relying in large part on the *Neshaminy State Park Natural Resource Management Plan* (DCNR, 2003) and supplemental data provided by DCNR. More-detailed information regarding areas of proposed mitigation is presented in Section 7 of this report. For selected mitigation areas additional data on natural resources are being collected or proposed for this summer and include the following:

- Phase I Environmental Site Assessment.
- Topographic and bathymetric survey.
- Wetland delineation.
- Vegetation characterization, including RTE surveys.
- Herpetile (reptile and amphibian) surveys.
- Soil characterization.
- Aquatic surveys (fish and benthic and SAV).
- Cultural resource survey.
- Coordinate with federal and state resource agencies to obtain site-specific supporting data.

Information obtained from these will be used to develop detailed, comprehensive mitigation plans.

4.1.1 Surface Water and Site Drainage

Located within the Delaware River watershed, NSP-West and NSP-East are divided by Neshaminy Creek, which emanates in Montgomery County and flows for approximately 50

miles in a southeasterly direction through Montgomery and Bucks Counties to its confluence with the Delaware River, where NSP is located. While NSP-East contains a marina basin, NSP does not contain any isolated bodies of water.

4.1.2 Soils

NSP exists within the Lansdale - Lawrenceville soil association, which contains the most widely distributed soils. Much of the park was covered by dredged material, up to 38 ft deep in some areas, which makes identification of the original soil impractical. This soil is generally alkaline and low in fertility.

Minor soils in the park are Alton, Lawrenceville, Pope, Marsh, and Urban. The Urban and Marsh soils are concentrated along the river and creek. Virtually none of the soils in the park are residual, but have been deposited either artificially or are alluvial in origin. The alluvial soils are all moderately to well-drained, except for the Marsh, and moderately to very fertile. These soils texturally are gravely to silt loams. The Urban soils are low to infertile and contain a high percentage of sand and gravel.

4.1.2.1 Observed Soils

4.1.2.2 Soil Factory

The Neshaminy Soil Factory Project occurred between 1981 and 1994, during which time a 5- to 10-acre site within the NSP served as an experimental and monitoring stage with the Philadelphia Water Department. The NSP marina basin was dredged in 1981 and 1987. Under permits from the Department of Environmental Resources (DER), infertile hydraulic dredge spoil and sludge, a by-product of wastewater management, were combined to produce well-draining, high-fertility topsoil for use in landscaping the nonproductive areas of Neshaminy.

Dredged material areas have been colonized naturally and consist of combinations of old fields and early succession wooded areas, located on established soils, undergoing natural succession. Topsoil produced in the park's "Soil Factory" project is landscaped on top of portions of this starved soil and then planted with warm-season grasses.

4.1.3 Wetlands

The wetlands at Neshaminy consist of tidal mudflats and a small wooded swamp along the creek, and beach and tidal pools along the Delaware River. These areas comprise less than 10% of the park. The mudflats contain eight plant species of special concern, three of which are endangered: swamp beggar ticks, an arrowhead, and subulate arrowhead. The most common species on the mudflats are spatterdock and *Sagittaria latifolia* arrowhead (DCNR, 2003).

The tidal pools contain predominantly Indian wild rice *(Zizania aquatica*), which is also a species of special concern, pitcherweed, and some spatterdock. The wooded swamp contains predominantly ash and tulip poplar.

4.1.3.1 Tidal Freshwater Wetlands

The wild rice - water-hemp tidal marsh community was inventoried by Morris Arboretum during field work conducted in June 2002. Mitigation activities have been potentially identified for portions of this community, which has the following distinct subtypes:

- **Low Marsh -** The low riverbank tidal marsh is nearest to the water and regularly inundated at high tide. The dominant plant is spatterdock (*Nuphar lutea*), which forms a canopy under which subulate arrowhead (*Sagittaria subulata*) forms a carpet. Other plants that may be present include long-lobed arrowhead (*Sagittaria calycina*), multi-flowered mud-plantain (*Heteranthera multiflora*), marsh purslane (*Ludwigia palustris*), chairmaker's rush (*Schoenoplectus pungens*), smartweed (*Polygonum punctatum*), Smith's bulrush (*Schoenoplectus smithii*), dwarf spike-rush (*Eleocharis parvula*), spike-rush (*Eleocharis obtusa var. peasii*), and at the upper edge, swamp beggar-ticks (*Bidens bidentoides*), showy beggar-ticks (*Bidens laevis*), water-hemp ragwort (*Amaranthus cannabinus*), and wild rice (*Zizania aquatica*). A nonnative invasive species, Chinese lobelia (*Lobelia chinensis*), which was first identified at NSP in 1985, is present in some areas.

- **High Marsh -** At a higher position on the riverbank, in more-or-less level areas that are inundated only at times of higher than usual tides, a more robust community of marsh vegetation exists. Sweet-flag (*Acorus calamus*), a nonnative plant, is a prominent component. Growing with it are water-hemp ragweed (*Amaranthus cannabinus*), wild rice (*Zizania aquatica*), rice cutgrass (*Leersia oryzoides*), purple-stem aster (*Aster puniceus*), wingstem (*Verbesina alternifolia*), jewelweed (*Impatiens capensis*), mad-dog skullcap (*Scutellaria lateriflora*), monkey-flower (*Mimulus ringens*), smartweed (*Polygonum punctatum*), cattail (*Typha latifolia*), false nettle (*Boehmeria cylindrica*), climbing hempweed (*Mikania scandens*), tearthumb (*Polygonum arifolium and P. sagittatum*), and arrowhead (*Sagittaria latifolia*). Other

invasive species present include reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), and common reed (*Phragmites australis*). A signficant area (>2 acres) dominated by a monotypic stand of common reed is located in the northeast corner of NSP-East south of State Road.

4.1.4 Upland Habitat and Vegetation

4.1.4.1 Wooded Habitat

Most of the forested areas have been cleared, at least once, since the 1600s for agriculture or building purposes. The least disturbed area is a narrow strip of hardwoods lining the mouth of Neshaminy Creek. This area is dominated by ash, hickory, and tulip poplar. As a result of the agricultural use and the filling of marshland with hydrophylic spoil, over 40% of the park's 330 acres are composed of old or natural vegetation fields in various stages of succession. Invasive species such as mile-a-minute and common reed are causing increasing problems to manage for native species in these areas. The forested acres consist of second- and third-growth hardwoods and conifer plantations.

Approximately 123 acres of the park is forested; however, much of tree-dominated acres occur in small acreage tracts. Approximately 65 acres of this area is in the mixed oak, consisting of red oak, white oak, tulip poplar, white ash, and hickory. The understory is very limited and composed mostly of grape vines.

As a result of the disruption from the reception of dredge spoil, about 11% of the park consists of pioneer species such as river birch, speckled alder, locust, and sweetgum. The soil in this area consists primarily of sand with high alkalinity and little organic matter.

NSP has two small, white pine plantations that were planted in the mid-1900s when the land was maintained by the Department of Forest and Waters. One plantation is in a section along the pool complex and the other is located at the intersections of Logan Walk and River Walk Trail.

Mitigation activities have been potentially identified for portions of the silver maple floodplain forest, which forms a band along the NSP-West's river bank and continues through the park to the north, just above the band of tidal marsh. Silver maple (*Acer saccharinum*) and box-elder (*Acer negundo*) are the most prominent species; other trees include American ash (*Fraxinus*

americana), American elm (*Ulmus americana*), and river birch (*Betula nigra*). Shrubs include arrowwood (*Viburnum recognitum*) and silky dogwood (*Cornus amomum*).

4.1.4.2 Upland Fields

The fields at Neshaminy fall into two distinct categories: successional old fields, located on established soils, undergoing natural succession and dredge spoil areas being colonized by natural vegetation. Old fields are present along State Road west of the Neshaminy Creek. Portions of these areas are maintained by regular mowing; in other areas groves of trees are invading including sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and black locust (*Robinia pseudoacacia*). The rare wild bean (*Strophostyles umbellata*) grows along the edges of the fields in areas that do not receive excessive mowing. Spoil areas are composed primarily of lichens, grasses, goldenrod, horseweed, and sweet everlasting. Topsoil produced in the park's "Soil Factory" project (see Subsection 4.1.2.2) is being landscaped on top of portions of this starved soil and then planted with warm-season grasses.

Mitigation activities have been potentially identified for a portion of the dredge spoil deposition area located on the peninsula of NSP-West. This area is primarily sandy and open with very sparse vegetation. Scattered trees, mostly willow oak (*Quercus phellos*) are present and herbaceous species include purple sandgrass (*Triplasis purpurea*), a state rarity. Common reed (*Phragmites australis*) has invaded the lower, moister portions.

About 10 acres of the park are barren. Approximately 8 acres of the barren areas is in a sand pit that was used to provide sand for the construction of I-95. The remaining 2 acres are composed of sand dunes along the Neshaminy Creek.

The remaining vegetative areas of the park are turf, which comprise approximately 52 acres of the park. All areas are mowed regularly. The main ground cover in these areas consists of Kentucky blue grass, tall fescue, and perennial ryegrass.

4.1.5 Sensitive Species and Habitat

As of August 2003, there were no federally endangered species and 19 state species of special concern found inside NSP (Table 2). All of the species were found to grow on the tidal mudflats

lining both sides of the mouth of the Neshaminy Creek, the Delaware River bank between the public boat launch and the marina basin and the riverbank on the main park side. Table 3 lists invasive plant species that were identified in August 2003, and remain on-site today.

Table 2 Plant Species of Special Concern

Common Name	Scientific Name	Pennsylvania Status	PA Biological Survey
Water-hemp ragweed	*Amaranthus cannabinus*	PR	PR
Bushy bluestem	*Andropogon glomeratus*	TU	PR
Swamp beggar-ticks	*Bidens bidentoides*	PT	PE
Beggar-ticks	*Bidens laevis*	N	TU
Smartweed dodder	*Cuscuta polygonorum*	TU	TU
Walter's barnyard-grass	*Echinochloa walteri*	PE	PE
Little-spike spike-rush	*Eleocharis parvula*	PE	PE
A eupatorium	*Eupatorium rotundifolium*	TU	UTF
Multiflowered mud-plantain	*Heteranthera multiflora*	PE	PE
American holly	*Ilex opaca*	PT	PT
Eastern jointweed	*Polygonella articulata*	TU	PE
Willow oak	*Quercus phellos*	PE	PE
Long-lobed arrowhead	*Sagittaria calycina var spongiosa*	PE	PE
Subulate arrowhead	*Sagittaria subulata*	PR	PR
River bulrush	Schoenoplectus fluvuiatilis	PR	PR
Smith's bulrush	Schoenoplectus smithii	PE	PE
Wild bean	*Strophostyles umbellata*	N	PE
Purple sandgrass	*Triplasis purpurea*	PE	PE
Indian wild rice	*Zizania aquatica*	PR	PR

Note: This list of plant species of special concern is slightly different than the 2002 list provided by Morris Arboretum; this list includes the additions of beggar-ticks, river bulrush, and smith's bulrush; this list does not include bugleweed (*Polygonella articulate*).

Table 3 Invasive Plant Species

Common Name	Scientific Name
Garlic mustard	*Alliaria petiolata*
Purple loosestrife	*Lythrum salicaria*
Common reed	*Phragmites australis*
Japanese knotweed	*Polygonum cuspidatum*
Mile-a-minute	*Polygonum perfoliatum*

4.1.6 Cultural Resources

There are four historic structures/sites located within the boundaries of the NSP, the Dunks Ferry Inn, a barn (burned in an arson fire in 1991), and a tack room and greenhouse/apartment left from the Robert R. Logan Estate (DCNR, 2003). The Lenni-Lennape Indians (Neshaminee Indians) used the area of the park located near the mouth of the Neshaminy Creek; this area may also have included a village.

4.2 JACK'S MARINA

The JM site consists of approximately 34 acres of land situated on the site of a former private marina (Figure 3). The site is located approximately 2,000 ft north of the confluence of the Delaware River with Neshaminy Creek. Located entirely within Bristol Township (Bucks County), JM directly abuts the NSP-East and is located directly across Neshaminy Creek from NSP-West. The site is bounded to the north and east by residential development. The property includes two dredged boat launching and docking lagoons. A large elongated inlet at the south end (Southern Inlet) of the site formerly contained docking, fueling, and restaurant facilities; and a smaller rectangular inlet at the north end (Northern Inlet) was used primarily for boat launching and servicing. The remainder of the ground contained various buildings and large areas that were used for outside boat storage. A large, tidally influenced wetland/marsh exists between the two inlets.

4.2.1 Surface Water and Site Drainage

JM is located in the Delaware River Watershed and drains entirely to the west into Neshaminy Creek. While the site contains two boat launching and docking lagoons, it does not contain any isolated bodies of water.

4.2.2 Soils

JM contains three types of soils, based upon the three distinct areas present on-site. The site's upland area, which was previously used for the marina support structures, contains Urban land-Matapeake complex soils (NRCS, 2008). Urban Land is land covered by streets, parking lots, buildings, and other structures that obscure the soils. Matapeake soils are yellowish brown silt

loams underlain by gravelly loamy to coarse sands that are dark yellowish brown. Urban Land has rapid runoff rates due to highly impermeable surfaces and low levels of erosion (NRCS 1996). The tidal wetland area contains Nanticoke-Hatboro silt loams (NRCS, 2008), which are very deep, very poorly drained soils within floodplains of tidally influenced rivers and creeks in the Mid-Atlantic coastal plain. They form in freshwater estuarine marshes and depressions (NRCS, 2002). Lastly, the peninsula of upland area located to the north of the Southern Inlet contains Udorthents, gravelly soils (NRCS, 2008), which are deep and very deep, moderately well to somewhat excessively drained soils in the Mid-Atlantic northern coastal plain. They formed within nearly level to gently sloping broad flats and terraces. This soil consists of areas that have been cut and filled during grading for roads, railroads, building site developments, recreation areas, and other similar uses and now have been converted to lawns, playgrounds, or sedimentation basins for aesthetic, recreational, or stormwater control uses adjacent to large urban areas (NRCS, 2002).

4.2.3 Tidal Freshwater Wetlands

The JM site contains large areas subject to tidal flow, including Neshaminy Creek and two lagoons cut out of the land immediately adjacent to Neshaminy Creek. A 12.4-acre tidal wetland exists in the center of the site and extends to the creek bank. It is complex and likely has a long history of disturbance. Rocks line the edge of the marsh along Neshaminy Creek, and three channels cutting through the rocks into the marsh behind. The tidal marsh contains the following three intergrading communities:

- A high-energy intertidal zone along the creek with spatterdock (*Nuphar lutea*) and *Sagittaria spp*.,
- An arc of *Nuphar* toward the inner edges, and
- A more diverse core of *Nuphar* mixed with sweet flag, jewelweed, clearweed, bur-reed, *Polygonum spp*., purple loosestrife, and many other species, often knit together by climbing hempweed.

The shoreline of both lagoons contains eroded banks with some concrete and/or wooden bulkheads on all sides. In November 2007, bathymetric soundings in the northern lagoon recorded average depths of between 4 and 5 ft, while recorded depths in the center of the

southern lagoon ranged between 4 and 8 ft (Hudson, 2007). Turbid conditions during WESTON's recent site visits have prevented the observation of any SAV that may be present within the lagoon areas; however, many pilings in both lagoons were observed.

4.2.4 Upland Areas

Upland areas are present around the perimeter of the JM site. The southern inlet formerly contained docking, fueling, and restaurant facilities; and the northern inlet was used primarily for boat launching and servicing. The remainder of the ground contained various buildings and large areas were used for outside boat storage. To date, most of the buildings and structures have been demolished; however, some demolition debris, vandalized boats, and pavilion-type structures remain on the property.

The ground is primarily bituminous pavement and gravelly type soils that are laden with weedy growth. Black willow, box elder, indigo bush, and Japanese knotweed shade many of the upland banks. Common herbaceous species in upland areas also include Canada goldenrod, heath aster, horseweed, evening primrose, and purple loosestrife. Massive mounds of Japanese hops cover large stretches of the southern inlet, and mile-a-minute weed is frequent. The eastern edge of the property contains a wooded buffer of mostly maple, ash, and mulberry trees and poison ivy.

4.2.5 Sensitive Species and Habitat

Through the PNDI review process conducted in August 2005, and more recently in March 2010, several federal and state-listed threatened and endangered species and species of special concern have been identified as potentially existing in the vicinity of the JM site.

DCNR determined activities on the JM site may pose impacts to 1 threatened, 11 endangered, and 10 species of special concern (Table 4), and 2 resources of special concern: freshwater intertidal mudflat and wild rice – water-hemp tidal marsh. The redbelly turtle [*Pseudemys rubriventris* (threatened)] was identified by the PFBC. During the August 2005 review, one federally managed species, the endangered shortnose sturgeon (*Acipenser brevirostrum*), was identified as having the potential to be impacted.

Table 4 Plant Species of Special Concern Identified for the Jack's Marina Site

Common Name	Scientific Name	Pennsylvania Status
Water-hemp ragweed *	*Amaranthus cannabinus*	Special Concern
Bushy bluestem	*Andropogon glomeratus*	Special Concern
Swamp beggar-ticks	*Bidens bidentoides*	Threatened
Beggar-ticks	*Bidens laevis*	Special Concern
Dodder *	*Cuscuta campestris*	Special Concern
Smartweed dodder	*Cuscuta polygonorum*	Special Concern
Walter's barnyard-grass *	*Echinochloa walteri*	Endangered
Wrights Spike Rush *	*Eleocharis obtusa*	Endangered
Little-spike spike-rush *	*Eleocharis parvula*	Endangered
Multiflowered mud-plantain *	*Heteranthera multiflora*	Endangered
American holly	*Ilex opaca*	Threatened
Bugleweed*	*Lycopus rubellus*	Endangered
Eastern jointweed	*Polygonella articulata*	Special Concern
Common Hop-tree	*Ptelea trifoliate*	Threatened
Willow oak	*Quercus phellos*	Endangered
Long-lobed arrowhead	*Sagittaria calycina var spongiosa*	Endangered
Subulate arrowhead *	*Sagittaria subulata*	Special Concern
River bulrush *	*Schoenoplectus fluvuiatilis*	Special Concern
Smith's bulrush *	*Schoenoplectus smithii*	Endangered
Wild bean	*Strophostyles umbellata*	Special Concern
Purple sandgrass	*Triplasis purpurea*	Endangered
Indian wild rice*	*Zizania aquatica*	Special concern

* Species observed on-site during 2006 botanical survey (botanical survey).

4.2.6 Cultural Resources

In a letter dated June 2006, the Pennsylvania Historical and Museum Commission (PHMC), Bureau of Historic Preservation found that the intensive development project proposed at that time for the JM site would have no impact on cultural resources; although, in an October 2003 letter, PHMC did indicate that while there were no recorded archaeological sites within the project boundaries, the soil type, topographic setting, slope direction, and distance to water of the

project area are similar to the settings of known archaeological sites in the vicinity. A Phase I archaeological survey was recommended, but not required.

4.2.7 Potential Hazardous Materials

A Phase I/Environmental Condition of Property (ECP), initially conducted for the JM site in March 1999, revealed no evidence of recognized environmental conditions in connection with the property; however, the report did recommend that on-site 500-gallon underground storage tanks (USTs) containing heating fuel oil be tested for potential leaks. Two USTs were tested for leaks in December 2002 and were found to not be leaking. Additionally, a second Phase I/ECP was conducted in December 2002 and resulted in the same findings. Backhoe excavations in the area investigated did not reveal any indication of buried drums containing petroleum products. Soil sample results confirmed that soils do not exceed the PADEP medium-specific concentrations for either direct contact or soil to groundwater limits for total lead.

Despite 2002 findings, a 2005 update to the Phase I/ECP report indicates that petroleum-contaminated groundwater was found near the USTs. In April 2006, two USTs and one aboveground storage tank (AST) were removed. Soil and groundwater issues were documented after UST and AST removals, which led to remedial actions. In April 2009, PADEP agreed that four consecutive quarterly sampling events for benzene, toluene, ethylbenzene, xylene, cumene, naphthalene, and methyl tert-butyl ether (MTBE), conducted between February 2008 and November 2008 in monitoring wells, were adequate to characterize recent groundwater quality and demonstrate the attainment of cleanup standard in groundwater at the JM site.

5. CREDIT DETERMINATION METHODOLOGY

Pursuant to federal and state regulatory programs and policies, for the Southport project compensatory mitigation is required to offset unavoidable impacts to wetlands and other waters, as well as documented sensitive species and habitats. A mitigation plan to compensate for the loss of wetlands, waters, and sensitive habitats is a required component of the Southport project's JPA. The determination of impacted resources requiring mitigation was made following significant efforts to avoid and minimize impacts to wetlands and other waters (refer to Subsection 1.4) and through discussions with regulatory and resource agencies. A summary of these impacts and the results of these discussions are presented in Subsection 2.5. Table 1 provides a list of the impacted resources and acreage or other features (e.g., state-listed plant species) requiring mitigation.

Based on preliminary discussions with federal and state regulatory and resource agencies, compensatory mitigation ratios (replacement to loss) for impacts to designated wetland/water areas and sensitive terrestrial resources have been initially determined and are discussed in detail in Subsection 2.5. Table 1 identifies the impacts requiring mitigation and proposed mitigation types, ratios, size, and location of proposed mitigation by site. Figures 3 through 6 present the locations and conceptual grading plans for proposed mitigation. More-detailed presentations of mitigation at the selected sites are presented in Section 7.

Note that mitigation for impacts to terrestrial resources and threatened and endangered species would be incorporated into the mitigation plan through agency coordination. This can include mitigation for impacts to state-listed plant species, and redbelly turtle habitat as applicable.

Credits for enhancement of existing habitats (intertidal wetlands, subtidal/deep water, and uplands) is proposed at a 3:1 ratio due to the value derived from implementing the proposed enhancements in areas adjacent to sensitive habitats and resources. Mitigation credit for the preservation of a large (>12 acre) intertidal wetland system at the JM site, which provides habitat for several state-listed plant species, is proposed at a 4:1 ratio. This is due to the proposed purchase of the JM property, implementation of site-wide mitigation, and transfer of the property to the DCNR for incorporation into NSP. Prior to the downturn in housing market conditions, JM

was planning to construct a townhouse community with an associated marina. If not purchased by the Commonwealth there is a high probability of the site being developed, which would result in the reduction of its ecological value, including the loss of adjacent, undeveloped (but disturbed) upland buffer areas and related impacts to intertidal wetlands and associated, undeveloped areas.

The determination of mitigation requirements and credits for impacts to 1.08 acres of SAV at the Southport project site will be made after an assessment of SAV found adjacent to NSP in the Delaware River and a determination of whether those conditions can be reproduced at the JM site. A mitigation ratio of 3:1 is initially proposed, with the potential for establishment of SAV in JM's existing lagoon areas. An alternative would be to evaluate the potential to expand areas of existing SAV in the Delaware River. The lack of SAV mitigation or restoration projects in the Delaware River presents one of the first opportunities to mitigate for the loss of SAV.

Proposed mitigation at the Southport site consists of relocating the existing tidal stormwater channel to a location parallel to the existing footprint. Similar habitat would be provided to compensate for this loss. The wharf along the northern and eastern edge of the project footprint is proposed to be placed on pilings, providing open-water habitat under the wharves. The open-water area under the wharves would total approximately 5.7 acres. This area exceeds the 3.62 acres of deep water (deeper than -9.75 ft NAVD88) impacted from a combination of dredge and fill activities within the Southport project footprint (Figures 1 and 2) and is considered compensation for impacts to this regulated area.

6. SITE PROTECTION INSTRUMENTS (e.g., CONSERVATION EASEMENTS)

Act 18 of 1995 states in part that the mission of the Bureau of State Parks is as follows:

- To supervise, maintain, improve, regulate, police, and preserve all parks belonging to the Commonwealth.

- For the purpose of promoting healthful outdoor recreation and education, and making available for such use natural areas of unusual scenic beauty or other unique and interesting features, to acquire in the name of the Commonwealth by purchase, gift, lease, or condemnation any lands which, in the judgment of the department, should be held, controlled, protected, maintained, and utilized as state park lands. Such lands may be purchased or accepted, subject to the conditions of any such lease and subject to such reservations, if any, of mineral rights, rights-of-way, or other encumbrances as the Department may deem not inconsistent with such holdings: provided, however, that the amount expended for the acquisition of lands for state park purposes shall not exceed the amount specifically appropriated for such purposes.

- To see that conveniences and facilities for the transportation, shelter, comfort, and education of people shall be so designed and constructed as to retain, so far as may be, the naturalistic appearance of state park areas, surroundings, and approaches, and conceal the hand of man as ordinarily visible in urban, industrial, and commercial activities.

On 17 February 1992, the Bureau of State Parks released *State Parks 2000*, which gave the Bureau directions for the next century. In this report, the Park Mission was simplified and reaffirmed; it states:

> *The primary purpose of state parks is to provide opportunities for enjoying healthful outdoor recreation and to serve as outdoor classrooms for environmental education. In meeting these purposes, the conservation of the natural, scenic, aesthetic, and historical values of the parks should be given first consideration. Stewardship responsibilities should be carried out in a way that protects the natural outdoor experience for the enjoyment of current and future generations.*

NSP fulfills this mission.

Compensatory mitigation implemented within the boundaries of NSP would be approved by, and coordinated with, park management; however, mitigation would not require the use of park resources. Once mitigation activities are complete, DGS and PRPA would be responsible for ongoing monitoring of mitigation areas (see Section 10); however, park staff, as is currently

included in their responsibilities, would be accountable for protecting and managing the day-to-day park operations among the mitigation areas.

Compensatory mitigation would be implemented at the JM site following DGS acquisition of the property. Once all components of mitigation are complete on the parcel, the land would be transferred to DCNR for incorporation into NSP, to be managed and maintained as parkland. Similar to the mitigation implemented within the current boundaries of NSP, DGS and PRPA would be responsible for ongoing monitoring and maintenance of mitigation areas on the JM parcel (see Section 10); however, park staff would be accountable for protecting and managing the day-to-day park operations among the mitigation areas following its Resource Management Plan and permit conditions.

7. MITIGATION WORK PLAN

The following summarizes the proposed mitigation design and assumptions. Refer to the conceptual mitigation plan drawings and details in Figures 3 through 6. This includes existing and proposed design grades.

There have been multiple site visits, conference calls, and requests for input from regulator and resource agencies related to determining acceptable forms of mitigation at the selected mitigation sites and mitigation commensurate with the unavoidable impacts to wetlands and other waters, as well as other sensitive resources.

The following includes general information used to develop the proposed mitigation plan:

- Intertidal area mitigation should focus on low marsh/mudflat elevations to exclude common reed.
- Channels connecting mitigation areas to rivers should always have standing water; therefore, excavate to depths approximately 1.5 to 2 ft below MLW.
- Threatened and endangered plants and redbelly turtle habitat is provided by some of the proposed mitigation areas. PFBC and DCNR have both approved mitigation plans for a proposed development at the JM site, and would be considered in the development of the mitigation design.
- Wetland to upland transitions – minimize elevations where common reed would establish. Retention of trees in wooded areas adjacent to mitigation areas provides shading that helps to control common reed along the edges of mitigation sites.
- If clean, material to be excavated may have a variety of uses, including the following:
  - Enhance area at NSP referred to as the “soil factory,”
  - Local projects might have use for some material, and
  - Construction rubble (concrete) can potentially be used to stabilize eroding shorelines at NSP-West.
- Tide Elevations
  - MHW – 3.96 ft (NAVD 88); 5.03 ft (NGVD 29)
  - MLW – -2.29 ft (NAVD 88); -1.22 ft (NGVD 29)

The proposed mitigation for each area is discussed in detail below.

7.1 NESHAMINY STATE PARK

7.1.1 Area A – Wetland Enhancement – Intertidal Wetland

Within this area is approximately 2.4 acres of intertidal area dominated by common reed. Eradication of common reed from this area would be achieved through excavation to depths approximately 1 ft lower in elevation to provide habitat for more desirable intertidal species in adjacent intertidal wetlands. It is proposed to allow the enhancement footprint to revegetate naturally from seed and vegetative growth from plants in adjacent intertidal wetlands.

7.1.2 Area B Creation – Nontidal Wetland Mitigation

This mitigation location consists of an upland area recently cleared of invasive woody species. Some adjacent areas still have invasive woody species, including tree of heaven. The cleared area and some adjacent areas with invasive trees would be excavated to depths designed to intercept groundwater, connect with the mapped wetland to the south, and provide for some tidal exchange with Neshaminy Creek. The adjacent wetland has a tidal connection to Neshaminy Creek via a culvert, which is located under the trail that is parallel to the river. Portions of the wetland flood during high tide and drain with each tidal cycle.

The proposed mitigation would include the removal of the culvert and part of the trail to promote greater tidal exchange of the wetland area, and include flooding and flushing of the mitigation wetland footprint. A footbridge would be constructed across the new channel to maintain the river walk. Figure 4 provides details of the proposed mitigation for Area B.

A planting plan would be developed based on the observed species in the adjacent wetland area. The wetland to upland transition zone would be planted with a species mix (herbaceous and woody) that provides some level of control of invasive and undesirable plant species (e.g., common reed, Asiatic tearthumb, and stiltgrass). A component of the mitigation plan would be monitoring and maintenance to control vegetation.

7.1.3 Area C Creation – Intertidal Wetland Construction

This mitigation location is a former dredged material disposal area (berms are still present). An isolated freshwater wetland (dominated by woody species – river birch) is located in a depression at southwest end of the mitigation footprint. Invasive species (black locust, tree of heaven, common reed, and stiltgrass) are present in most of the proposed mitigation footprint. Note that the site elevation increases from west to east.

The goal is to excavate to elevations that are suitable for the establishment of intertidal and subtidal habitats. The area would connect via a channel to the Delaware River. The channel and inlet would be designed to avoid shoaling and erosion. A footbridge would be constructed across the new channel to maintain the river walk. Figure 5 provides details of the proposed mitigation for Area C. It is proposed to allow the intertidal footprint to revegetate naturally from seed and vegetative growth from plants in adjacent intertidal wetlands. The wetland to upland transition zone would be planted with a species mix (herbaceous and woody) designed to provide some level of control of invasive and undesirable plant species (e.g., common reed, Asiatic tearthumb, and stiltgrass). A component of the mitigation plan would be monitoring and maintenance to control vegetation.

7.1.4 Additional Mitigation Options for NSP

Additional mitigation at NSP under consideration includes the following:

- Immediately southwest of Area A is an approximately 4-acre sand area. This area contains documented state-listed plant species and turtle nesting. Common reed is present in this area, though relatively sparse. Mitigation would consist of implementing an invasive species control program.

- North of Area C is an open field commonly called the “soil factory” (see Subsection 4.1.2.2). The plant species composition includes invasive species and a planted species mix to stabilize the soils. NSP and DCNR would like to restore this area to a more desirable vegetative community. Excavated soils from the mitigation areas could be placed in these areas and planted with a native woody and herbaceous species mix to create a more desirable upland vegetation community.

7.2 JACK'S MARINA (AREA D MITIGATION) – INTERTIDAL/SUBTIDAL CONSTRUCTION, ENHANCEMENT, AND PRESERVATION, AND UPLAND ENHANCEMENT

A variety of mitigation alternatives are presented based on discussions and site visits with regulatory and resource agency staff. Some general considerations follow. More details for specific locations within JM are then presented. Figure 6 presents a plan view of the mitigation areas.

- Construct intertidal wetlands on existing upland paved areas where feasible.
- Remove the stormwater culvert discharging at the eastern edge of the intertidal wetland area would improve tidal flow in this area. The potential for culvert removal resulting in increased tidal flows into upgradient areas and flooding adjacent property owners needs to be evaluated.
- Lagoon areas – Determine if these areas are suitable for the establishment of SAV. Explore nearby areas for SAV and determine if SAV habitat characteristics exist. Potentially utilize fill material stockpiled along the north side of southern lagoon to raise elevations if needed.
- Keep the river shoreline stabilized to retain site structure and consider adding concrete/armoring as appropriate. Break up concrete slabs already in place along shoreline. Concrete slabs in other portions of site can be used to stabilize areas, including the park shoreline along the east side of Neshaminy Creek and the Delaware River (see below).
- A forested wetland is present on the NSP property, adjacent to the south boundary of JM. The wetland has no apparent outlet (depression system with an assumed perched water table); therefore, to avoid draining the wetland, maintain an upland berm/buffer between any intertidal wetland mitigation on the JM parcel. Can also enhance the buffer with plantings for some mitigation credit.
- Make sure that design for the intertidal and subtidal areas does not promote shoaling at entrance(s) and impact hydraulics/hydrologic conditions of wetlands/shallow water and deeper water areas.
- Threatened and endangered plants and redbelly turtle that use the site must be addressed in the mitigation plan. PFBC and DCNR have both approved mitigation plans for the formally proposed development of JM. Review and incorporate components of the approved plans into this project's proposed mitigation design.
- Significant sections of upland areas are paved/impervious surface and there is uncertainty regarding underlying substrate.

7.2.1 JACK'S MARINA MITIGATION BY AREA

- **Maintain an Upland Buffer along South Edge of JM -** There is a forested wetland on the NSP-West property adjacent to the south boundary of JM. There is no apparent outlet; therefore, to avoid draining this wetland, ensure that the mitigation plan maintains an upland "berm" on the JM parcel between the south lagoon and the wetland. Enhance the buffer with native plantings.

- **Redbelly Turtle Nesting Habitat** – Two upland islands (2 acres) would be retained to create a nesting area for redbelly turtles known to frequent the area. A natural "barrier" would be constructed at the east edge of these areas to reduce the potential for the disturbance, predation and loss of eggs of nests from fox, raccoon, and skunk.

- **Wetland Enhancement/Culvert Removal** – Removing the stormwater culvert discharging at the eastern edge of the intertidal wetland area would improve tidal flow in this area. The culvert would be removed and the area graded to maximize low marsh intertidal habitat. A footbridge or sturdier structure would potentially need to be constructed to provide for foot traffic or access for park vehicles. The potential for culvert removal resulting in increased tidal flows into upgradient areas and flooding adjacent property owners needs to be evaluated.

- **Intertidal Wetland Mitigation** – Excavate the majority of these areas to depths below 2 ft NAVD 88 and connect to existing lagoons. At the edge of the large centrally located intertidal wetland area, maintain a 5-ft contour interval. However, consider excavating to lower depths at this edge to 1) maximize the areas of intertidal wetland by excavating to 0.5 ft lower than adjacent wetland toe of slope, and 2) to minimize the inclusion and invasion of potential common reed habitat in the mitigation footprints. It is proposed to allow the intertidal footprint to revegetate naturally from seed and vegetative growth from plants in adjacent intertidal wetlands. The wetland to upland transition zone would be planted with a species mix (herbaceous and woody) designed to provide some level of control of invasive and undesirable plant species (e.g., common reed, Asiatic tearthumb, and stiltgrass). A component of the mitigation plan would be monitoring and maintenance to control vegetation.

- **Upland Restoration** – Upland areas at JM consist of highly disturbed areas characterized by impervious surfaces, construction rubble, and abandoned boats. These areas have a plant species composition characteristic of highly disturbed areas. A component of the mitigation at JM would be to restore these uplands to a more desirable mix of upland vegetation and to evaluate the use of these areas to mitigate for impacts to state-listed plant species from the Southport site.

- **Lagoon Preservation/Enhancement** – The use of the two lagoons that are present on JM to better accommodate for fish needs (yet to be assessed). Depending on the results of the fish survey, mitigation in these areas could consist of 1) preservation in its existing condition and incorporation into the overall site mitigation design or

enhanced, 2) attempt to establish SAV to compensate for the loss of SAV areas from the Southport project, and 3) raise the elevation of a portion of both lagoons (perhaps utilizing excavated fill material from on-site) to increase the areas of intertidal habitat.

- **Intertidal Wetland Preservation** – An approximate 12-acre, centrally located intertidal marsh exists on JM property. It is characterized by a diverse, native intertidal marsh community, including several state-listed species. Invasive species (common reed and purple loosestrife) area present in this area and could be removed as a part of the mitigation. The value of this intertidal wetland would be enhanced by removing JM from potential future development and implementing mitigation in adjacent areas to provide habitat diversity and protection of this sensitive area.

- **Other Mitigation Considerations at JM** – Uplands within the mitigation areas can include public trails, observation points, and interpretive signs.

- **Shoreline Restoration – Park Shoreline east side of Neshaminy Creek** – There is significant erosion of the NSP-West shoreline at the mouth of Neshaminy Creek and along the Delaware River. The potential exists to use construction rubble (concrete) generated from mitigation activities to stabilize some of these eroding areas.

8. MAINTENANCE PLAN

Maintenance is the work needed to keep the mitigation site in the condition designated in the approved as-built construction plans and specifications. Monitoring and maintenance of the mitigation area for a minimum of 5 years following the completion of mitigation is required for ensuring mitigation performance. An adaptive management approach should be undertaken to achieve the restoration goals and objectives.

It is anticipated that maintenance plans would be developed and implemented in three phases. First, the as-built construction plans and specifications would include maintenance requirements for activities during and following construction. This includes demonstrating that the mitigation designs have been correctly implemented and sites are achieving stated goals and objectives. This could include demonstrating the stabilization of soils and sediments, achieving the appropriate grades and elevations, the establishment of appropriate water regime (tidal flows, wetland hydrologic conditions, irrigation, etc.) sustaining vegetation (planted and recruited from adjacent areas) and controlling invasive species, and sustaining fish and wildlife.

Second, the mitigation sites are owned by the Commonwealth of Pennsylvania and would be managed and maintained under the existing Resource Management Plan developed for NSP by DCNR. This includes protection of existing wetlands and other waters, sensitive habitats and species, and management of invasive species as appropriate. DGS and PRPA would be responsible for conducting and funding the maintenance and monitoring. As a steward of natural resources at NSP, DCNR would be involved in directly implementing and would actively coordinate maintenance activities at the mitigation sites as it deems appropriate.

Third, a separate maintenance plan would be prepared to address the need for continued maintenance of mitigation sites following the demonstration by the construction (including landscape contractors) contractors that the mitigation design goals and objectives for each site have been achieved, the sites stabilized, and vegetation standards met. This plan would be incorporated with the monitoring plan to ensure effective communication among the responsible parties and timely response to identified issues requiring maintenance. Examples include the following:

- **Sustaining Vegetation** – Ensure that the planted vegetation (seed, cuttings, plugs, woody planting, etc.) is surviving and, as appropriate, spreading. In areas where natural recruitment from seed and vegetation growth in adjacent similar habitats (e.g., intertidal wetlands), assess the establishment of species (diversity and cover) and need for maintenance. Examples of maintenance measures include replanting, invasive species control, irrigation, regrading soils, controlling erosion, and animal management (e.g., deer, geese, etc.).

- **Stabilizing Soils** – Ensure that soils are stabilized throughout the performance period. Maintenance of soils could be in response to unusual weather events, eroding banks, unstable soils, failing erosion and sedimentation control structures, and damage from animals and vandalism. Examples of maintenance activities include regrading and the placement of erosion control blankets, the placement of coir logs along banks of intertidal channels, placement of riprap in eroding areas, and replanting areas of exposed soils.

- **Sustaining Water Regimes** – The predicted hydrologic conditions may not be met by the implemented mitigation design or unanticipated site conditions requiring proactive maintenance. For example, unpredicted periods of excessive precipitation may require control of water flow and periods of drought may require irrigation of some areas. The timing of plant installation (e.g., early summer versus spring) may result in the need for irrigation to allow plants to survive and grow until normal precipitation patterns return. Other examples include installing riprap to stabilize inlets to intertidal wetland areas, or to stabilize eroding banks.

- **Sustaining Wildlife** – Ensure that habitats constructed for specific wildlife retain the design objectives. Habitat for select species of wildlife (e.g., redbelly turtle) may require maintenance for a number of reasons. This can include the need to control the establishment of undesirable plant species in the created habitat or the need to construct barriers to predators (e.g., fox predation of redbelly turtle nests).

The development of a maintenance plan and program to address the approved mitigation program would be an iterative process involving the site owners, regulatory and resource agencies, and contractors selected to provide maintenance and monitoring. These plans would be developed during the review and acceptance of mitigation proposed for the Southport project.

9. ECOLOGICAL PERFORMANCE STANDARDS

The ecological performance standards would be determined by the final approved permit for the Southport project, including the compensatory mitigation plan. In general, performance standards for the mitigation areas should focus on the establishment of self-producing and sustaining native vegetation communities and habitat types.

Performance standards by vegetative community and habitat type are outlined below. The final performance standard details would be developed through coordination with the regulatory and resource agencies.

- **Intertidal** – Construct functional intertidal zones that provide habitat for the diversity of intertidal plant species present in similar wetlands at both NSP and JM. (Note that most of the intertidal zone at the Southport site is unvegetated.) The selected elevations are similar to those in which the most valuable intertidal wetland communities are found at NSP and JM. To the extent possible, elevations at which common reed are found in the mitigation area would be avoided.

- **Subtidal** – Provide stabilized subtidal habitat that can be used by the fish and benthic communities present in the NSP and JP area. The establishment of SAV is a component. Potential areas to establish SAV include the existing lagoons at JM and expansion of documented SAV areas in the Delaware River. These areas of SAV will be fully characterized this summer to support the development of a SAV mitigation plan as necessary. A lack of SAV mitigation and restoration efforts in the Delaware River will necessitate close coordination with resource agencies to develop a mutually agreeable plan to compensate for impacts to SAV from the Southport project.

- **Deep Water** – The loss of deep-water habitat from the Southport project would be compensated from the available open water under the wharf area at Southport following construction. No performance standards are proposed for this habitat type.

- **Upland Buffer** – This would consist of two components. First, wooded areas with desirable, established woody species would be protected to the extent possible during implementation of mitigation. This would help to reduce the potential for the establishment of invasive species along the edges of some mitigation areas (such as common reed). Second, planting upland buffers adjacent to existing wetlands (e.g., forested wetland area adjacent to the south edge of JP) and clearings to promote the establishment of an upland buffer zone having a desired native vegetation community.

Threatened and Endangered Species Mitigation

- **Redbelly Turtle** – In addition to providing intertidal and subtidal habitat for the existing redbelly turtle population in the area, basking platforms would be installed in wetland/water areas and upland nesting areas established in the JM site. Protection or enhancement of areas at NSP suitable for turtle nesting may also a component of the mitigation. An example is the approximately 4-acre sand area located southwest of the proposed intertidal emergent wetland enhancement area.

- **Vegetation** – Suitable locations to establish habitat for state-listed species proposed to be transplanted (either by seed or vegetative propagule) exist at both NSP and JM. Transplanting into designated upland areas (threatened and endangered species at the Southport site) as well as willow oak, American Holly, and other species identified within the mitigation project footprints.

Performance standards for the mitigation areas should focus on the establishment of a self-producing and sustaining native vegetation community. For herbaceous vegetation (seed or other source), an 85% cover is a recommended goal after 5 years. For planted trees and shrubs, an 85% survival rate for planted individuals after 5 years should be a goal. Should these survival rates not be achieved, additional planting may be required to achieve the minimum percent cover. The final performance standards may vary depending on the planting design selected.

10. MONITORING

The proposed mitigation for the Southport project consists of the establishment of multiple habitat types, including the following:

- Intertidal wetland/subtidal habitat.
- Freshwater wetlands with limited tidal exchange.
- SAV habitat.
- Uplands to establish threatened and endangered plant species impacted from the Southport project.
- Redbelly turtle nesting habitat.
- Upland buffers.

The conceptual components of the proposed mitigation have been presented in this mitigation report. The final mitigation plans and design details would be determined through the permit review process. Similarly, the development of a detailed monitoring program would be determined through the permit review process. The following is an example of a monitoring program developed for an approved mitigation plan for a project in Pennsylvania involving the construction of an emergent wetland in the Susquehanna River watershed. It is presented as a point for discussion among the applicant, consultants, and regulatory and resource agencies. The final monitoring program for the Southport project would necessarily be broader and more complex given the size and diversity of the proposed mitigation for the Southport project.

10.1 SAMPLE MITIGATION MONITORING PLAN

Monitoring should consist of two components. First, regular visits (at least monthly during the first growing season following mitigation site construction) should be made to conduct qualitative assessments of the mitigation area (overall site conditions, plant survival, cover, species composition, photographic documentation). Second, quantitative assessments should be conducted toward the end of each growing season (September) at quadrats established in each habitat type, including a reference area in adjacent emergent wetlands. Each vegetation community/habitat type will be monitored to assess performance of the mitigation areas and the

need for institutional controls (e.g., management of invasive species), if necessary. Quantitative assessments will occur annually for a period of 5 years unless it can be demonstrated that the mitigation goals have been met sooner.

For years 2 through 5 qualitative site assessments should occur during the spring and early summer.

The monitoring program will focus on assessing vegetation since the emergent wetland area is assumed to have standing water or saturation to the soil surface year-round. Monitoring hydrologic conditions will consist of measuring water depth (surface water, free water and saturation in soil borings) adjacent to quadrats during site visits for quantitative monitoring. Characterization of soils is not proposed for this program.

For both qualitative and quantitative monitoring events, general observations on the mitigation and reference wetlands should be documented, and photographs taken at permanent stations and other applicable locations as appropriate. Note the general health of the mitigation area, observed wildlife, stabilization of soils and sediments, and vegetation cover and diversity. The location and extent of common reed and other potentially invasive species should be assessed to determine if these species are encroaching into the mitigation area.

The number and approximate locations for sample stations, including the reference wetland area, will be mutually agreed upon by participating agencies and stakeholders. If required, permanent sample stations shall be selected in the field and the location surveyed using Global Positioning System (GPS) hardware. Each sample station, including locations for photographic documentation, would be marked with labeled stakes or other permanent markers.

The following is a proposed monitoring program to be implemented following mitigation. Data would be collected as follows:

10.1.1 Qualitative Assessments

During each monitoring event, and a minimum of twice annually (spring and early summer), qualitative assessments of the mitigation site and adjacent areas should be conducted. The site

- Stability of soils and sediments. Observations should be made regarding areas where erosion/scouring, slumping channel banks, etc., is occurring and corrective actions may be necessary.
- General assessment of the overall site and each vegetation community type.
- Observations on vegetative cover, invasive species, hydrologic conditions, wildlife use, and functional attributes.
- Photographs of each wetland restoration area should be taken during each site visit at permanent stations. Documentation of the overall site condition, including each habitat type.
- Monitoring should occur in both mitigation and reference areas.

10.1.2 Annual Quantitative Assessments

Quantitative assessments of the mitigation and reference areas will be conducted annually in September for the 5-year monitoring period. These monitoring events will include detailed data collection in established quadrats following the guidelines outlined below. Photographic documentation of select quadrats will be a component of this program. In addition, a qualitative functional assessment of the restoration area will be conducted.

10.1.3 Vegetation

Determine percent cover, using the Braun-Blanquet method, of vegetation species identified within designated 1m x 1m quadrats.

Plants are identified, when feasible, to genus and species using appropriate plant taxonomic keys for the region. Generally, for each monitoring period some species cannot be identified to genus and species because of a lack of flowering structures and the time of year during which the survey was conducted.

10.1.4 Soils/Sediments

Soil and sediment characterization is not proposed. The majority of the mitigation area will consist of emergent wetlands containing standing water or saturation to the soil surface for most of the year.

10.1.5 Hydrologic Conditions

Observations of direct and indirect hydrologic conditions will be made for each monitoring station. Direct observation of hydrologic conditions included documentation of standing water and free water and saturation in soil borings. Indirect observations include features such as water-stained leaves, drainage patterns, and soil characteristics.

The assessment method will be utilized in annual quantitative assessment monitoring events (September) and incorporated into the annual monitoring report.

10.1.6 Reports

Reports should be prepared following each monitoring event. Representative photographs should be a component of each report. General observations on the restoration wetlands and adjacent areas should be made.

Progress reports should be prepared following each site visit and should, at a minimum, include the following:

- Information describing the function/value of the site at the time of inspection.
- Inventory, as applicable, the surviving plant species and percent cover.
- Representative photographs of the restoration site and a map indicating the location and direction of photographs.
- If appropriate, include a written plan to correct any deficiencies identified during the monitoring event.

The annual/quantitative assessment report should provide more-detailed information regarding species composition, estimates of percent cover, and estimates of survival of planted tree and shrub individuals. The quantitative assessment results should include data on species

composition and percent cover sufficient to determine the approximate cover of herbaceous vegetation. The same reporting format should be followed in subsequent years.

11. LONG-TERM SUSTAINABILITY OF THE PROPOSED RESTORATION

As demonstrated in this mitigation report, the proposed compensatory mitigation for the Southport project is designed to be self-sustaining and represents the collective input of federal and state regulatory and resource agencies. The design is intended to provide for the establishment of functional, self-maintaining (e.g., wetland and other water hydrologic conditions including tidal/open-water connections to Neshaminy Creek and the Delaware River) vegetative communities and habitats designed to develop and maintain important functions and values that would be lost from the proposed Southport project.

When performance standards have been met, the Commonwealth of Pennsylvania DCNR would ensure long-term sustainability of the mitigation areas following the guidelines outlined in the Neshaminy State Park Resource Management Plan (RMP), which provides for management and protection of natural resources, including wetlands and tidal wetlands, vegetation, water resources, fish and wildlife, and natural areas (DCNR, 2003). The NSP RMP includes goals and objectives for maintaining the diversity and integrity of its diverse natural resources. The NSP has environmental and maintenance staff that manages the NSP natural resources, including an active invasive species management program, which would extend to mitigation areas. A component of incorporating the long-term sustainability of the mitigation areas would be to, as needed, incorporate guidance for the select mitigation areas into the RMP to comply with federal and state permit conditions.

12. ADAPTIVE MANAGEMENT

Due to the magnitude and complexity of impacts to wetlands, waters, and sensitive resources from the proposed Southport project, an adaptive management approach to address the compensatory mitigation for unavoidable impacts is appropriate. The program proposed in this mitigation plan provides a mechanism throughout the planning, implementation, and post-construction phases to ensure that the stated goals are developed and met using an adaptive management approach, which is simply defined as "Learning by Doing."

Key characteristics of adaptive management plans include (Nyberg and Taylor, 1995):

- Acknowledgment of uncertainty about what policy is "best."
- Thoughtful selection of policies or practices.
- Careful implementation of a plan.
- Monitoring of the key response indicators.
- Analysis of the outcome in consideration of the original objectives.
- Incorporation of the results into future decisions.

Successful mitigation requires an integrated, iterative approach under which adaptive management principles and "learning by doing" are applied. The implementation, monitoring and management of the approved mitigation plan would incorporate mechanisms to evaluate and modify actions in response to lessons learned from implementing the various components of the mitigation (see below).

The Commonwealth of Pennsylvania DCNR would ensure long-term sustainability of the mitigation areas following the guidelines outlined in the NSP RMP, which provides for management and protection of natural resources, including wetlands and tidal wetlands, vegetation, water resources, fish and wildlife, and natural areas (DCNR, 2003). The NSP RMP includes goals and objectives for maintaining the diversity and integrity of its diverse natural resources. The NSP has environmental and maintenance staff who manage the NSP natural resources, including an active invasive species management program that would extend to mitigation areas. A component of incorporating the long-term sustainability of the mitigation areas would be to, as needed, incorporate guidance for the select mitigation areas into the RMP to comply with federal and state permit conditions.

13. FINANCIAL ASSURANCES

The Commonwealth is committed to funding the implementation of the approved, implementable compensatory mitigation plan and is in the process of obtaining the necessary funding, which would be based on the cost estimates developed after the mitigation plan is approved.

14. REFERENCES

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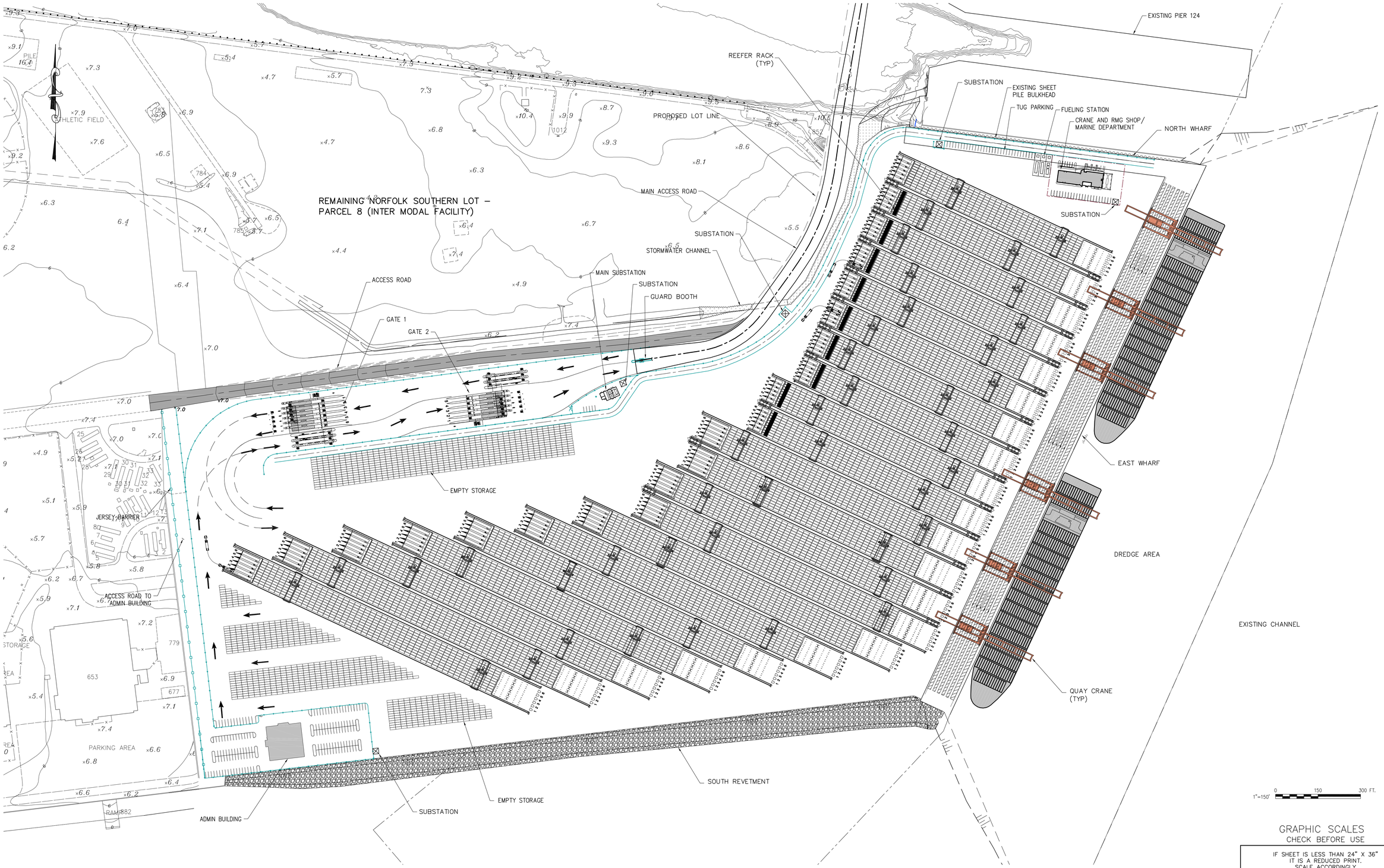
DRAFT

FIGURES



GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Halcrow

WESTON SOLUTIONS

DESIGNED BY	Z E FG
DRAWN BY	
CHECKED BY	
PROJECT ENGR	

COMMONWEALTH OF PENNSYLVANIA
PHILADELPHIA REGIONAL PORT AUTHORITY
PHILADELPHIA, PA

SOUTHPORT PROJECT

Figure 1-2
Site Concept Plan
Preferred Alternative

SCALE 1"=150'

DATE JULY 15, 2010

REVISION

DRAWING NO.

G–5

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SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83),
VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

REFERENCE: AERIAL DATA REDUCTION ASSOCIATES, INC.
DATE OF PHOTOGRAPHY: JUNE 22, 1994
DATE OF COMPILATION: NOVEMBER 1994

CONVERSION OF THE NAVD 1988 GROUND ELEVATIONS TO NGVD 1929 IS +0.98'
CONVERSION OF THE NAVD 1988 TIDAL DATA TO NGVD 1929 IS +1.32'

THE EXTENT OF TIDAL JURISDICTION IS BASED UPON TIDAL DATA AS FOLLOWS:
SECTION 10 –– MEAN HIGH WATER –– 3.04' NAVD 1988
SECTION 404 – SPRING HIGH WATER – 4.48' NAVD 1988

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE, STATION 8545240, PHILADELPHIA (USCG STATION), DELAWARE RIVER, PA, BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 IS AS FOLLOWS:

HIGHEST RECORDED TIDE 7.34' (NOV 1950)
MEAN HIGHER HIGH TIDE 3.46'
MEAN HIGH TIDE 3.04'
MEAN TIDE LEVEL 0.04'
MEAN LOW TIDE –2.96'
MEAN LOWER TIDE –3.15'
LOWEST RECORDED TIDE –9.96' (DEC 1962)
100 YEAR FLOOD ELEVATION 9.00' (NAVD 88)

GENERAL NOTES

- TOPOGRAPHY INFORMATION FROM CUSHMAN & WAKEFIELD OF PA (1992) PNBC TOPOGRAPHY MAP, MODIFIED BY PERIMETER SURVEY PERFORMED BY RETTEW ASSOCIATES, INC. MARCH 2010.
- BATHYMETRY INFORMATION FROM FATHOMETRIC SURVEY CONDUCTED BY HYDROGRAPHIC SURVEYS DATED SEPTEMBER 3, 2009.
- WETLAND DELINEATIONS WERE CONDUCTED IN 2009 AND 2010, BY WESTON SOLUTIONS, INC.

LEGEND

- FENCE
- GUIDERAIL
- UTILITY POLE
- DENSE VEGETATION/ SHADOWS (DENSE WOODS)
- BUILDING WITH NUMBER (5432)
- WOODS LINE
- SHRUB/BRUSH AREA
- EXISTING CONTOURS WITH LABELS (10, 2)
- DRAINAGE
- SITE BOUNDARY
- PHOTOGRAPH LOCATION AND DIRECTION (11)
- SAMPLE STATION (4)
- SURVEYED WETLAND BOUNDARY LINES
- SURVEYED WETLAND BOUNDARY POINTS (A2)
- STORMWATER CHANNEL
- ISOLATED FRESHWATER WETLANDS
- INTERTIDAL WATERS
- SUB-TIDAL WATERS
- DEEP WATER
- SPRING HIGH WATER LINE
- MEAN HIGH WATER LINE

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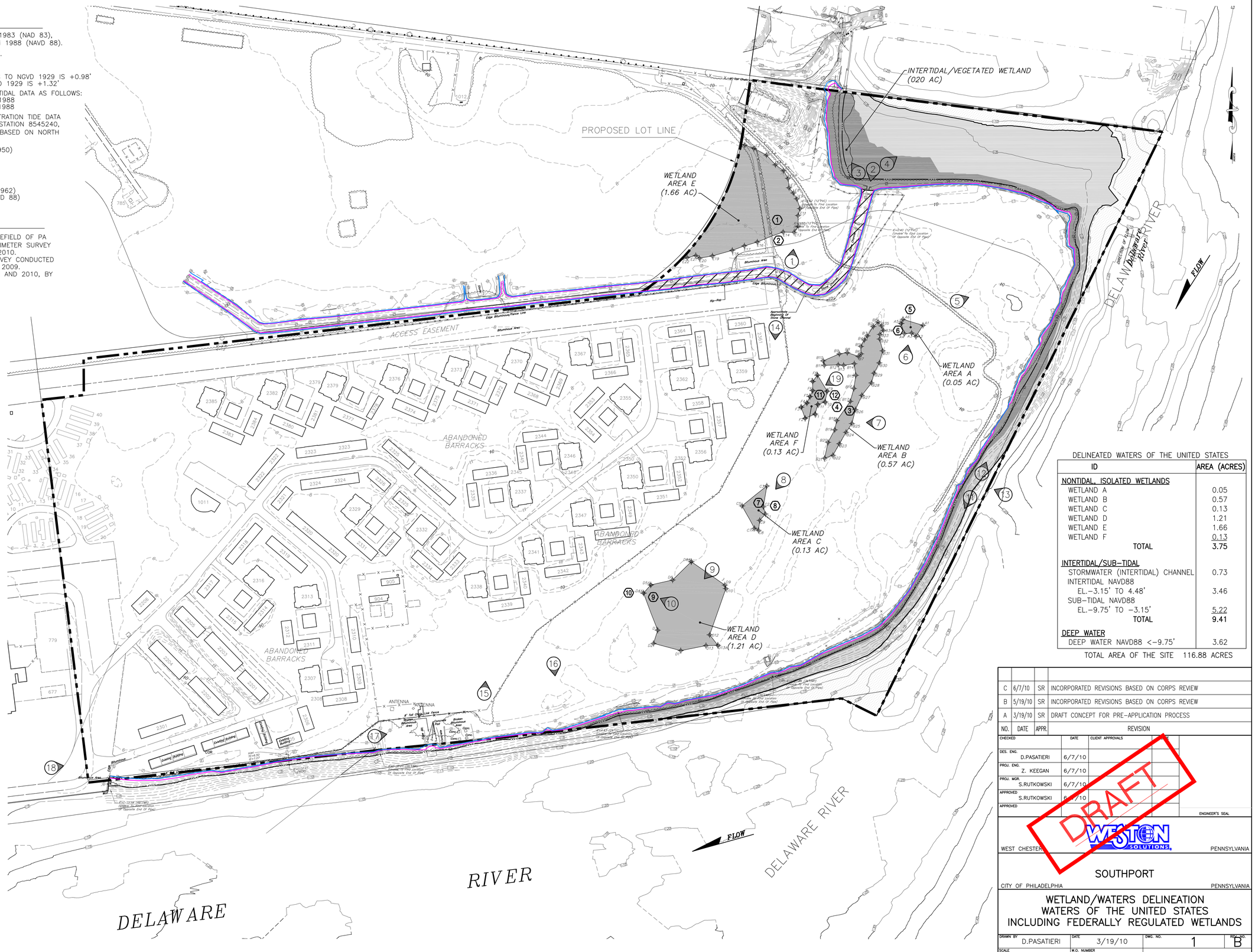

DELINEATED WATERS OF THE UNITED STATES

ID	AREA (ACRES)
NONTIDAL, ISOLATED WETLANDS	
WETLAND A	0.05
WETLAND B	0.57
WETLAND C	0.13
WETLAND D	1.21
WETLAND E	1.66
WETLAND F	0.13
TOTAL	3.75
INTERTIDAL/SUB-TIDAL	
STORMWATER (INTERTIDAL) CHANNEL	0.73
INTERTIDAL NAVD88 EL.–3.15' TO 4.48'	3.46
SUB-TIDAL NAVD88 EL.–9.75' TO –3.15'	5.22
TOTAL	9.41
DEEP WATER	
DEEP WATER NAVD88 <–9.75'	3.62

TOTAL AREA OF THE SITE 116.88 ACRES

NO.	DATE	APPR.	REVISION
C	6/7/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
B	5/19/10	SR	INCORPORATED REVISIONS BASED ON CORPS REVIEW
A	3/19/10	SR	DRAFT CONCEPT FOR PRE-APPLICATION PROCESS

CHECKED	DATE	CLIENT APPROVALS
DES. ENG. D.PASATIERI	6/7/10	
PROJ. ENG. Z. KEEGAN	6/7/10	
PROJ. MGR. S.RUTKOWSKI	6/7/10	
APPROVED S.RUTKOWSKI	6/7/10	
APPROVED		

ENGINEER'S SEAL

DRAFT

WEST CHESTER WESTON SOLUTIONS PENNSYLVANIA

SOUTHPORT

CITY OF PHILADELPHIA PENNSYLVANIA

WETLAND/WATERS DELINEATION WATERS OF THE UNITED STATES INCLUDING FEDERALLY REGULATED WETLANDS

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	3/19/10	1	B
SCALE 1"=120'-0"	W.O. NUMBER 14637.001.001.0003.07	SHEET 1 OF 1	

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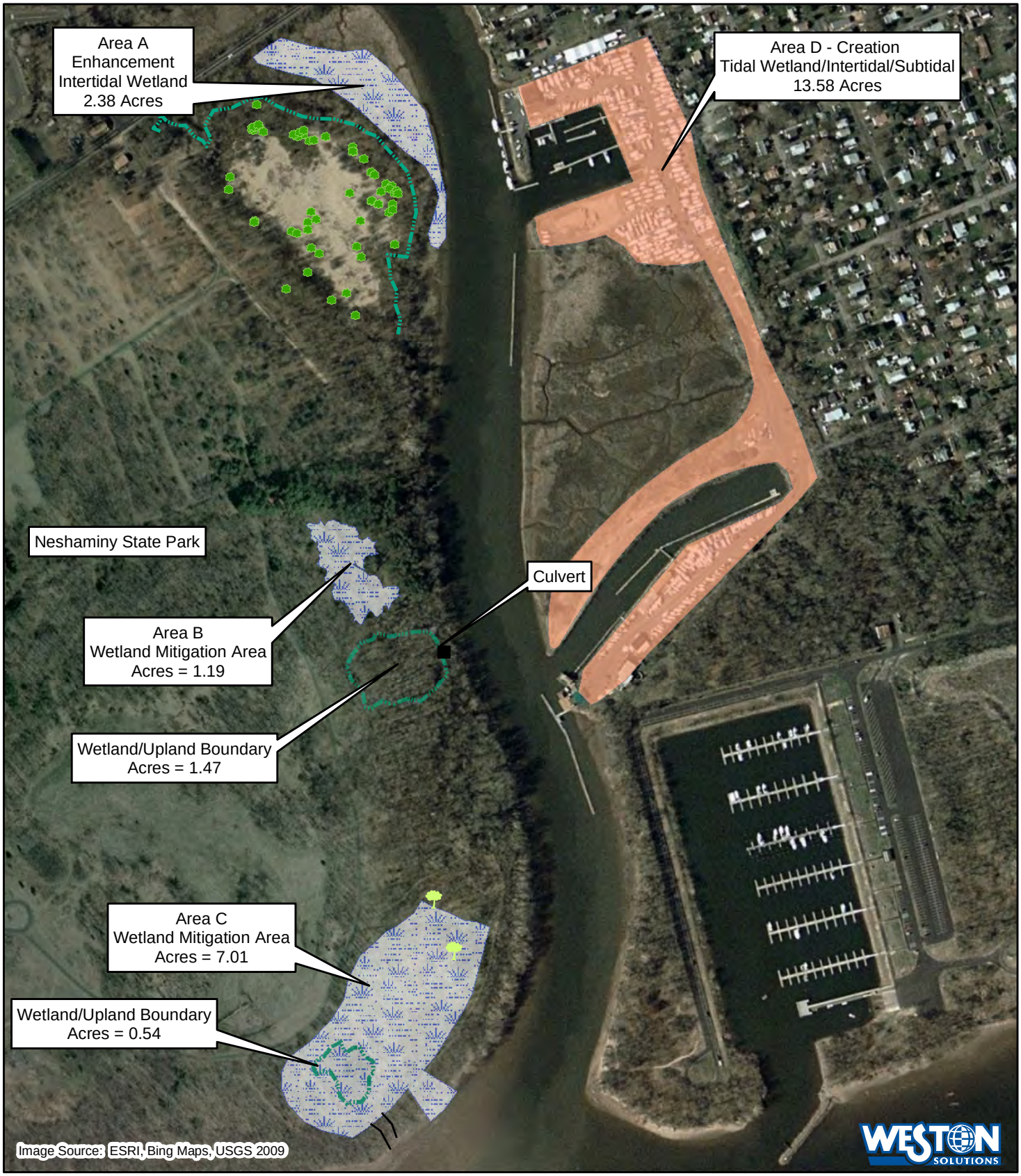


Legend

- Willow Oak
- American Holly
- Wetland/Upland Boundary
- Mitigation Areas - Jack's Marina
- Wetland Mitigation Areas - Neshaminy State Park

N
W E
S

0 450 Feet

Figure 3
Wetland/Water Mitigation
Creation and Enhancement Areas
Neshaminy State Park and Jack's Marina
Bensalem, Pa

File: \\fsfed01\tig\Neshaminy State Park\MXD\Creation_Enhancement_calcs_v2.mxd, 29-Jun-10 15:47, ricksc

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83), VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

AERIAL PHOTOGRAMMETRY AND DATA REDUCTION PERFORMED BY AERO2, INC. DURING THE MONTH OF MAY 2010.

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE, STATION 8539094, DELAWARE RIVER AT BURLINGTON, NJ, BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 AS FOLLOWS:

HIGHEST RECORDED TIDE 7.16' (OCT 2003)
MEAN HIGHER HIGH TIDE 4.35'
MEAN HIGH TIDE 3.98'
MEAN TIDE LEVEL 0.40'
MEAN LOW TIDE -3.17'
MEAN LOWER TIDE -3.38'
LOWEST RECORDED TIDE -6.30' (JAN 2003)
100 YEAR FLOOD ELEVATION 9.93' (NAVD 88)

GENERAL NOTES

- WETLAND DELINEATIONS WERE CONDUCTED IN 2010, BY WESTON SOLUTIONS, INC.

LEGEND

EXISTING CONTOUR WITH LABEL — 10

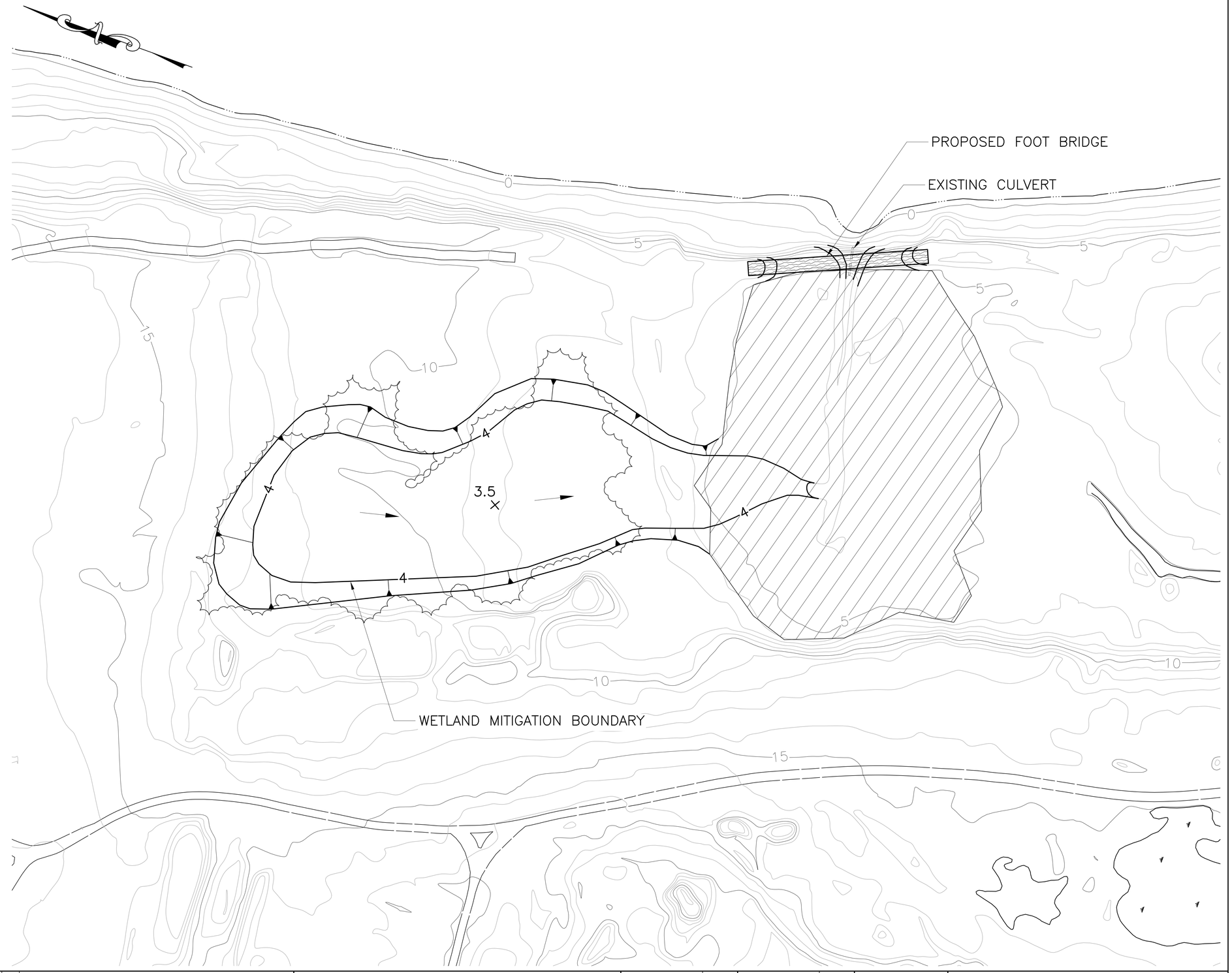
PROPOSED CONTOUR — 0

EDGE OF WATER

INVASIVE/NUISANCE SPECIES FOOTPRINT

FRESHWATER WETLAND

LIMIT OF EXISTING CLEARING



40 0 40 80
SCALE: IN FEET

NO.	DATE	APPR.	REVISION
A	7/02/10	SR	ISSUED FOR PERMIT REVIEW

NO.	DATE	APPR.	REVISION

SOUTHPORT
CONCEPTUAL MITIGATION PLAN

WESTON SOLUTIONS
WEST CHESTER PENNSYLVANIA

CHECKED		DATE	CLIENT APPROVALS	DATE
DES. ENG.	D.P.	5/03/10		
PROJ. ENG.	E.L.	5/03/10		
PROJ. MGR.	N.J.	5/03/10		
APPROVED	S.B.	5/03/10		
APPROVED				

FIGURE 4
NESHAMINY STATE PARK
AREA B
NONTIDAL WETLAND MITIGATION

DRAWN	DATE	DWG. NO.	REV. NO.
D.PASATIERI	6/29/10	C-2	A
SCALE 1"=40'-0"	W.O. NO. 14637.001.001.0004.03	SHT. ___ OF ___	

G:\ACADPROJ\12796006003_PRPA_Southport\JacksMarina\Weston\SitePlan.dwg

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83), VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

AERIAL PHOTOGRAMMETRY AND DATA REDUCTION PERFORMED BY AERO2, INC. DURING THE MONTH OF MAY 2010.

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LEGEND

EXISTING CONTOUR WITH LABEL — 10 —

PROPOSED CONTOUR — 0 —

EDGE OF WATER

INVASIVE/NUISANCE SPECIES FOOTPRINT

IDENTIFIED AMERICAN HOLLY

ISOLATED FRESHWATER WETLAND

40 0 40 80
SCALE: IN FEET

G:\ACADPROJ\12796006003 PRPA Southport\JacksMarina\Weston\SitePlan.dwg

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
A	7/02/10	SR	ISSUED FOR PERMIT REVIEW				

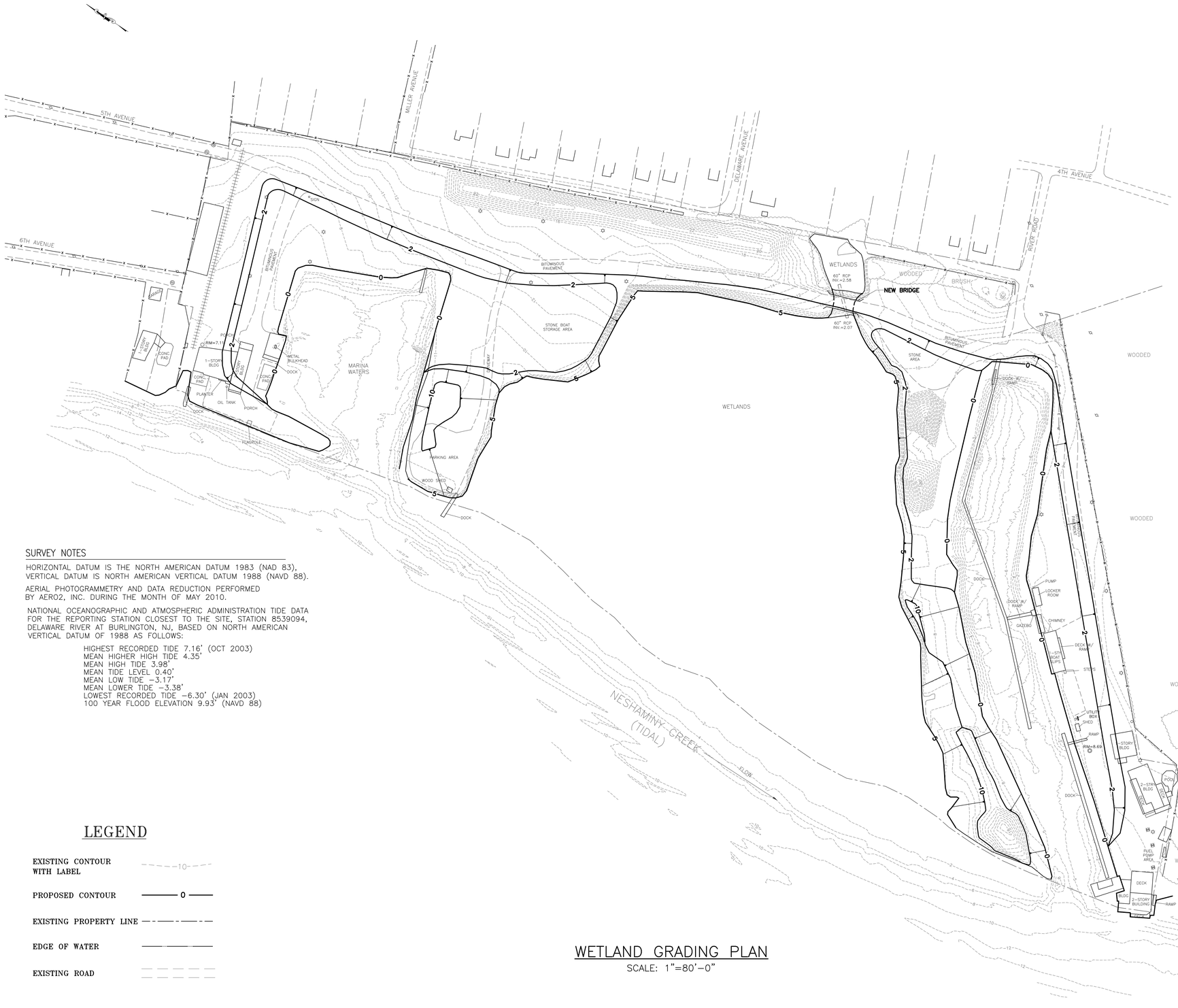
SOUTHPORT
CONCEPTUAL MITIGATION PLAN

WEST CHESTER PENNSYLVANIA

CHECKED		DATE	CLIENT APPROVALS	DATE
DES. ENG.	D.P.	5/03/10		
PROJ. ENG.	E.L.	5/03/10		
PROJ. MGR.	N.J.	5/03/10		
APPROVED	S.B.	5/03/10		
APPROVED				

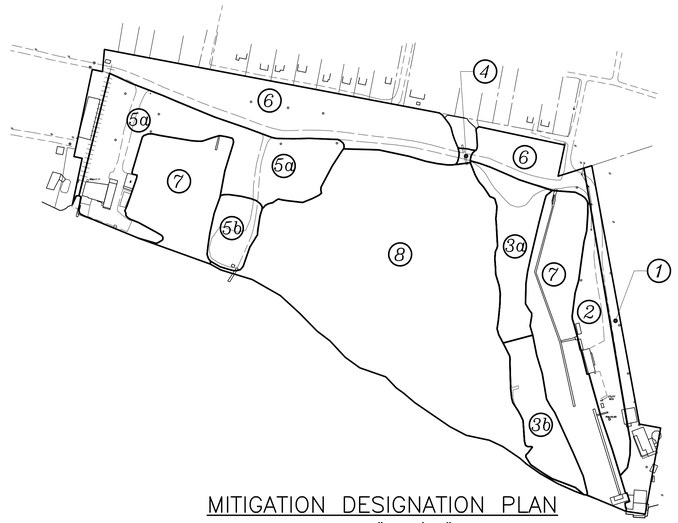
FIGURE 5
NESHAMINY STATE PARK
AREA C
INTERTIDAL/SUBTIDAL WETLAND MITIGATION

DRAWN	DATE	DWG. NO.	REV. NO.
D.PASATIERI	6/29/10	C-3	A
SCALE 1"=40'-0"	W.O. NO. 14637.001.001.0004.03	SHT. ___ OF ___	



WETLAND GRADING PLAN

SCALE: 1"=80'-0"



MITIGATION DESIGNATION PLAN

SCALE: 1"=200'-0"

MITIGATION DESIGNATION SUMMARY

AREA DESIGNATION	WETLAND TYPE	AREA (ACRES)
2, 3a, 5a	INTERTIDAL	7.14
4	WETLAND RESTORATION	0.05
1 AND 6	UPLAND RESTORATION/BUFFER	6.53
3b AND 5b	RED-BELLIED TURTLE NESTING	2.04
7	SUBTIDAL/DEEP WATER (LAGOON) POTENTIAL SUBMERGED AQUATIC VEGETATION (SAV) HABITAT	5.70
8	PRESERVATION INTERTIDAL WETLANDS	12.34

SURVEY NOTES

HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM 1983 (NAD 83), VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

AERIAL PHOTOGRAMMETRY AND DATA REDUCTION PERFORMED BY AERO2, INC. DURING THE MONTH OF MAY 2010.

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION TIDE DATA FOR THE REPORTING STATION CLOSEST TO THE SITE, STATION 8539094, DELAWARE RIVER AT BURLINGTON, NJ, BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 AS FOLLOWS:

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100 YEAR FLOOD ELEVATION 9.93' (NAVD 88)

LEGEND

EXISTING CONTOUR WITH LABEL — 10 —

PROPOSED CONTOUR — 0 —

EXISTING PROPERTY LINE

EDGE OF WATER

EXISTING ROAD

80 0 80 160

SCALE: 1"=80'-0"

NO.	DATE	APPR.	REVISION
A	7/2/10	SR	ISSUED FOR PERMIT REVIEW

CHECKED KTM	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

ENGINEER'S SEAL

WEST CHESTER — WESTON SOLUTIONS — PENNSYLVANIA

SOUTHPORT
CONCEPTUAL MITIGATION PLAN

CLIENT CITY — CLIENT STATE

FIGURE 6
JACK'S MARINA

DRAWN BY	DATE	DWG. NO.	REV. NO.
D.PASATIERI	6/29/2010	C-1	A
SCALE 1"=80'-0"	W.O. NUMBER 14637.001.001.0004.03	SHEET XX OF XX	

Filename: G:\ACADPROJ\12769006003_PRPA_Southport\JacksMarina\SitePlan.dwg

Weston Solutions, Inc.
1400 Weston Way
West Chester, PA 19380
610-701-3500 ● Fax 610-701-3401
www.westonsolutions.com

14 January 2010

Randal Brown
PADEP Watershed Management
2 East Main Street
Norristown PA

W.O. No. 14637.001.002.0016.03

Re: Site Characterization Activities at Jack's Marina and Neshaminy State Park
Neshaminy, Pennsylvania

Dear Mr. Randy Brown,

Weston Solutions, Inc. (WESTON®) performed a limited site characterization of the 35 acre former Jack's Marina and select areas of Neshaminy State Park. These sites are the proposed future wetland mitigation areas for the Southport Marine Terminal construction. Site characterization consisted of the installation and sampling of twenty-seven Geoprobe® soil borings on October 4th, 6th and 7th 2010. The sites are at the confluence of Neshaminy Creek and the Delaware River in Bensalem Township, Bucks County, Pennsylvania. The areas are presently generally flat-lying, lightly wooded in places, and devoid of existing structures. A site location map is provided in Figure 1.

METHODS

Characterization activities and the date of occurrence consisted of marking all proposed boring locations, conducting a utility clearance, followed by Geoprobe soil boring and sampling on October 4th, 6th and 7th 2010. WESTON initiated the utility clearance process by contacting PA One-Call, the Pennsylvania utility location system. All locations at the former Jacks Marina were cleared for subsurface utilities by TPI environmental under subcontract to WESTON. TPI conducted a multi-staged subsurface utility investigation at each of the proposed boring locations at Jacks Marina in order to identify and locate underground utilities and other subsurface anomalies and obstructions. TPI, using geophysical methods EM61 (a high sensitivity metal detector), utility locators, and ground penetrating radar (GPR), proceeded to identify underground utilities in the vicinity of each of the proposed locations. Upon receiving clearance, the location was then marked and circumscribed with a 10-ft^2 buffer to allow for the possibility of offsetting the boring location if necessary. TPI's report is included in Appendix A. No utilities were identified in Neshaminy State Park by PA One-Call and this was confirmed by the State Park Ranger Josh Schwartley.

The 22 site characterization soil borings were advanced using a Geoprobe Model 8040 DT unit to depths of 12 feet below ground surface (bgs). TPI Environmental was contracted by WESTON to conduct the soil boring and sampling activities. Soil samples were collected using acetate-lined geoprobe samplers measuring 4 feet in length. Upon collection, the acetate samplers were field screened using an organic vapor meter (OVM) and logged by a WESTON geoscientist. One grab soil sample was collected from each boring at either the top of the water table or at a depth corresponding to elevated OVM readings or visual indications of impacted

soils. Soil boring locations are shown in Figure 1 and soil boring logs are included in Appendix B.

Soil samples were submitted for analyses of volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and Act 2 metals. Eight soil samples were chosen for herbicide and pesticide analysis. VOC soil samples were analyzed using EPA Method 5035, SVOC soil samples were analyzed using EPA Method 8270C, PCB soil samples were analyzed using EPA Method 8082, and Act 2 metals soil samples were analyzed using EPA Method 6010B. Herbicides were analyzed using EPA Method 8151. Pesticides were analyzed using EPA Method 8081. Samples were collected in laboratory-prepared sample containers and chilled in coolers to 4ºC for same-day courier delivery to Hampton-Clarke, Inc./Veritech Laboratory, in Fairfield, NJ (PA Certification No. 68-00463).

RESULTS

A summary of detected analytes and comparative clean fill standards for the sample locations is presented as Table 1. A review of Table 1 demonstrates that one location exhibited an exceedance of PADEP clean fill guidelines at the site. One sample collected at the former Jacks Marina, GP-JM-6, had a benzo(a)pyrene result of 3.1 mg/kg, slightly above the clean fill standard of 2.5 mg/kg. No other results exceeded the PADEP clean fill guidelines. All laboratory data packages are included in Appendix C.

CONCLUSIONS AND RECOMMENDATIONS

One soil sample, GP-JM-6, had exceedance of benzo(a)pyrene however because this sample was collected as a grab the clean fill guidelines allow for applying a "75% / 2x rule". The concentration is less than 2x the clean fill requirement standard and it was only one sample of 15 meaning more than 75% of the samples did not exhibit exceedences, the site soils meet the "75% / 2x rule". By meeting the clean fill requirements the soil materials can be reused. Based on these results, the net cut of 75,000cy (current estimate of grading materials) can be reused as fill at the Southport site.

WESTON recommends that during site development that soils be screened using an OVM as well as visual and olfactory senses by competent person and sampling of material to be reused offsite be sampled at the frequency recommended by the clean fill guidelines for benzo(a)pyrene to be certain that no other contamination exists and potentially transported offsite. A reduction in sampling frequency would likely be allowed by PADEP so long as the material sampled during the initial phases of the project for reuse consistently meet the accepted standard.

WESTON looks forward to working with PADEP on this important mitigation/redevelopment project. If you have any questions, please do not hesitate to contact Sonny Rutkowski at 610 701 3719 or me at 610-701-3513 or by email at jess.anderson@westonsolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Jess Anderson
Senior Geoscientist

cc: S. Rutkowski (WESTON)
J. Newbold (PADEP)
A. Nassani (PADEP)
Z. Nucci(PADEP)

FIGURE

Legend

Soil Boring Locations

N
W E
S

0 650 Feet

Image Source: ESRI, Bing Maps, USGS 2009

Figure 1
Soil Boring Location Plan
Neshaminy State Park
Former Jack's Marina

File: \\fsfed01\tig\Neshaminy State Park\MXD\SoilBoring_loc_plan.mxd, 30-Nov-10 14:48, ricksc

TABLES

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-JM-1		GP-JM-2		GP-JM-3		GP-JM-4		GP-JM-5		GP-JM-6		GP-JM-7		GP-JM-8		GP-JM-9		GP-JM-13		GP-JM-14		GP-JM-15		GP-JM-10		GP-JM-11		GP-JM-12	
	LAB ID:	AC54779-001		AC54779-002		AC54779-003		AC54779-004		AC54779-005		AC54779-006		AC54779-007		AC54779-008		AC54779-009		AC54779-010		AC54779-011		AC54779-012		AC54779-013		AC54779-014		AC54779-015	
	COLLECTION DATE:	10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/5/2010		10/5/2010		10/5/2010	
	SAMPLE MATRIX:	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
	Clean Fill Concentration Limits																														
Analyte	mg/Kg	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
Herbicides																															
2,4,5-T	NA	ND	0.013	NS		NS		ND	0.012	NS		ND	0.012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.02
2,4-D	NA	ND	0.013	NS		NS		ND	0.012	NS		ND	0.012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.02
Dicamba	NA	ND	0.013	NS		NS		ND	0.012	NS		ND	0.012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.02
Silvex	NA	ND	0.013	NS		NS		ND	0.012	NS		ND	0.012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.02
Metals																															
Mercury	10	0.15	0.11	ND	0.11	ND	0.1	0.12	0.1	0.29	0.11	0.38	0.1	0.12	0.11	0.23	0.11	ND	0.14	ND	0.13	ND	0.098	0.17	0.12	0.55	0.13	0.22	0.12	ND	0.17
Antimony	27	ND	2.6	ND	2.7	ND	2.5	ND	2.4	ND	2.7	ND	2.4	ND	2.7	ND	2.6	ND	3.3	ND	3	ND	2.4	ND	2.8	3.6	3.2	ND	2.9	ND	4.1
Arsenic	12	7.1	2.6	9.1	2.7	6.5	2.5	4.6	2.4	9.8	2.7	7	2.4	7.6	2.7	9	2.6	6.8	3.3	7.3	3	3.7	2.4	5.9	2.8	6.8	3.2	6.3	2.9	11	4.1
Barium	8200	130	13	110	13	55	12	72	12	120	14	300	12	110	14	120	13	170	16	110	15	37	12	140	14	150	16	130	15	180	20
Beryllium	320	1.5	0.77	1.3	0.8	0.96	0.74	0.98	0.72	1.9	0.81	1.4	0.73	1.1	0.82	1.3	0.78	1.5	0.98	1.2	0.91	ND	0.71	1.5	0.85	1.7	0.95	1.5	0.88	2.5	1.2
Cadmium	38	2.9	0.77	ND	0.8	ND	0.74	ND	0.72	3.6	0.81	1.4	0.73	0.87	0.82	0.92	0.78	1	0.98	ND	0.91	ND	0.71	1.8	0.85	7.2	0.95	ND	0.88	3.7	1.2
Chromium	190000	34	6.4	22	6.7	19	6.2	17	6	35	6.8	45	6.1	25	6.8	32	6.5	34	8.2	31	7.6	13	5.9	32	7	63	7.9	37	7.4	53	10
Copper	8200	50	6.4	22	6.7	19	6.2	21	6	45	6.8	95	6.1	30	6.8	46	6.5	27	8.2	37	7.6	22	5.9	36	7	120	7.9	29	7.4	64	10
Lead	450	57	6.4	24	6.7	53	6.2	63	6	60	6.8	180	6.1	84	6.8	110	6.5	32	8.2	39	7.6	9	5.9	40	7	120	7.9	37	7.4	85	10
Nickel	650	22	6.4	21	6.7	14	6.2	14	6	23	6.8	81	6.1	19	6.8	23	6.5	25	8.2	29	7.6	13	5.9	23	7	29	7.9	21	7.4	36	10
Selenium	26	ND	2.3	ND	2.4	ND	2.2	ND	2.2	ND	2.4	ND	2.2	ND	2.5	ND	2.3	ND	3	ND	2.7	ND	2.1	ND	2.5	ND	2.9	ND	2.6	ND	3.7
Silver	84	ND	1.9	ND	2	ND	1.9	ND	1.8	ND	2	ND	1.8	ND	2.1	ND	1.9	ND	2.5	ND	2.3	ND	1.8	ND	2.1	ND	2.4	ND	2.2	ND	3.1
Thallium	14	ND	1.5	ND	1.6	ND	1.5	ND	1.4	ND	1.6	ND	1.5	ND	1.6	ND	1.6	ND	2	ND	1.8	ND	1.4	ND	1.7	ND	1.9	ND	1.8	ND	2.4
Zinc	12000	420	13	81	13	70	12	110	12	580	14	390	12	160	14	500	13	160	16	220	15	66	12	250	14	870	16	100	15	500	20
PCBs																															
Aroclor (Total)	NA	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	0.2	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1016	15	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1221	0.63	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1232	0.5	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1242	16	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1248	9.9	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	0.15	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1254	4.4	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1260	30	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	0.054	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1262	NA	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Aroclor-1268	NA	ND	0.032	ND	0.033	ND	0.031	ND	0.03	ND	0.034	ND	0.03	ND	0.034	ND	0.032	ND	0.041	ND	0.038	ND	0.029	ND	0.035	ND	0.04	ND	0.037	ND	0.051
Pesticides																															
Aldrin	0.1	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Alpha-BHC	0.046	ND	0.0013	NS		NS		ND	0.0012	NS		ND	0.0012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.002
beta-BHC	0.22	ND	0.0013	NS		NS		ND	0.0012	NS		ND	0.0012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.002
Chlordane	49	ND	0.032	NS		NS		ND	0.03	NS		0.15	0.03	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.051
delta-BHC	11	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Dieldrin	0.11	ND	0.0013	NS		NS		ND	0.0012	NS		ND	0.0012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.002
Endosulfan I	110	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Endosulfan II	130	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Endosulfan Sulfate	70	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Endrin	5.5	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Endrin Aldehyde	NA	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Endrin Ketone	NA	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
gamma-BHC	0.072	ND	0.0013	NS		NS		ND	0.0012	NS		ND	0.0012	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.002
Heptachlor	0.68	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Heptachlor Epoxide	1.1	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
Methoxychlor	630	ND	0.0064	NS		NS		ND	0.006	NS		ND	0.0061	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.01
p,p'-DDD	6.8	ND	0.0032	NS		NS		ND	0.003	NS		0.032	0.003	NS		NS		NS		NS		NS		NS		NS		NS		0.022	0.0051
p,p'-DDE	41	ND	0.0032	NS		NS		ND	0.003	NS		0.017	0.003	NS		NS		NS		NS		NS		NS		NS		NS		0.029	0.0051
p,p'-DDT	53	ND	0.0032	NS		NS		ND	0.003	NS		ND	0.003	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.0051
Toxaphene	1.2	ND	0.032	NS		NS		ND	0.03	NS		ND	0.03	NS		NS		NS		NS		NS		NS		NS		NS		ND	0.051

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-JM-1		GP-JM-2		GP-JM-3		GP-JM-4		GP-JM-5		GP-JM-6		GP-JM-7		GP-JM-8		GP-JM-9		GP-JM-13		GP-JM-14		GP-JM-15		GP-JM-10		GP-JM-11		GP-JM-12	
	LAB ID:	AC54779-001		AC54779-002		AC54779-003		AC54779-004		AC54779-005		AC54779-006		AC54779-007		AC54779-008		AC54779-009		AC54779-010		AC54779-011		AC54779-012		AC54779-013		AC54779-014		AC54779-015	
	COLLECTION DATE:	10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/5/2010		10/5/2010		10/5/2010	
	SAMPLE MATRIX:	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
	Clean Fill Concentration Limits																														
Analyte	mg/Kg	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
SemiVolatiles																															
1,2,4-Trichlorobenzene	27	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
1,2-Diphenylhydrazine	0.15	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2,4,5-Trichlorophenol	2300	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2,4,6-Trichlorophenol	3.1	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2,4-Dichlorophenol	1	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2,4-Dimethylphenol	32	ND	0.021	ND	0.022	ND	0.021	ND	0.02	ND	0.023	ND	0.02	ND	0.023	ND	0.022	ND	0.027	ND	0.025	ND	0.02	ND	0.023	ND	0.026	ND	0.025	ND	0.034
2,4-Dinitrophenol	0.21	ND	0.43	ND	0.44	ND	0.41	ND	0.4	ND	0.45	ND	0.41	ND	0.46	ND	0.43	ND	0.55	ND	0.51	ND	0.39	ND	0.47	ND	0.53	ND	0.49	ND	0.68
2,4-Dinitrotoluene	0.05	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2,6-Dinitrotoluene	1.1	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2-Chloronaphthalene	6200	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2-Chlorophenol	4.4	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2-Methylnaphthalene	2900	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	0.18	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	0.25	0.094	ND	0.11	ND	0.098	ND	0.14
2-Methylphenol	64	ND	0.021	ND	0.022	ND	0.021	ND	0.02	ND	0.023	ND	0.02	ND	0.023	ND	0.022	ND	0.027	ND	0.025	ND	0.02	ND	0.023	ND	0.026	ND	0.025	ND	0.034
2-Nitroaniline	0.038	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
2-Nitrophenol	5.9	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
3&4-Methylphenol	36	ND	0.021	ND	0.022	ND	0.021	ND	0.02	ND	0.023	ND	0.02	ND	0.023	ND	0.022	ND	0.027	ND	0.025	ND	0.02	ND	0.023	ND	0.026	ND	0.025	ND	0.034
3,3'-Dichlorobenzidine	8.3	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
3-Nitroaniline	0.03	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
4,6-Dinitro-2-methylphenol	NA	ND	0.43	ND	0.44	ND	0.41	ND	0.4	ND	0.45	ND	0.41	ND	0.46	ND	0.43	ND	0.55	ND	0.51	ND	0.39	ND	0.47	ND	0.53	ND	0.49	ND	0.68
4-Bromophenyl-phenylether	NA	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
4-Chloro-3-methylphenol	1100	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
4-Chloroaniline	19	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
4-Chlorophenyl-phenylether	NA	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
4-Nitroaniline	0.03	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
4-Nitrophenol	4.1	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Acenaphthene	2700	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	0.24	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	0.17	0.094	ND	0.11	ND	0.098	ND	0.14
Acenaphthylene	2500	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	0.11	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Anthracene	350	ND	0.085	ND	0.089	ND	0.082	0.14	0.08	ND	0.09	0.45	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	0.44	0.094	0.14	0.11	ND	0.098	ND	0.14
Benzidine	0.078	ND	0.43	ND	0.44	ND	0.41	ND	0.4	ND	0.45	ND	0.41	ND	0.46	ND	0.43	ND	0.55	ND	0.51	ND	0.39	ND	0.47	ND	0.53	ND	0.49	ND	0.68
Benzo[a]anthracene	25	0.13	0.085	ND	0.089	0.12	0.082	0.5	0.08	0.17	0.09	2.6	0.081	0.17	0.091	0.26	0.087	0.25	0.11	0.27	0.1	0.18	0.078	0.69	0.094	0.59	0.11	0.41	0.098	0.21	0.14
Benzo[a]pyrene	2.5	0.13	0.085	ND	0.089	0.14	0.082	0.41	0.08	0.18	0.09	3.1	0.081	0.16	0.091	0.23	0.087	0.24	0.11	0.28	0.1	0.16	0.078	0.52	0.094	0.61	0.11	0.42	0.098	0.23	0.14
Benzo[b]fluoranthene	25	0.21	0.085	ND	0.089	0.18	0.082	0.54	0.08	0.27	0.09	4	0.081	0.23	0.091	0.31	0.087	0.34	0.11	0.42	0.1	0.24	0.078	0.7	0.094	0.97	0.11	0.68	0.098	0.36	0.14
Benzo[g,h,i]perylene	180	0.1	0.085	ND	0.089	0.085	0.082	0.25	0.08	0.14	0.09	1.9	0.081	0.14	0.091	0.14	0.087	0.15	0.11	0.19	0.1	0.098	0.078	0.28	0.094	0.42	0.11	0.31	0.098	0.19	0.14
Benzo[k]fluoranthene	250	ND	0.085	ND	0.089	ND	0.082	0.21	0.08	0.1	0.09	1.4	0.081	ND	0.091	0.11	0.087	0.13	0.11	0.16	0.1	0.082	0.078	0.26	0.094	0.27	0.11	0.19	0.098	ND	0.14
bis(2-Chloroethoxy)methane	NA	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
bis(2-Chloroethyl)ether	0.0039	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
bis(2-Chloroisopropyl)ether	8	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
bis(2-Ethylhexyl)phthalate	130	ND	0.085	ND	0.089	ND	0.082	ND	0.08	0.13	0.09	0.13	0.081	0.68	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	0.39	0.14
Butylbenzylphthalate	10000	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Carbazole	21	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	0.21	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	0.16	0.094	ND	0.11	ND	0.098	ND	0.14
Chrysene	230	0.16	0.085	ND	0.089	0.12	0.082	0.44	0.08	0.21	0.09	2.6	0.081	0.16	0.091	0.23	0.087	0.27	0.11	0.31	0.1	0.17	0.078	0.67	0.094	0.76	0.11	0.52	0.098	0.26	0.14
Dibenzo[a,h]anthracene	2.5	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	0.57	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	0.097	0.094	0.13	0.11	ND	0.098	ND	0.14
Dibenzofuran	NA	ND	0.021	ND	0.022	ND	0.021	ND	0.02	ND	0.023	ND	0.02	ND	0.023	ND	0.022	ND	0.027	ND	0.025	ND	0.02	0.24	0.023	ND	0.026	ND	0.025	ND	0.034
Diethylphthalate	160	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Dimethylphthalate	NA	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Di-n-butylphthalate	NA	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Di-n-octylphthalate	NA	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Fluoranthene	3200	0.26	0.085	ND	0.089	0.21	0.082	0.99	0.08	0.37	0.09	4	0.081	0.3	0.091	0.54	0.087	0.54	0.11	0.48	0.1	0.35	0.078	1.5	0.094	1.4	0.11	0.89	0.098	0.48	0.14
Fluorene	3000	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	0.14	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	0.43	0.094	ND	0.11	ND	0.098	ND	0.14
Hexachlorobenzene	0.96	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Hexachlorobutadiene	1.2	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Hexachlorocyclopentadiene	91	ND	0.43	ND	0.44	ND	0.082	ND	0.4	ND	0.45	ND	0.41	ND	0.46	ND	0.43	ND	0.55	ND	0.51	ND	0.39	ND	0.47	ND	0.53	ND	0.49	ND	0.68
Hexachloroethane	0.56	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Indeno[1,2,3-cd]pyrene	25	0.088	0.085	ND	0.089	ND	0.082	0.22	0.08	0.13	0.09	1.7	0.081	0.13	0.091	0.12	0.087	0.13	0.11	0.16	0.1	0.095	0.078	0.25	0.094	0.38	0.11	0.28	0.098	0.15	0.14
Isophorone	1.9	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Naphthalene	25	ND	0.021	ND	0.022	ND	0.021	ND	0.02	ND	0.023	0.15	0.02	ND	0.023	ND	0.022	ND	0.027	ND	0.025	ND	0.02	0.38	0.023	ND	0.026	ND	0.025	ND	0.034
Nitrobenzene	0.79	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
N-Nitrosodimethylamine	0.000018	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
N-Nitroso-di-n-propylamine	0.0013	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
N-Nitrosodiphenylamine	20	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Pentachlorophenol	5	ND	0.85	ND	0.89	ND	0.41	ND	0.8	ND	0.9	ND	0.81	ND	0.91	ND	0.87	ND	1.1	ND	1	ND	0.78	ND	0.94	ND	1.1	ND	0.98	ND	1.4
Phenanthrene	10000	0.13	0.085	ND	0.089	0.12	0.082	0.53	0.08	0.15	0.09	1.6	0.081	0.11	0.091	0.3	0.087	0.27	0.11	0.2	0.1	0.15	0.078	1.8	0.094	0.88	0.11	0.49	0.098	0.2	0.14
Phenol	66	ND	0.085	ND	0.089	ND	0.082	ND	0.08	ND	0.09	ND	0.081	ND	0.091	ND	0.087	ND	0.11	ND	0.1	ND	0.078	ND	0.094	ND	0.11	ND	0.098	ND	0.14
Pyrene	2200	0.29	0.085	0.09	0.089	0.19	0.082	0.92	0.08	0.36	0.09	4.2	0.081	0.3	0.091	0.43	0.087	0.54	0.11	0.52	0.1	0.28	0.078	1.5	0.094	1.3	0.11	0.88	0.098	0.44	0.14

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-JM-1		GP-JM-2		GP-JM-3		GP-JM-4		GP-JM-5		GP-JM-6		GP-JM-7		GP-JM-8		GP-JM-9		GP-JM-13		GP-JM-14		GP-JM-15		GP-JM-10		GP-JM-11		GP-JM-12	
	LAB ID:	AC54779-001		AC54779-002		AC54779-003		AC54779-004		AC54779-005		AC54779-006		AC54779-007		AC54779-008		AC54779-009		AC54779-010		AC54779-011		AC54779-012		AC54779-013		AC54779-014		AC54779-015	
	COLLECTION DATE:	10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/4/2010		10/5/2010		10/5/2010		10/5/2010	
	SAMPLE MATRIX:	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
	Clean Fill Concentration Limits																														
Analyte	mg/Kg	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
Volatiles																															
1,1,1-Trichloroethane	7.2	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
1,1,2,2-Tetrachloroethane	0.0093	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,1,2-Trichloroethane	0.15	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
1,1-Dichloroethane	0.65	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,1-Dichloroethene	0.19	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,2,4-Trimethylbenzene	9	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,2-Dibromoethane	0.0012	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,2-Dichlorobenzene	59	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
1,2-Dichloroethane	0.1	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,2-Dichloropropane	0.11	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,3,5-Trimethylbenzene	2.8	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
1,3-Dichlorobenzene	0.12	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
1,4-Dichlorobenzene	10	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
2-Butanone	54	ND	0.0063	ND	0.0069	0.026	0.0057	0.055	0.0056	0.026	0.0063	0.035	0.0059	0.023	0.0061	ND	0.0058	0.065	0.0073	0.049	0.0068	ND	0.0056	0.093	0.0063	0.038	0.0073	0.057	0.007	0.04	0.0094
2-Chloroethylvinylether	NA	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
2-Hexanone	NA	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
4-Methyl-2-pentanone	NA	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Acetone	41	0.037	0.032	0.048	0.035	0.12	0.029	0.21	0.028	0.11	0.032	0.14	0.03	0.083	0.031	0.073	0.029	0.22	0.037	0.2	0.034	0.084	0.028	0.4	0.032	0.15	0.036	0.25	0.035	0.15	0.047
Acrolein	0.00062	ND	0.032	ND	0.035	ND	0.029	ND	0.028	ND	0.032	ND	0.03	ND	0.031	ND	0.029	ND	0.037	ND	0.034	ND	0.028	ND	0.032	ND	0.036	ND	0.035	ND	0.047
Acrylonitrile	0.0087	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Benzene	0.13	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Bromodichloromethane	3.4	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Bromoform	290	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Bromomethane	0.54	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Carbon disulfide	160	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Carbon tetrachloride	0.26	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Chlorobenzene	6.1	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Chloroethane	5	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Chloroform	2.5	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Chloromethane	180	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
cis-1,2-Dichloroethene	1.6	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
cis-1,3-Dichloropropene	NA	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Dibromochloromethane	12	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Ethylbenzene	46	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Isopropylbenzene	780	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
m&p-Xylenes	990	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Methylene chloride	0.038	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Methyl-t-butyl ether	0.28	ND	0.0013	ND	0.0014	ND	0.0011	0.0062	0.0011	ND	0.0013	0.0049	0.0012	ND	0.0012	0.002	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Naphthalene	25	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
o-Xylene	99	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Styrene	24	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
Tetrachloroethene	0.43	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Toluene	44	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
trans-1,2-Dichloroethene	2.3	ND	0.0063	ND	0.0069	ND	0.0057	ND	0.0056	ND	0.0063	ND	0.0059	ND	0.0061	ND	0.0058	ND	0.0073	ND	0.0068	ND	0.0056	ND	0.0063	ND	0.0073	ND	0.007	ND	0.0094
trans-1,3-Dichloropropene	NA	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Trichloroethene	0.17	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Vinyl chloride	0.03	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Xylenes (Total)	990	ND	0.0013	ND	0.0014	ND	0.0011	ND	0.0011	ND	0.0013	ND	0.0012	ND	0.0012	ND	0.0012	ND	0.0015	ND	0.0014	ND	0.0011	ND	0.0013	ND	0.0015	ND	0.0014	ND	0.0019
Other Parameters																															
Particle Size	NA																														

Footnotes
Highlighting indicaed exceeded of the PADEP Clean Fill Criteria
ND - Not Detected
RL - Reporting Limit
NA - Not Applicable
NS- Not Sampled

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-NP-06		DUP-1-10062010		GP-NP-07		GP-NP-08		GP-NP-04		GP-NP-05		GP-NP-09		GP-NP-10		GP-NP-11		GP-NP-12		GP-NP-13		GP-NP-03		DUP-2-10062010	
	LAB ID:	AC54860-001		AC54860-002		AC54860-003		AC54860-004		AC54860-005		AC54860-006		AC54860-007		AC54860-008		AC54860-009		AC54860-010		AC54860-011		AC54860-012		AC54860-013	
	COLLECTION DATE:	10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/7/2010		10/6/2010	
	SAMPLE MATRIX:	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
	Clean Fill Concentration Limits																										
Analyte	mg/Kg	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
Herbicides																											
2,4,5-T	NA	ND	0.011	ND	0.011	NS		NS		ND	0.016	NS		NS		NS		ND	0.012	NS		ND	0.012	ND	0.02	ND	0.011
2,4-D	NA	ND	0.011	ND	0.011	NS		NS		ND	0.016	NS		NS		NS		ND	0.012	NS		ND	0.012	ND	0.02	ND	0.011
Dicamba	NA	ND	0.011	ND	0.011	NS		NS		ND	0.016	NS		NS		NS		ND	0.012	NS		ND	0.012	ND	0.02	ND	0.011
Silvex	NA	ND	0.011	ND	0.011	NS		NS		ND	0.016	NS		NS		NS		ND	0.012	NS		ND	0.012	ND	0.02	ND	0.011
Metals																											
Mercury	10	ND	0.089	ND	0.09	ND	0.093	ND	0.088	ND	0.13	ND	0.14	ND	0.093	ND	0.084	0.24	0.097	ND	0.093	ND	0.1	ND	0.17	ND	0.092
Antimony	27	ND	2.1	ND	2.2	ND	2.2	ND	2.1	ND	3.2	ND	3.3	ND	2.2	ND	2	ND	2.3	ND	2.2	ND	2.4	ND	4	ND	2.2
Arsenic	12	4.6	2.1	5.4	2.2	6.7	2.2	7	2.1	ND	3.2	3.4	3.3	ND	2.2	2.2	2	8.9	2.3	ND	2.2	ND	2.4	ND	4	6.7	2.2
Barium	8200	32	11	29	11	32	11	19	11	75	16	150	16	98	11	21	10	170	12	ND	11	21	12	98	20	31	11
Beryllium	320	ND	0.64	ND	0.65	ND	0.67	ND	0.63	ND	0.97	ND	0.98	ND	0.67	ND	0.61	3.3	0.7	ND	0.67	ND	0.73	ND	1.2	ND	0.66
Cadmium	38	ND	0.64	ND	0.65	ND	0.67	ND	0.63	ND	0.97	ND	0.98	0.89	0.67	ND	0.61	6	0.7	ND	0.67	ND	0.73	ND	1.2	ND	0.66
Chromium	190000	24	5.3	13	5.4	17	5.6	19	5.3	18	8.1	23	8.2	26	5.6	7.5	5.1	61	5.8	6.1	5.6	7.9	6.1	20	10	18	5.5
Copper	8200	12	5.3	13	5.4	17	5.6	15	5.3	9	8.1	16	8.2	22	5.6	16	5.1	93	5.8	ND	5.6	6.6	6.1	12	10	17	5.5
Lead	450	7.9	5.3	7.7	5.4	13	5.6	6.2	5.3	ND	8.1	13	8.2	9.4	5.6	14	5.1	140	5.8	ND	5.6	ND	6.1	ND	10	21	5.5
Nickel	650	21	5.3	11	5.4	14	5.6	8.7	5.3	13	8.1	18	8.2	13	5.6	11	5.1	33	5.8	ND	5.6	15	6.1	15	10	14	5.5
Selenium	26	2.3	1.9	ND	1.9	ND	2	ND	1.9	ND	2.9	ND	3	ND	2	ND	1.8	ND	2.1	ND	2	ND	2.2	ND	3.6	ND	2
Silver	84	ND	1.6	ND	1.6	ND	1.7	ND	1.6	ND	2.4	ND	2.5	ND	1.7	ND	1.5	ND	1.7	ND	1.7	ND	1.8	ND	3	ND	1.6
Thallium	14	ND	1.3	ND	1.3	ND	1.3	ND	1.3	ND	1.9	ND	2	3.4	1.3	ND	1.2	ND	1.4	ND	1.3	ND	1.5	ND	2.4	ND	1.3
Zinc	12000	53	11	34	11	43	11	24	11	42	16	54	16	84	11	97	10	670	12	18	11	72	12	65	20	48	11
PCBs																											
Aroclor (Total)	NA	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	0.22	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1016	15	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1221	0.63	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1232	0.5	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1242	16	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1248	9.9	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1254	4.4	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1260	30	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	0.22	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1262	NA	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Aroclor-1268	NA	ND	0.027	ND	0.027	ND	0.028	ND	0.026	ND	0.04	ND	0.041	ND	0.028	ND	0.025	ND	0.029	ND	0.028	ND	0.03	ND	0.05	ND	0.027
Pesticides																											
Aldrin	0.1	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Alpha-BHC	0.046	ND	0.0011	ND	0.0011	NS		NS		ND	0.0016	NS		NS		NS		ND	0.0012	NS		ND	0.0012	ND	0.002	ND	0.0011
beta-BHC	0.22	ND	0.0011	ND	0.0011	NS		NS		ND	0.0016	NS		NS		NS		ND	0.0012	NS		ND	0.0012	ND	0.002	ND	0.0011
Chlordane	49	ND	0.027	ND	0.027	NS		NS		ND	0.04	NS		NS		NS		0.047	0.029	NS		ND	0.03	ND	0.05	ND	0.027
delta-BHC	11	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Dieldrin	0.11	ND	0.0011	ND	0.0011	NS		NS		ND	0.0016	NS		NS		NS		0.0034	0.0012	NS		ND	0.0012	ND	0.002	ND	0.0011
Endosulfan I	110	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Endosulfan II	130	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Endosulfan Sulfate	70	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Endrin	5.5	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Endrin Aldehyde	NA	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Endrin Ketone	NA	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
gamma-BHC	0.072	ND	0.0011	ND	0.0011	NS		NS		ND	0.0016	NS		NS		NS		ND	0.0012	NS		ND	0.0012	ND	0.002	ND	0.0011
Heptachlor	0.68	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Heptachlor Epoxide	1.1	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
Methoxychlor	630	ND	0.0053	ND	0.0054	NS		NS		ND	0.0081	NS		NS		NS		ND	0.0058	NS		ND	0.0061	ND	0.01	ND	0.0055
p,p'-DDD	6.8	ND	0.0027	ND	0.0027	NS		NS		ND	0.004	NS		NS		NS		0.025	0.0029	NS		ND	0.003	ND	0.005	ND	0.0027
p,p'-DDE	41	0.0066	0.0027	0.003	0.0027	NS		NS		ND	0.004	NS		NS		NS		0.026	0.0029	NS		ND	0.003	ND	0.005	ND	0.0027
p,p'-DDT	53	ND	0.0027	ND	0.0027	NS		NS		ND	0.004	NS		NS		NS		0.0069	0.0029	NS		ND	0.003	ND	0.005	ND	0.0027
Toxaphene	1.2	ND	0.027	ND	0.027	NS		NS		ND	0.04	NS		NS		NS		ND	0.029	NS		ND	0.03	ND	0.05	ND	0.027

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

CLIENT ID:		GP-NP-06		DUP-1-10062010		GP-NP-07		GP-NP-08		GP-NP-04		GP-NP-05		GP-NP-09		GP-NP-10		GP-NP-11		GP-NP-12		GP-NP-13		GP-NP-03		DUP-2-10062010	
LAB ID:		AC54860-001		AC54860-002		AC54860-003		AC54860-004		AC54860-005		AC54860-006		AC54860-007		AC54860-008		AC54860-009		AC54860-010		AC54860-011		AC54860-012		AC54860-013	
COLLECTION DATE:		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/7/2010		10/6/2010	
SAMPLE MATRIX:		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
SAMPLE UNITS:		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
SemiVolatiles																											
1,2,4-Trichlorobenzene	27	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
1,2-Diphenylhydrazine	0.15	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2,4,5-Trichlorophenol	2300	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2,4,6-Trichlorophenol	3.1	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2,4-Dichlorophenol	1	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2,4-Dimethylphenol	32	ND	0.018	ND	0.018	ND	0.019	ND	0.018	ND	0.027	ND	0.027	ND	0.019	ND	0.017	ND	0.019	ND	0.019	ND	0.02	ND	0.033	ND	0.018
2,4-Dinitrophenol	0.21	ND	0.35	ND	0.36	ND	0.37	ND	0.35	ND	0.54	ND	0.55	ND	0.37	ND	0.34	ND	0.39	ND	0.37	ND	0.41	ND	0.67	ND	0.37
2,4-Dinitrotoluene	0.05	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2,6-Dinitrotoluene	1.1	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2-Chloronaphthalene	6200	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2-Chlorophenol	4.4	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2-Methylnaphthalene	2900	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2-Methylphenol	64	ND	0.018	ND	0.018	ND	0.019	ND	0.018	ND	0.027	ND	0.027	ND	0.019	ND	0.017	ND	0.019	ND	0.019	ND	0.02	ND	0.033	ND	0.018
2-Nitroaniline	0.038	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
2-Nitrophenol	5.9	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
3&4-Methylphenol	36	ND	0.018	ND	0.018	ND	0.019	ND	0.018	ND	0.027	ND	0.027	ND	0.019	ND	0.017	ND	0.019	ND	0.019	ND	0.02	ND	0.033	ND	0.018
3,3'-Dichlorobenzidine	8.3	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
3-Nitroaniline	0.03	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
4,6-Dinitro-2-methylphenol	NA	ND	0.35	ND	0.36	ND	0.37	ND	0.35	ND	0.54	ND	0.55	ND	0.37	ND	0.34	ND	0.39	ND	0.37	ND	0.41	ND	0.67	ND	0.37
4-Bromophenyl-phenylether	NA	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
4-Chloro-3-methylphenol	1100	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
4-Chloroaniline	19	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
4-Chlorophenyl-phenylether	NA	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
4-Nitroaniline	0.03	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
4-Nitrophenol	4.1	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Acenaphthene	2700	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Acenaphthylene	2500	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Anthracene	350	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Benzidine	0.078	ND	0.35	ND	0.36	ND	0.37	ND	0.35	ND	0.54	ND	0.55	ND	0.37	ND	0.34	ND	0.39	ND	0.37	ND	0.41	ND	0.67	ND	0.37
Benzo[a]anthracene	25	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.23	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Benzo[a]pyrene	2.5	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.26	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Benzo[b]fluoranthene	25	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.42	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Benzo[g,h,i]perylene	180	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.19	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Benzo[k]fluoranthene	250	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.16	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
bis(2-Chloroethoxy)methane	NA	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
bis(2-Chloroethyl)ether	0.0039	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
bis(2-Chloroisopropyl)ether	8	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
bis(2-Ethylhexyl)phthalate	130	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.25	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Butylbenzylphthalate	10000	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Carbazole	21	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Chrysene	230	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.3	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Dibenzo[a,h]anthracene	2.5	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Dibenzofuran	NA	ND	0.018	ND	0.018	ND	0.019	ND	0.018	ND	0.027	ND	0.027	ND	0.019	ND	0.017	ND	0.019	ND	0.019	ND	0.02	ND	0.033	ND	0.018
Diethylphthalate	160	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Dimethylphthalate	NA	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Di-n-butylphthalate	NA	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Di-n-octylphthalate	NA	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Fluoranthene	3200	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.49	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Fluorene	3000	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Hexachlorobenzene	0.96	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Hexachlorobutadiene	1.2	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Hexachlorocyclopentadiene	91	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.54	ND	0.55	ND	0.37	ND	0.34	ND	0.39	ND	0.37	ND	0.41	ND	0.67	ND	0.37
Hexachloroethane	0.56	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Indeno[1,2,3-cd]pyrene	25	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.16	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Isophorone	1.9	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Naphthalene	25	ND	0.018	ND	0.018	ND	0.019	ND	0.018	ND	0.027	ND	0.027	ND	0.019	ND	0.017	ND	0.019	ND	0.019	ND	0.02	ND	0.033	ND	0.018
Nitrobenzene	0.79	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
N-Nitrosodimethylamine	0.000018	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
N-Nitroso-di-n-propylamine	0.0013	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
N-Nitrosodiphenylamine	20	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Pentachlorophenol	5	ND	0.35	ND	0.36	ND	0.37	ND	0.35	ND	1.1	ND	1.1	ND	0.74	ND	0.67	ND	0.78	ND	0.74	ND	0.81	ND	1.3	ND	0.73
Phenanthrene	10000	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.21	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Phenol	66	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	ND	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073
Pyrene	2200	ND	0.071	ND	0.072	ND	0.074	ND	0.07	ND	0.11	ND	0.11	ND	0.074	ND	0.067	0.39	0.078	ND	0.074	ND	0.081	ND	0.13	ND	0.073

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

CLIENT ID:		GP-NP-06		DUP-1-10062010		GP-NP-07		GP-NP-08		GP-NP-04		GP-NP-05		GP-NP-09		GP-NP-10		GP-NP-11		GP-NP-12		GP-NP-13		GP-NP-03		DUP-2-10062010	
LAB ID:		AC54860-001		AC54860-002		AC54860-003		AC54860-004		AC54860-005		AC54860-006		AC54860-007		AC54860-008		AC54860-009		AC54860-010		AC54860-011		AC54860-012		AC54860-013	
COLLECTION DATE:		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/6/2010		10/7/2010		10/6/2010	
SAMPLE MATRIX:		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
SAMPLE UNITS:		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Volatiles																											
1,1,1-Trichloroethane	7.2	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
1,1,2,2-Tetrachloroethane	0.0093	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,1,2-Trichloroethane	0.15	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
1,1-Dichloroethane	0.65	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,1-Dichloroethene	0.19	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,2,4-Trimethylbenzene	9	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,2-Dibromoethane	0.0012	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,2-Dichlorobenzene	59	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
1,2-Dichloroethane	0.1	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,2-Dichloropropane	0.11	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,3,5-Trimethylbenzene	2.8	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
1,3-Dichlorobenzene	0.12	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
1,4-Dichlorobenzene	10	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
2-Butanone	54	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	0.031	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	0.086	0.0093	ND	0.0052
2-Chloroethylvinylether	NA	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
2-Hexanone	NA	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
4-Methyl-2-pentanone	NA	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Acetone	41	ND	0.027	ND	0.026	ND	0.028	ND	0.026	0.16	0.039	0.12	0.037	ND	0.027	0.031	0.024	0.062	0.032	0.026	0.024	ND	0.027	0.35	0.047	ND	0.026
Acrolein	0.00062	ND	0.027	ND	0.026	ND	0.028	ND	0.026	ND	0.039	ND	0.037	ND	0.027	ND	0.024	ND	0.032	ND	0.024	ND	0.027	ND	0.047	ND	0.026
Acrylonitrile	0.0087	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Benzene	0.13	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Bromodichloromethane	3.4	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Bromoform	290	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Bromomethane	0.54	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Carbon disulfide	160	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Carbon tetrachloride	0.26	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Chlorobenzene	6.1	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Chloroethane	5	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Chloroform	2.5	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Chloromethane	180	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
cis-1,2-Dichloroethene	1.6	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
cis-1,3-Dichloropropene	NA	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Dibromochloromethane	12	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Ethylbenzene	46	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Isopropylbenzene	780	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
m&p-Xylenes	990	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Methylene chloride	0.038	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Methyl-t-butyl ether	0.28	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Naphthalene	25	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
o-Xylene	99	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Styrene	24	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
Tetrachloroethene	0.43	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Toluene	44	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
trans-1,2-Dichloroethene	2.3	ND	0.0054	ND	0.0053	ND	0.0056	ND	0.0053	ND	0.0078	ND	0.0073	ND	0.0054	ND	0.0047	ND	0.0064	ND	0.0047	ND	0.0053	ND	0.0093	ND	0.0052
trans-1,3-Dichloropropene	NA	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Trichloroethene	0.17	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Vinyl chloride	0.03	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Xylenes (Total)	990	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0011	ND	0.0016	ND	0.0015	ND	0.0011	ND	0.00095	ND	0.0013	ND	0.00095	ND	0.0011	ND	0.0019	ND	0.001
Other Parameters																											
Particle Size	NA																										

Footnotes
ND - Not Detected
RL - Reporting Limit
NA - Not Applicable
NS- Not Sampled

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-NP-14		GP-NP-15	
	LAB ID:	AC54916-001		AC54916-002	
	COLLECTION DATE:	10/7/2010		10/7/2010	
	SAMPLE MATRIX:	Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg	
	Clean Fill Concentration Limits				
Analyte	mg/Kg	Result	RL	Result	RL
Herbicides					
2,4,5-T	NA	ND	0.015	NS	
2,4-D	NA	ND	0.015	NS	
Dicamba	NA	ND	0.015	NS	
Silvex	NA	ND	0.015	NS	
Metals					
Mercury	10	ND	0.12	ND	0.12
Antimony	27	ND	2.9	ND	2.8
Arsenic	12	10	2.9	4.7	2.8
Barium	8200	170	15	78	14
Beryllium	320	0.9	0.88	ND	0.85
Cadmium	38	1	0.88	0.88	0.85
Chromium	190000	42	7.4	21	7
Copper	8200	41	7.4	23	7
Lead	450	64	7.4	28	7
Nickel	650	27	7.4	20	7
Selenium	26	3	2.6	ND	2.5
Silver	84	ND	2.2	ND	2.1
Thallium	14	ND	1.8	ND	1.7
Zinc	12000	260	15	200	14
PCBs					
Aroclor (Total)	NA	ND	0.037	ND	0.035
Aroclor-1016	15	ND	0.037	ND	0.035
Aroclor-1221	0.63	ND	0.037	ND	0.035
Aroclor-1232	0.5	ND	0.037	ND	0.035
Aroclor-1242	16	ND	0.037	ND	0.035
Aroclor-1248	9.9	ND	0.037	ND	0.035
Aroclor-1254	4.4	ND	0.037	ND	0.035
Aroclor-1260	30	ND	0.037	ND	0.035
Aroclor-1262	NA	ND	0.037	ND	0.035
Aroclor-1268	NA	ND	0.037	ND	0.035
Pesticides					
Aldrin	0.1	ND	0.0074	NS	
Alpha-BHC	0.046	ND	0.0015	NS	
beta-BHC	0.22	ND	0.0015	NS	
Chlordane	49	ND	0.037	NS	
delta-BHC	11	ND	0.0074	NS	
Dieldrin	0.11	ND	0.0015	NS	
Endosulfan I	110	ND	0.0074	NS	
Endosulfan II	130	ND	0.0074	NS	
Endosulfan Sulfate	70	ND	0.0074	NS	
Endrin	5.5	ND	0.0074	NS	
Endrin Aldehyde	NA	ND	0.0074	NS	
Endrin Ketone	NA	ND	0.0074	NS	
gamma-BHC	0.072	ND	0.0015	NS	
Heptachlor	0.68	ND	0.0074	NS	
Heptachlor Epoxide	1.1	ND	0.0074	NS	
Methoxychlor	630	ND	0.0074	NS	
p,p'-DDD	6.8	ND	0.0037	NS	
p,p'-DDE	41	ND	0.0037	NS	
p,p'-DDT	53	ND	0.0037	NS	
Toxaphene	1.2	ND	0.037	NS	

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-NP-14		GP-NP-15	
	LAB ID:	AC54916-001		AC54916-002	
	COLLECTION DATE:	10/7/2010		10/7/2010	
	SAMPLE MATRIX:	Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg	
	Clean Fill Concentration Limits				
Analyte	mg/Kg	Result	RL	Result	RL
SemiVolatiles					
1,2,4-Trichlorobenzene	27	ND	0.098	ND	0.094
1,2-Diphenylhydrazine	0.15	ND	0.098	ND	0.094
2,4,5-Trichlorophenol	2300	ND	0.098	ND	0.094
2,4,6-Trichlorophenol	3.1	ND	0.098	ND	0.094
2,4-Dichlorophenol	1	ND	0.098	ND	0.094
2,4-Dimethylphenol	32	ND	0.025	ND	0.023
2,4-Dinitrophenol	0.21	ND	0.49	ND	0.47
2,4-Dinitrotoluene	0.05	ND	0.098	ND	0.094
2,6-Dinitrotoluene	1.1	ND	0.098	ND	0.094
2-Chloronaphthalene	6200	ND	0.098	ND	0.094
2-Chlorophenol	4.4	ND	0.098	ND	0.094
2-Methylnaphthalene	2900	ND	0.098	ND	0.094
2-Methylphenol	64	ND	0.025	ND	0.023
2-Nitroaniline	0.038	ND	0.098	ND	0.094
2-Nitrophenol	5.9	ND	0.098	ND	0.094
3&4-Methylphenol	36	ND	0.025	ND	0.023
3,3'-Dichlorobenzidine	8.3	ND	0.098	ND	0.094
3-Nitroaniline	0.03	ND	0.098	ND	0.094
4,6-Dinitro-2-methylphenol	NA	ND	0.49	ND	0.47
4-Bromophenyl-phenylether	NA	ND	0.098	ND	0.094
4-Chloro-3-methylphenol	1100	ND	0.098	ND	0.094
4-Chloroaniline	19	ND	0.098	ND	0.094
4-Chlorophenyl-phenylether	NA	ND	0.098	ND	0.094
4-Nitroaniline	0.03	ND	0.098	ND	0.094
4-Nitrophenol	4.1	ND	0.098	ND	0.094
Acenaphthene	2700	ND	0.098	ND	0.094
Acenaphthylene	2500	ND	0.098	ND	0.094
Anthracene	350	ND	0.098	ND	0.094
Benzidine	0.078	ND	0.49	ND	0.47
Benzo[a]anthracene	25	0.11	0.098	0.21	0.094
Benzo[a]pyrene	2.5	ND	0.098	0.15	0.094
Benzo[b]fluoranthene	25	0.11	0.098	0.2	0.094
Benzo[g,h,i]perylene	180	ND	0.098	ND	0.094
Benzo[k]fluoranthene	250	ND	0.098	ND	0.094
bis(2-Chloroethoxy)methane	NA	ND	0.098	ND	0.094
bis(2-Chloroethyl)ether	0.0039	ND	0.098	ND	0.094
bis(2-Chloroisopropyl)ether	8	ND	0.098	ND	0.094
bis(2-Ethylhexyl)phthalate	130	ND	0.098	0.16	0.094
Butylbenzylphthalate	10000	ND	0.098	ND	0.094
Carbazole	21	ND	0.098	ND	0.094
Chrysene	230	0.098	0.098	0.17	0.094
Dibenzo[a,h]anthracene	2.5	ND	0.098	ND	0.094
Dibenzofuran	NA	ND	0.025	ND	0.023
Diethylphthalate	160	ND	0.098	ND	0.094
Dimethylphthalate	NA	ND	0.098	ND	0.094
Di-n-butylphthalate	NA	ND	0.098	ND	0.094
Di-n-octylphthalate	NA	ND	0.098	ND	0.094
Fluoranthene	3200	0.18	0.098	0.27	0.094
Fluorene	3000	ND	0.098	ND	0.094
Hexachlorobenzene	0.96	ND	0.098	ND	0.094
Hexachlorobutadiene	1.2	ND	0.098	ND	0.094
Hexachlorocyclopentadiene	91	ND	0.49	ND	0.47
Hexachloroethane	0.56	ND	0.098	ND	0.094
Indeno[1,2,3-cd]pyrene	25	ND	0.098	ND	0.094
Isophorone	1.9	ND	0.098	ND	0.094
Naphthalene	25	ND	0.025	ND	0.023
Nitrobenzene	0.79	ND	0.098	ND	0.094
N-Nitrosodimethylamine	0.000018	ND	0.098	ND	0.094
N-Nitroso-di-n-propylamine	0.0013	ND	0.098	ND	0.094
N-Nitrosodiphenylamine	20	ND	0.098	ND	0.094
Pentachlorophenol	5	ND	0.98	ND	0.94
Phenanthrene	10000	0.14	0.098	0.14	0.094
Phenol	66	ND	0.098	ND	0.094
Pyrene	2200	0.19	0.098	0.25	0.094

Table 1
Jacks Marina / Neshaminy State Park
Soil Sample Results

	CLIENT ID:	GP-NP-14		GP-NP-15	
	LAB ID:	AC54916-001		AC54916-002	
	COLLECTION DATE:	10/7/2010		10/7/2010	
	SAMPLE MATRIX:	Soil		Soil	
	SAMPLE UNITS:	mg/Kg		mg/Kg	
	Clean Fill Concentration Limits				
Analyte	mg/Kg	Result	RL	Result	RL
Volatiles					
1,1,1-Trichloroethane	7.2	ND	0.0067	ND	0.0065
1,1,2,2-Tetrachloroethane	0.0093	ND	0.0013	ND	0.0013
1,1,2-Trichloroethane	0.15	ND	0.0067	ND	0.0065
1,1-Dichloroethane	0.65	ND	0.0013	ND	0.0013
1,1-Dichloroethene	0.19	ND	0.0013	ND	0.0013
1,2,4-Trimethylbenzene	9	ND	0.0013	ND	0.0013
1,2-Dibromoethane	0.0012	ND	0.0013	ND	0.0013
1,2-Dichlorobenzene	59	ND	0.0067	ND	0.0065
1,2-Dichloroethane	0.1	ND	0.0013	ND	0.0013
1,2-Dichloropropane	0.11	ND	0.0013	ND	0.0013
1,3,5-Trimethylbenzene	2.8	ND	0.0013	ND	0.0013
1,3-Dichlorobenzene	0.12	ND	0.0067	ND	0.0065
1,4-Dichlorobenzene	10	ND	0.0067	ND	0.0065
2-Butanone	54	0.031	0.0067	0.022	0.0065
2-Chloroethylvinylether	NA	ND	0.0067	ND	0.0065
2-Hexanone	NA	ND	0.0067	ND	0.0065
4-Methyl-2-pentanone	NA	ND	0.0067	ND	0.0065
Acetone	41	0.13	0.033	0.11	0.033
Acrolein	0.00062	ND	0.033	ND	0.033
Acrylonitrile	0.0087	ND	0.0067	ND	0.0065
Benzene	0.13	ND	0.0013	ND	0.0013
Bromodichloromethane	3.4	ND	0.0013	ND	0.0013
Bromoform	290	ND	0.0067	ND	0.0065
Bromomethane	0.54	ND	0.0067	ND	0.0065
Carbon disulfide	160	ND	0.0067	ND	0.0065
Carbon tetrachloride	0.26	ND	0.0067	ND	0.0065
Chlorobenzene	6.1	ND	0.0067	ND	0.0065
Chloroethane	5	ND	0.0067	ND	0.0065
Chloroform	2.5	ND	0.0067	ND	0.0065
Chloromethane	180	ND	0.0067	ND	0.0065
cis-1,2-Dichloroethene	1.6	ND	0.0067	ND	0.0065
cis-1,3-Dichloropropene	NA	ND	0.0013	ND	0.0013
Dibromochloromethane	12	ND	0.0013	ND	0.0013
Ethylbenzene	46	ND	0.0013	ND	0.0013
Isopropylbenzene	780	ND	0.0013	ND	0.0013
m&p-Xylenes	990	ND	0.0013	ND	0.0013
Methylene chloride	0.038	ND	0.0067	ND	0.0065
Methyl-t-butyl ether	0.28	ND	0.0013	ND	0.0013
Naphthalene	25	ND	0.0013	ND	0.0013
o-Xylene	99	ND	0.0013	ND	0.0013
Styrene	24	ND	0.0067	ND	0.0065
Tetrachloroethene	0.43	ND	0.0013	ND	0.0013
Toluene	44	ND	0.0013	ND	0.0013
trans-1,2-Dichloroethene	2.3	ND	0.0067	ND	0.0065
trans-1,3-Dichloropropene	NA	ND	0.0013	ND	0.0013
Trichloroethene	0.17	ND	0.0013	ND	0.0013
Vinyl chloride	0.03	ND	0.0013	ND	0.0013
Xylenes (Total)	990	ND	0.0013	ND	0.0013

Footnotes
ND - Not Detected
RL - Reporting Limit
NA - Not Applicable
NS- Not Sampled

ATTACHMENT A

TPI GEOPHYSICAL INVESTIGATION

October 6, 2010

Pat McDonald
Weston Solutions, Inc.
1400 Weston Way, PO Box 2653
Westchester, PA 19380

Project: Geophysical Survey – Jack's Marina – Croydon, PA

Dear Pat;

The following is a brief letter report detailing the results of the geophysical survey performed at the above referenced site. Site maps and/or pertinent ground penetrating radar (GPR) transects are contained in the report and Appendix A. It would be helpful to review Appendix A and the site maps when reading this report. TPI's standard practice is to indicate the results of the geophysical survey by marking all identified utility lines, tanks, and GPR anomalies etc. with chalk, paint or flags. It should be noted that this report is a means of transferring data and results of data interpretation, which was performed during the time allotted for the fieldwork

Project Scope and Visual Site Inspection

TPI Environmental, Inc. (TPI) was contracted by Weston Solutions, Inc. (client) to clear soil borings and locate private utilities in the immediate vicinity of the borings. TPI was also tasked with confirming or denying the presence of potential underground storage tanks (USTs) in the southernmost extent of the site. The site consists of an abandoned and partially demolished marina. Upon arrival to the site on October 4, 2010, TPI performed a site walk to review one call utility mark outs and evidence of other on-site utilities in the vicinity of the borings. During the site walk the following areas of interest were noted;

- Utilities not marked and to be investigated during the survey include; water, private electric, storm sewer, and the sanitary sewer.
- TPI was directed to the location to be scanned for potential USTs (demolished fueling station). No initial evidence of USTs (i.e. vents, fill ports) was observed in the area.

Methodology

Geophysical surveys are typically accomplished by employing the following techniques; GPR, Fisher TW6 electromagnetic metal detection (TW6 EM), a Geonics EM61-MK2 Time – Domain Electromagnetic Detector unit (EM61), radio frequency line locating (RF), and magnetics. Known utilities are typically traced with the RF unit, GPR, and the TW6 EM unit depending on the size, matrix and conductive properties of the line. The EM61 is a high power, high sensitivity metal detector capable of detecting both ferrous and non-ferrous metal. The TW6 EM unit sounds an audible alarm in the presence of a large mass of metal such as an UST. A description and discussion of these geophysical methods as well as TPI's standard procedures for performing geophysical surveys is found in Appendix A. In general, "blind surveys" are

typically performed by initially scanning the site with a TW6 EM unit and/or an EM61 unit and noting areas of relatively high EM response. Then locations with high EM response are further investigated with GPR. EM units are typically not effective and practical in areas underlain with reinforced concrete and/or the presence of ubiquitous metallic objects.

Geophysical Survey Results

The geophysical survey at this site was accomplished with the EM61, RF and GPR units. Known utilities were traced and confirmed with the GPR and RF units then the borings were scanned and cleared with the GPR unit. An EM61 scan was conducted throughout the fueling station area where accessible (Figure 1, 2). Access was often restricted due to overgrown vegetation. Results of the geophysical survey were marked on the ground with paint and a map of the geophysical survey result as well as pertinent GPR images are contained in this report. Results of the geophysical survey are as follows;

- No UST-like EM or GPR anomalies were detected within the accessible areas of the demolished fueling station (Figure 2). Two linear EM/GPR anomalies (A1, A2) were detected (Figure 1, 2).
- Fifteen soil boring locations were scanned, moved as needed, and marked with white paint.

TPI completes non-intrusive geophysical surveys using equipment and techniques representing best available technology. TPI does not accept responsibility for survey limitations due to inherent technological limitations or unforeseen and varying site-specific conditions such as metal-reinforced concrete. In practical terms, TPI serves to reduce the risk of encountering subsurface utilities during excavation operations or greatly increase the chance of locating man made subsurface objects depending on the goal of the project. The results of this investigation should only be used as a tool and should not be considered a guarantee regarding the presence or absence of USTs or piping.

If you should require additional information or have any questions, please do not hesitate to contact me at the above phone number or email me at ffendler@tpienv.com.

Sincerely,

Frank Fendler

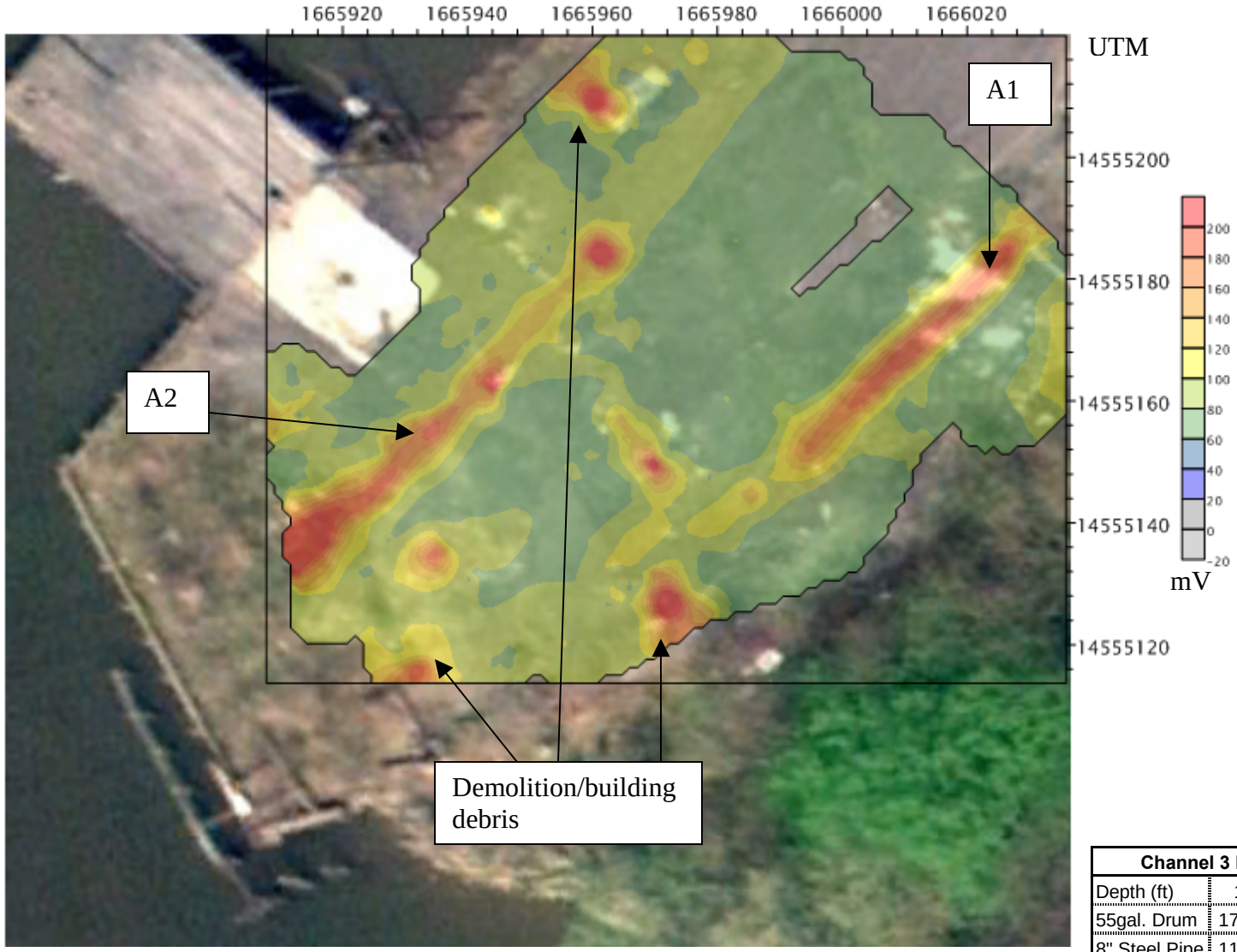
Frank Fendler, M.S, P.G.
President

Michael Robbins

Michael Robbins, M.S.
Geologist

LEGEND
Abandoned electric
EM/GPR anomaly

TPI environmental	Scale	Jack's Marina, Croydon PA		Figure 1
	NTS	Client: Weston	Date: 10-4-10	Geophysical Survey Results



Channel 3 Relative Response (Mv)							
Depth (ft)	1	2	3	4	5	6	7
55gal. Drum	1700	500	160	60	28	13	7
8" Steel Pipe	1150	340	120	47	21	10	5

TPI environmental

Jack's Marina, Croydon PA

Client: Weston

Date: 10-4-10

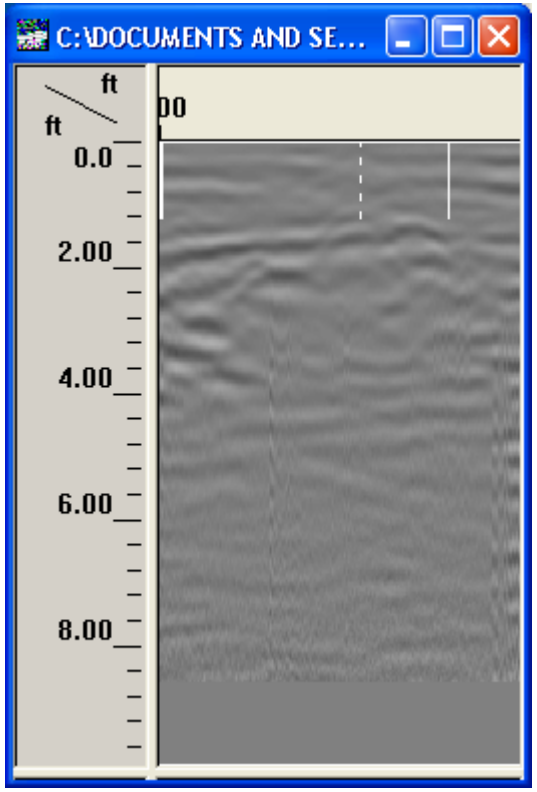
Figure 2

AOC1 EM61 Survey Results – Channel D

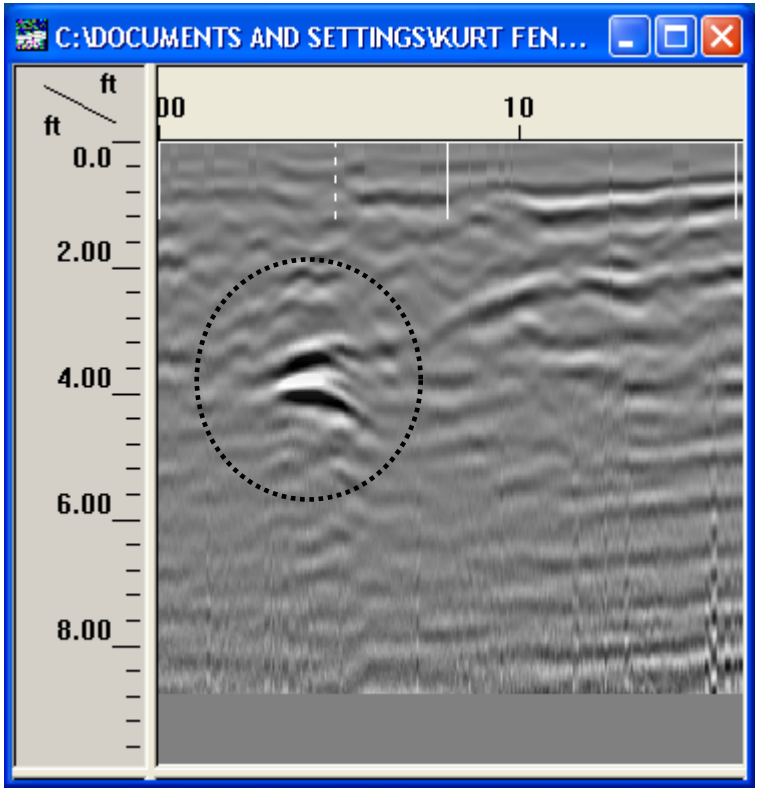
Appendix A

Geophysical Survey Data & Results

GPR Transect 912
East Across SB 7



GPR Transect 913
East Across A2



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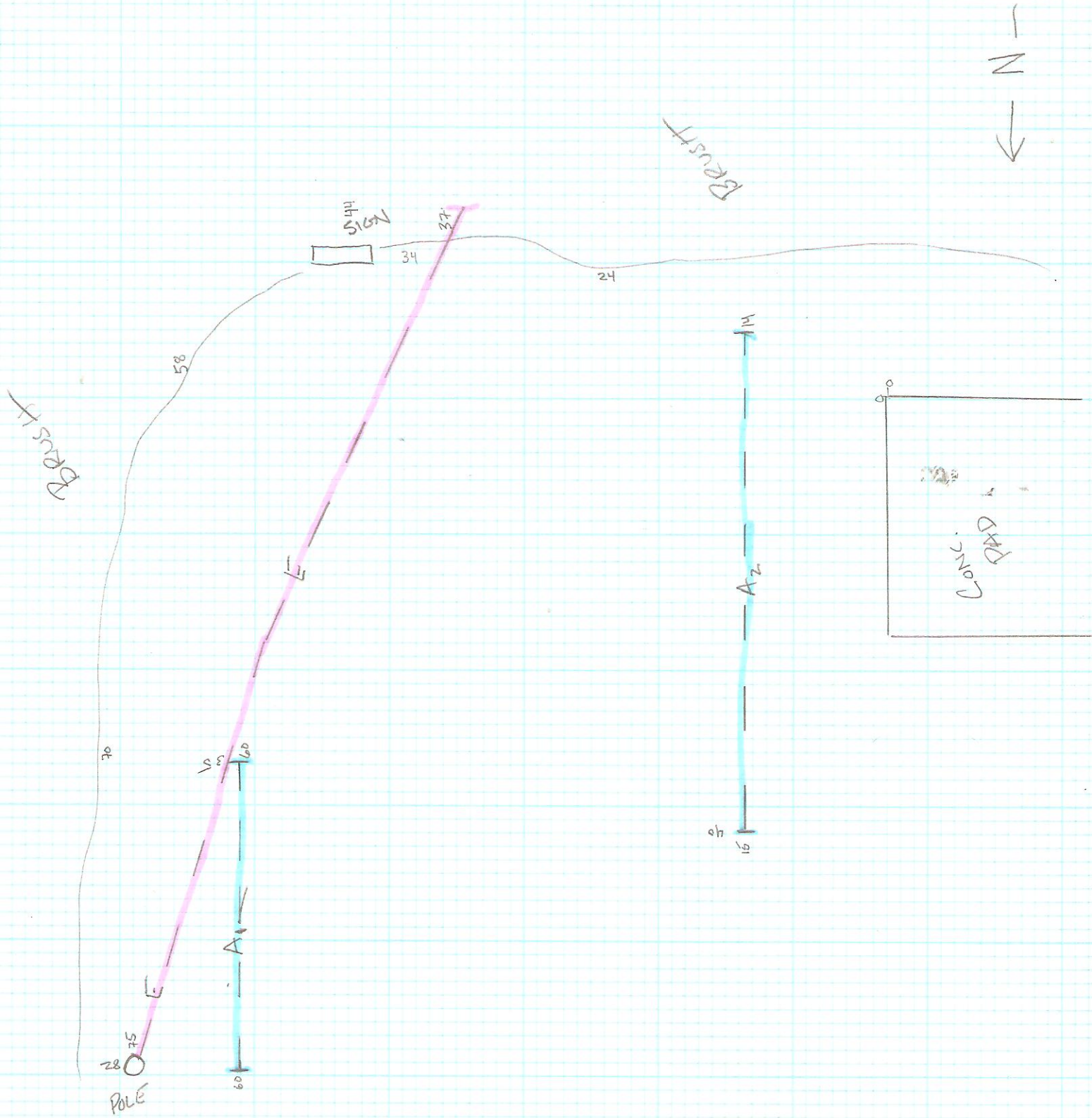


Weston - Croydon
Jack's Marina
10/4/10

A — Anomaly
E — Electric

Field Notes

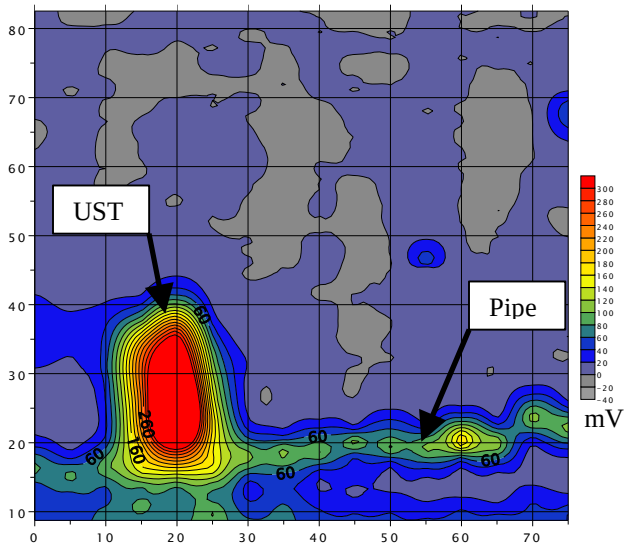
TPI Environmental, Inc.
888-204-3266

Attachment A
TPI's Geophysical Survey Equipment & Methods

Geonics EM61-MK2

The EM61 is a high resolution time-domain metal detector which is used to detect ferrous and non-ferrous metallic objects. It consists of a powerful transmitter that generates a pulsed primary magnetic field, which induces eddy currents in nearby metallic objects. The decay of these currents is measured by two receiver coils mounted on the coil assembly. The responses are recorded and displayed by an integrated computer based digital data logger with real time numberical and graphic display. Two ports on the logger allows simultaneous collection of EM and GPS data. For further processing and interpretation data can be transferred to a laptop computer in the field and a color contoured map of the EM61 reponse is prepared (see below).

EM61 Color Contoured Map



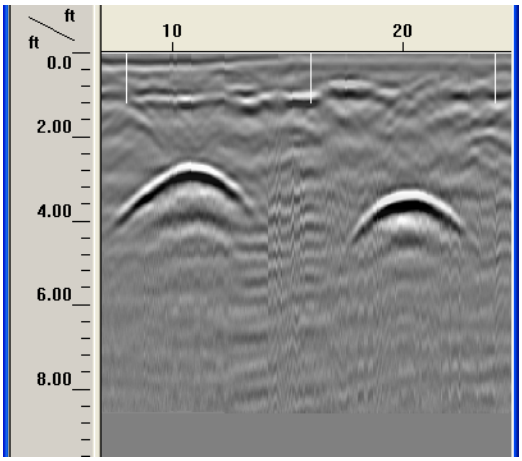
The EM61-MK2 detects a single 55 gallon drum at a depth of over 10-feet beneath the instrument, yet it is relatively insentsitive to interference from nearby surface metal such as fences, buildings, cars, etc. By making the measurement at a relatively long time after termination of the primary pulse, the response is practically independent of the electrical conductivity fo the ground.

Due to it unique coil arrangements, the response curve is a single well defined positive peak greatly facilitating quick and accurate location of the target, the depth of which can usually be estimated from the width of the response and/or from relative response from each of the two receiver coils.

GPR

This method is one of the most powerful and cost effective methods of locating man made objects and stratigraphic layers in the subsurface. It is an active method that transmits electromagnetic pulses into the ground, the radar pulses are reflected from materials or layers of differing dielectric and electrical conductive properties. The GPR computer measures the elapsed time in billionths of a second (nanoseconds) from when the pulses are sent and when they are received back at the surface that can then be converted to depth. Results of the radar scan are displayed as a continuous cross section of the subsurface on the computer screen in real time. Metallic materials such as tanks, pipes conduits, rebar etc. have vastly different dielectric properties then soils so there reflections are striking and relatively easy to identify. Pipes and tanks constructed of PVC, concrete, and terracotta also produce distinct reflections, however, these reflections are typically not as striking as metallic materials. A typical radar image of two metallic underground storage tanks is found below.

GPR Image Of Two Metallic USTs



GPR surveys are conducted with the most advanced GPR equipment currently available

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including a Geophysical Survey Systems (GSSI) SIR-3000 subsurface radar unit with a 400 MHz antenna. The 400 MHz antenna has a depth range of approximately 20-feet and other antennas may be employed with the system depending on specific site conditions and objectives of the survey. The GPR transect data may be saved on the internal hard drive and transferred to a PC for storage, printing, and post processing. GSSI is the world leader in the development of GPR systems and was the first company to commercialize GPR in 1970. GPR hardware and software has improved dramatically over the last several years allowing for relatively rapid and economical GPR surveys. With 3-dimensional capabilities, the latest GPR software takes data processing a step farther then the former 2-dimensional viewing method. Three-dimensional visualization helps you to see the whole picture, giving you a powerful tool to interpret complex utility layouts and identify subtle linear features that may have otherwise been missed.

GPR surveys are typically conducted by searching for GPR hyperbolas indicative of subsurface pipes or tanks signatures in the vicinity of known entities. Theses signatures are marked on the ground and areas progressively further from the known entity are scanned and marked. This process is continued until the GPR operator performed enough scans to determine and mark the subsurface pipe, tank or anomaly. During this process the GPR data is typically not saved due to the immense size of the data files. After this phase of the GPR survey is completed, representative GPR transects or grids are performed and saved for the report and post processing. Some of the factors that may negatively affect GPR results include clay soils, rebar in concrete, high moisture content, depth of the target, and the integrity, size, and material of the target.

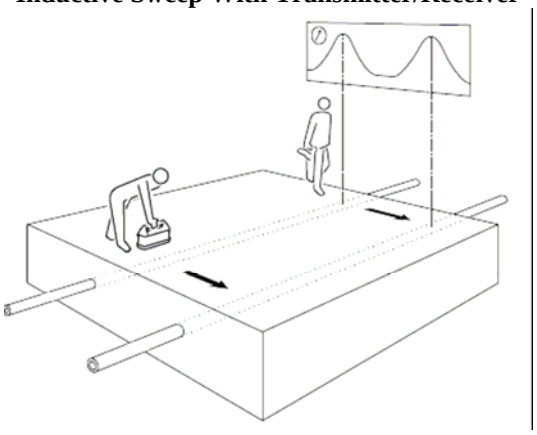
TW-6 EM Unit

TPI routinely employs a Fisher TW-6 electromagnetic metal detector when performing GPR surveys. The TW-6 creates an electromagnetic field with a transmitting coil and measures the strength of that field with a receiving coil. As the TW-6 passes over electrically conductive materials such as metal tanks or drums the field is distorted and the instrument produces an audible alarm based on the degree of the distortion. The TW-6 can detect conductive materials the size of drums or small tanks to depths of 10-feet. The instrument is actually a relatively poor metal detector which makes it ideal for locating large conductive materials such as metal drums, medium to large metal pipes, reinforced concrete pipes, and metal tanks. A more sensitive metal detector would produce "false positives" on small pieces of metal that are typically found in fill and throughout developed sites. If the survey area is underlain by reinforced concrete or cars and other large surficial metallic features are within 10-feet, the TW-6 will not be useful.

Line Locating

Line locating is performed with a Radiodetection RD400 PXL-2 line locator with a 433 HCTX-2 transmitter. The transmitter emits a specific radio or electromagnetic signal which is indirectly induced or directly conducted onto the metallic line. The transmitter is capable of producing frequencies of 512 Hz, 8 kHz, or 33 kHz and the receiver is configured for the specific transmitted frequency. The induced signal is coupled with the line by either using an induction clamp which surrounds an exposed line or placing the transmitter above a buried line and transmitting the signal to it. The receiver may also be used in a passive locate mode (power) to identify the presence of current carrying lines. Nonmetallic lines may also be located by snaking a sonde down accessible lines with push rods. A sonde is a small transmitter that emits a specific electromagnetic frequency which can be detected by the receiver at depths of 12 to 16-feet.

Inductive Sweep With Transmitter/Receiver



ATTACHMENT B

BORING LOGS

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON	SOIL BORING LOG	PAGE 1 OF 1

Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-1**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	Dry	ASPHALT		
	1	GP		Dry	f SAND with silt, tan/orange, some clay	0	95
4				Moist	vf SAND , brown to black, trace silt and clay	0	
	2	GP				0	97.5
8						0	
	3	GP		Moist	SAA but all brown	0	100
12						0	
16							
20							
24							
					Encore collected at 7' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON	SOIL BORING LOG			PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-2**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	GRAVEL, gray, c sand	0	100
4				wet	GRAVEL with black, c sand	0	
	2	GP				0	90
8				wet	m/c SAND, gray, trace silt	0	
	3	GP				0	95
12				wet	c SAND, orange	0	
	4						
16							
20							
24							
					Encore collected at 7'-9" bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-3**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT	82	
	1	GP		dry	GRAVEL with c sand, gray and black, some wood pieces		50
4						0	
				moist	f SAND with trace clay and silt, dark brown		
	2	GP		moist	SAA, orange	0	95
8						0	
	3	GP				0	90
12				wet	c SAND with pebbles		
16							
20							
24							
					Encore Collected at 7' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-4**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
4	1	GP	NA	dry	FILL, gravel, wood, some brick fragments	0 0	75
8	2	GP				0 0	80
	3	GP				0	95
12				moist	m/f SAND, some silt, trace gravel	0	
16							
20							
24							
					Encore collected at 11' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON	SOIL BORING LOG			PAGE 1 OF 1
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-5**	**Groundwater Level**
Job No.	**14637.001.002.0016.03**			**Date Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe	Not Encountered
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs	
Drill Foreman		**Location**	Jack's Marina	
Logged By	PH	**Survey Data**		

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	SILT, brown, some gravel and f/m sand	0	100
4					SAA, no gravel, trace organics	0	
	2	GP		moist	SILT, dark brown, some f/m sand, trace organics and little clay	0	100
					clay increases with depth		
8						0	
	3	GP				0	100
12						0	
16							
20							
24							
					Encore collected at 7'-6" bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-6**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	TOPSOIL		
	1	GP		dry	STONE FILL, gray, some brown silt and brock fragments	0	92.5
4						0	
	2	GP				0	100
8						0	
				moist	c SAND, black, some wood fragments, odor		
	3	GP				6.9	37.5
12							
16							
20							
24							
					Encore at 9' bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-7**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	GRAVEL FILL, some brick and a few wood fragments	0	100
4						0	
	2	GP				0	50
8						0	
	3	GP		moist	SILT, tan/brown, some clay and trace organics	0	77.5
12						0	
16							
20							
24							
					Encore collected at 11' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-8**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	GRAVEL FILL	0	82.5
				dry	STONE fill with some brick		
4						0	
	2	GP		moist	soft, plastic CLAY, gray, trace organics	0	82.5
8				moist	CLAY, orange, some f sand, some silt	0	
				wet	c SAND with gravel, orange		
	3	GP				0	50
12						0	
16							
20							
24							
					Encore collected at 7' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-9**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	TOPSOIL		
	1	GP		dry	stone rubble, bricks, cinder	0	100
4						0	
	2	GP		moist	SILT and CLAY, brown, organics	0	100
8						0	
	3	GP				0	100
12						0	
16							
20							
24							
					Encore collected at 6' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-10**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	5 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	TOPSOIL		
	1	GP		dry	SILT, brown, some fine sand and little wood pieces	0	60
				dry	GRAVEL and BRICK		
4				moist	SILT, some gravel and clay, trace organics	0	
	2	GP		moist	rock fragments, light gray	0	95
				moist	CLAY with some silt and organics		
8						0	
	3	GP				0	92.5
12						0	
16							
20							
24							
					Encore collected at 7' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-11**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	5 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	TOPSOIL		
	1	GP				0	100
				dry	SILT and CLAY with trace organics		
4						0	
				moist	SAA		
	2	GP				0	100
8						0	
	3	GP		wet	SAA	0	100
				wet	CLAY with silt and organics, some black staining		
12						0	
16							
20							
24							
					Encore collected at 10'-6" bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-12**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	5 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	TOPSOIL		
	1	GP		moist	SILT, dark brown, some clay, trace gravel and trace organics	0	82.5
4						0	
	2	GP		moist	COBBLES, light gray, c sand	0	82.5
				moist	CLAY with silt and organics		
8						0	
	3	GP		moist	c SAND, gray, some pebbles	0	100
				moist	CLAY with some silt		
12						0	
16							
20							
24							
					Encore collected at 6' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-13**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	GRAVEL FILL	0	92.5
4						0	
	2	GP		wet	c SAND, gray	0	75
8						0	
	3	GP				0	100
12				moist	organic SILT, brown	0	
16							
20							
24							
					Encore collected at 11' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-14**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	GRAVEL FILL	0	85
4						0	
	2	GP		moist	c/m SAND, gray	0	90
8						0	
	3	GP				0	100
12				moist	organic SILT, brown	0	
16							
20							
24							
					Encore collected at 11' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON	SOIL BORING LOG			PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-JM-15**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	4 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Jack's Marina		
Logged By	PH	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	dry	ASPHALT		
	1	GP		dry	GRAVEL FILL	0	85
4				dry	SILT with some organics	0	
	2	GP				0	90
8						0	
	3	GP		moist	m/c SAND, tan	0	100
12				moist	CLAY, brown, some silt	0	
16							
20							
24							
					Encore collected at 11' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-3**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	7 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
	1	GP	NA	wet	clayey SILT, gray, some organics	0	80
4						0	
	2	GP				0	27.5
8						0	
	3	GP				0	50
12						0	
16							
20							
24							
					Encore collected at 10' bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-4**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
	1	GP	NA	wet	clayey SILT, gray, organic (reeds) throughout, brownish	0	25
4						0	
	2	GP				0	90
8						0	
	3	GP				0	75
12						0	
16							
20							
24							
					Encore collected at 10.5' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-5**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	wet	clayey SILT, gray, organic (reeds) throughout, brownish		
	1	GP			2" layer of c/m/f black SAND at 1.0'	0	25
4						0	
	2	GP				0	90
8						0	
	3	GP				0	75
12						0	
16							
20							
24							
					Encore collected at 5' bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-6**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	wet	SILT, brown, some f sand		
	1	GP		dry	SAA	0	
4				dry	f/c GRAVEL, brown and white, some f/m sand	0	
	2	GP				0	
8						0	
	3	GP				0	
12						0	
16							
20							
24							
					Encore collected at 1.5' bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-7**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	SILT, dark brown, trace f sand with a 2" detritus layer		
	1	GP				0	
				dry	SILT, brown		
4				dry	SILT, light brown	0	
	2	GP				0	
				dry	GRAVEL and SAND, tan and brown, trace silt		
8						0	
				wet	SAA		
	3	GP				0	
12						0	
16							
20							
24							
					Encore collected at 3.5' bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-8**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	SILT, dark brown, trace f sand with a 3" detritus layer		
	1	GP		moist	SILT, light brown	0	
4				moist	SILT, brown	0	
				moist	f/c GRAVEL and c/m/f SAND, brown		
	2	GP				0	
8						0	
	3	GP				0	
12						0	
16							
20							
24							
					Encore collected at 3.0' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-9**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	m/f micaceous SAND, 2" detritus layer at top		
	1	GP				0	77.5
				dry	m/f SAND, tan		
4						0	
	2	GP		dry	m/c/f SAND, brown and tan, some f rounded pebbles	0	75
8						0	
	3	GP		wet	m/c/f SAND, gray, trace f rounded gravel	0	62.5
12						0	
16							
20							
24							
					Encore collected at 1.5' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-10**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	SILT with detritus, brown		
	1	GP		moist	m/f SAND, brown, trace silt	0	80
4				dry	m/f SAND, tan	0	
	2	GP				0	90
				dry	SAA with f rounded GRAVEL, white		
8				moist	m/c/f SAND, brown	0	
	3	GP				0	80
12						0	
16							
20							
24							
					Encore collected at 0.5' bgs.		

***Sample type:** **SS-Split Spoon** **Grain Size:** **F-Fine**
RC-Rock Core **M-Medium**
GP-GeoProbe Sleeve **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-11**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	SILT, brown		
	1	GP				0	75
4				moist	c/m/f SAND, brown (oxidation)	0	
				dry	m/f SAND, gray		
	2	GP		moist	m/f SAND, brown	0	95
8				moist	c/m/f SAND, brown, some fine gravel	0	
	3	GP				0	80
12						0	
16							
20							
24							
					Encore collected at 2.5' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-12**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	SILT, brown, 2" detritus layer at top		
	1	GP		dry	m/f micaceous SAND, brown, some f gravel	0	97.5
				dry	m/f SAND, brown		
4				dry	SAA except tan	0	
	2	GP				0	77.5
8				moist	f gravelly, m/c/f SAND, trace silt	0	
	3	GP		wet		0	52.5
12				wet	m/c/f SAND, gray	0	
16							
20							
24							
					Encore collected at 10.5' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-13**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	6 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
			NA	moist	SILT, brown, 2" detritus layer at top		
	1	GP		moist	m/c/f SAND	0	95
4				wet	c/f GRAVEL and c/m/f SAND	0	
	2	GP			m/c/f SAND, gray, some f/c gravel, sappolite, pieces of schist	0	97.5
8						0	
	3	GP				0	70
12						0	
16							
20							
24							
					Encore collected at 8.0' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-14**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	7 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
4	1	GP	NA	moist	m/c/f SAND, brown, detritus layer top 6"	0 0	77.5
8	2	GP		wet	m/c/f SAND, gray	0 0	65
	3	GP				0	62.5
12				wet	m/f SAND with interbedded fat clay, gray and tan	0	
16							
20							
24							
					Encore collected at 11.5' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

PRPA -- Southport
Jack's Marina / Neshaminy Park

WESTON		SOIL BORING LOG		PAGE 1 OF 1	
Job Name	**PRPA -- Jack's/Neshaminy**	**Boring No.**	**GP-NP-15**	**Groundwater Level**	
Job No.	**14637.001.002.0016.03**			**Date**	**Depth*** **
Date Drilled	7 October 2010	**Boring Method**	Geoprobe		
Drilling Co.	TPI	**Completion Depth**	12.0 ft bgs		
Drill Foreman		**Location**	Neshaminy Park		
Logged By	AB	**Survey Data**			

Depth (feet)	Sample No.	Sample Type*	Sample Blow Counts** (per 6 in.)	Moisture	Visual Description	OVM (ppm)	% Rec
4	1	GP	NA	moist	m/c/f SAND, brown, trace f gravel, detritus layer top 6"	0 0	85
8	2	GP		wet	m/c/f SAND, gray	0 0	50
	3	GP				0	0
12						0	
16							
20							
24							
					Encore collected at 11.5' bgs.		

***Sample type:** **SS-Split Spoon** **RC-Rock Core** **GP-GeoProbe Sleeve**

Grain Size: **F-Fine** **M-Medium** **C-Course**

****ASTM D-1586 Standard Penetration Test**

*****Depth measured from top of inner casing**

ATTACHMENT C

LABORATORY DATA PACKAGES

ATTACHMENT 2

REPORTS FROM PRIOR PROPOSED DEVELOPMENT AT JACK'S MARINA

All files are in a PDF
portfolio on this disk.
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