4.0 EXISTING CONDITIONS

4.1 Natural Resources

4.1.1 Geology

Middlesex County lies within two major physiographic provinces, the Coastal Plain and the Piedmont provinces, while Union County is within the Piedmont Province. The differences in the two provinces are based upon the rocks, bedrock structure, and the geomorphic history of the location. The project area is located within the Coastal Plain physiographic province in Middlesex County and the Piedmont Province in Union County. This area is underlain by unconsolidated sands and clays of the Cretaceous age. The Coastal Plain has a nearly level topography with slight undulations. The elevation ranges between 0 and 140 feet above mean sea level.

The portion of the Coastal Plain within the project area was subject to a period of glaciation, which resulted in the formation of a layer of till, or recessional moraine. The glacier's terminal moraine, which is comprised of cobbles and boulders of clay, silt and sand, is along a line from Perth Amboy to South Plainfield.

4.1.2 Soils

4.1.2.1 Regional Description

The U.S. Department of Agriculture, Soil Conservation Service has prepared a soil survey for Middlesex County and Union County, New Jersey (USDA, SCS 1987) (Figure No. 14). This survey indicates that there are three soil-mapping units in the vicinity of the proposed TPCR. These include:

- **Psamments, wet substratum (PW) –** This soil unit consists of excessively drained to well drained soils that have been used to cover landfills. The surface in most areas is smoothed and the topography is nearly level to gently sloping. Included in this soil unit are areas of Sulfaquents and Sulfihemists, most of which was also used as landfill cover material. The characteristics of this unit are variable with the depth of the soil generally ranging between 2 and 4 feet thick, covering layers of soil and household and industrial trash.

- **Sulfaquents and Sulfihemists, frequently flooded (SU) –** This soil unit consists of level, very poorly drained organic soils located along the Rahway River. The soils are found in tidal marshes and are subject to tidal flooding. Generally, the Sulfaquents will have a surface layer of mucky silt loam over a sandy substratum.

Soils Type

- PsuB - Psamments, waste substratum, 0 to 8 percent slopes
- TrkAv - Transquaking mucky peat, 0 to 2 percent slopes, very frequently flooded
- UR - Urban land
- UdkttB - Udorthents, loamy substratum, 0 to 8 percent slopes
- UdoB - Udorthents, organic substratum, 0 to 8 percent slopes
- WATER - Water

Legend

Tremley Point Connector Road

Source:
USDA SSURGO Soil Database of Union and Middlesex counties, 2007
Access Alternatives From New Jersey Turnpike To Tremley Point, Dated November 2006, Drawn by Edwards & Kelsey.
ArcGIS Online – Aerials Express, 2006.

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TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET,
MIDDLESEX COUNTY,
CITY OF LINDEN
UNION COUNTY, NEW JERSEY

SOILS MAP

Drn By: JFA	Scale: 1" = 500'	Project: 02595.003.004
Ch'kd By: IPD	Date: 8/15/08	Figure No. : 14

Map Document: (P:\02595\003\Y\N\Maps\Fig14_soils_081508_05.mxd)
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The Sulfihemists are mucky soils that range in thickness from 18 to 60 inches or more, but are typically about 24 inches thick over a sandy substratum. The permeability of this soil unit is moderate, and available water capacity is high. The water table is near the surface and fluctuates very little throughout the year. Reaction of the soil in most areas is strongly acidic to neutral. If excavated and exposed to oxygen, the organic matter in these soils oxidizes and forms sulfides that become extremely acidic.

- **Urban Land (UL)** – The Urban Land mapping unit consists of areas where industrial plants, shopping and business centers, and other structures cover more than 80 percent of the surface. These areas are nearly all in highly populated areas. Most are nearly level to moderately sloping, but there are some areas that are steep. Fill material has been used in some places to build up wet soils. Most areas have been excavated or filled with material that is now totally paved or impervious.

4.1.2.2 Geotechnical Borings

Geotechnical soil borings were drilled along TPCR Alternates 5, 6, and 7. At the time of the boring program, Alternates 9 and 10 had not been fully developed. As described in Section 4.1.9 herein, environmental sampling was also completed in the same bore holes. The boring program also included three soil borings drilled through the lagoon on Cytec property (part of TPCR Alternates 9 and 10). The 18 borings drilled along TPCR Alternate 6 were designated with the symbol CR- for Connector Road. The four borings located along Alternate 5 alignment were designated A5- and the seven borings along Alternate 7 alignment were designated A7-. All soil borings were drilled to the top of rock. The rock was cored 30 feet in soil borings drilled in the Rahway River. All other borings were drilled five feet into the rock. A copy of the TPCR Geotechnical Report and boring locations is included in Appendix F.

The subsurface soils and rock encountered are similar to the ones found during earlier studies in 2002. In general, organic deposits overlay glacial alluvial material and shale bedrock. In non-virgin areas, a fill layer of variable thickness is found. Most of the borings were located in wetlands and in the Rahway River, and thus very few of the borings encountered a fill layer. Eight to 16 feet of a black organic silt layer is typically encountered at the Rahway River borings. The thickness of the organics throughout the project site varies from 4 to 25 feet.

In general, rock is encountered at shallow depths that range from 20 to 50 feet below existing grade.

The top of rock surface elevation varies from elevation (El.) –26 to –37 on the Carteret side using North American Vertical Datum 1988 (NAVD 1988). The top of rock elevation at Cytec property varies from El.- 35 to –51. The rock surface is

shallower at the Linden side of the Rahway River and was encountered at El. –19 to –30.

Seven soil borings were drilled in the Rahway River: two each along the TPCR Alternate 6 and Alternate 5 alignments; and three soil borings along the Alternate 7 alignment. The top of rock surface in the Rahway River was encountered at an elevation that varies from El. –26 to –37 with one boring showing the rock at El. –44.

In conclusion, the soil conditions are consistent along the proposed alignments and did not vary from the conditions found in earlier studies.

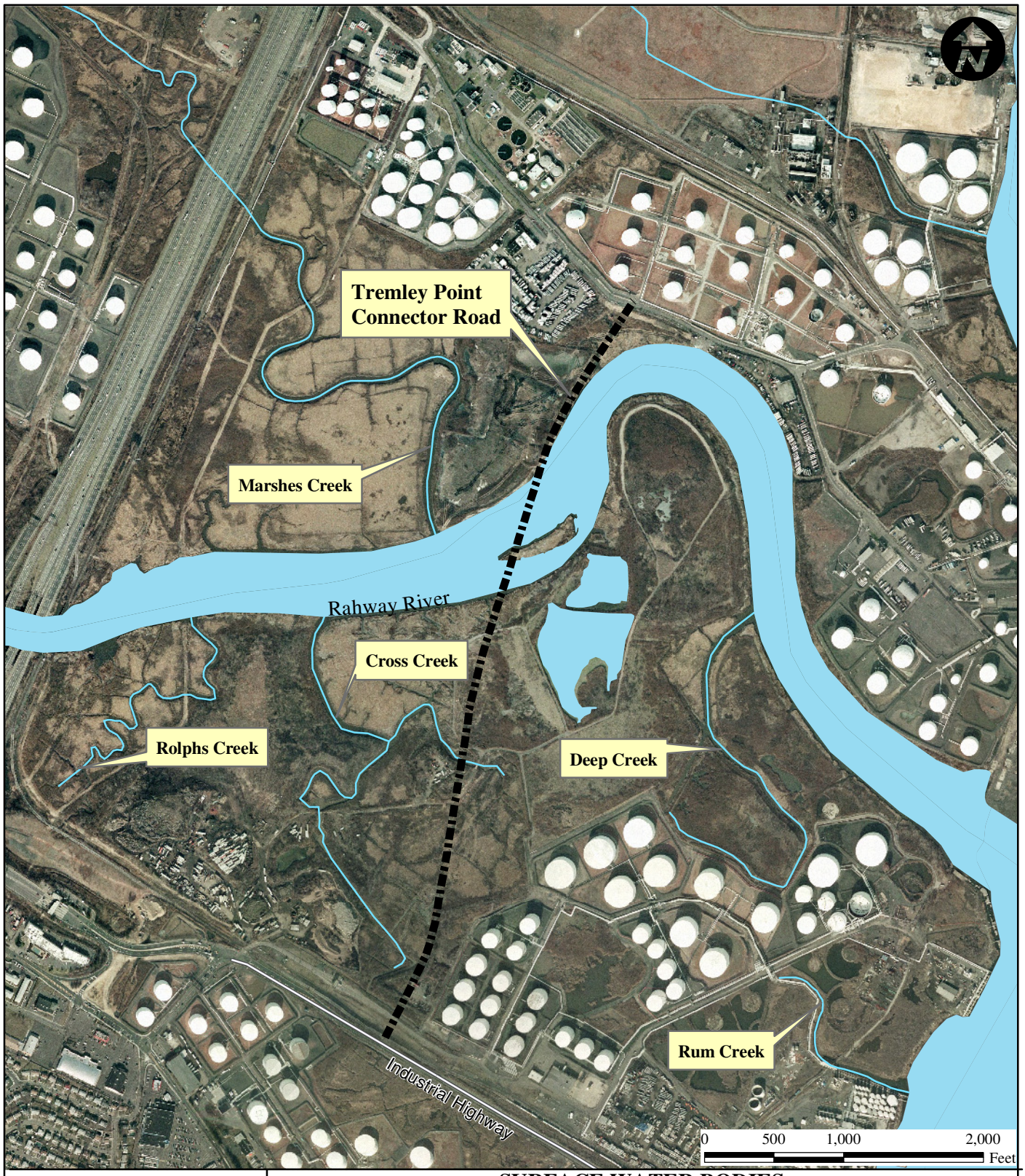
4.1.3 Land Form

Topography in the project area is generally gently sloping with urbanized areas ranging in elevation between 20 and 30 feet above mean sea level, and undeveloped land and tank farm areas, including wetland areas ranging between 0 and 10 feet above mean sea level. The land areas within the immediate area of the proposed TPCR are dominated by a combination of existing roads (i.e., Industrial Highway and Interchange 12 in Carteret and Tremley Point Road in Linden), a warehouse distribution facility located upon a former sanitary landfill, bulk petroleum storage tank farms and chemical storage tanks. The wetlands are predominantly composed of tidally influenced wetlands along the Rahway River and its associated tributaries (see Section 4.1.4.1) and freshwater wetlands located at higher elevations. The project area is interspersed with contaminated sites that have been previously impacted by hazardous materials due to prior industrial activity, municipal landfills and former sludge lagoons located adjacent to the Rahway River (see Section 4.1.9, Hazardous Materials). The proposed alignments cut through or are adjacent to these contaminated sites.

4.1.4 Hydrological Features

4.1.4.1 Surface Water

There are six streams within the project area that ultimately discharge into the Arthur Kill (Figure No. 15). These streams include the Rahway River, Marshes Creek, Rolph's Creek, Cross Creek, Deep Creek and Rum Creek. The flow characteristics, depth, dominant vegetation and water quality of each of these water bodies is discussed below:



Legend

Tremley Point Connector Road

SURFACE WATER BODIES
NEW JERSEY TURNPIKE AUTHORITY
TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET, MIDDLESEX COUNTY
AND CITY OF LINDEN, UNION COUNTY, NEW JERSEY

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SOURCE:
Aerials Express, 2006
TeleAtlas, 2006

Drawn By: ML	Scale: 1" = 1,000'	Project No. 02595.003.004
Chk'd By: IPD	Date: 8/15/08	Figure No. 15

Map Document: (P:\02595\003\Y\N\Maps\Fig15_surface_water_bodies_060507_05.mxd)
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- **Rahway River –** The headwaters of the Rahway River are located in central Essex County. The majority of its drainage area is heavily urbanized. The Rahway River flows generally south to its confluence with the South Branch of the Rahway River, where it turns east and flows into the Arthur Kill between Linden and Carteret. The lower reach of the Rahway River is tidal with a salinity that ranges from 17 to 27 parts per thousand. In the vicinity of the project area, the Rahway River is approximately 450-feet wide with the channel being approximately 16-feet in depth.

  The streambed is brown mud and sand and the banks of the river are vegetated with common reed *(Phragmites communis)* and salt marsh cordgrass (*Spartina alterniflora*). Water quality is characterized by low dissolved oxygen and salinity, except along the bottom of the river where a salt wedge exists. The mouth of the river is approximately 400-feet wide and 15-feet deep at high tide. There are numerous piers and chemical facilities at the confluence of the Rahway River and the Arthur Kill.

- **Rolph's Creek –** Rolph's Creek is a tidal tributary of the Rahway River. This tidal creek originates east of the Turnpike from the southern side of the Rahway River and meanders approximately 3,000 feet southwest to the Conrail tracks along the northwestern side of the Titan PDC warehouse distribution facility. The creek bed is predominantly composed of soft mud. The banks of the creek are vegetated by a mixture of marsh elder (*Iva frutescens*), salt marsh cordgrass, and common reed associations. At its mouth, the creek is approximately 50-feet wide and 4-feet deep at high tide.

- **Cross Creek** – Cross Creek is a tidal tributary of the Rahway River originating east of Rolph's Creek. This creek is located along the eastern border of the Titan PDC warehouse facility. The first 3,000 feet of the creek meanders south. The headwaters of the creek appear to have been channelized as part of a mosquito elimination project. The creek bed is a soft mud/sand mix. At its mouth, the creek is approximately 40-feet wide and 4-feet deep at high tide. Dominant vegetation along its banks is salt marsh cordgrass.

- **Marshes Creek** – Marshes Creek is situated in Linden and is a tidal tributary of the Rahway River originating approximately 3,000 feet downstream of where the Rahway River passes under the Turnpike. The mouth of the creek is approximately 50-feet wide and 6-feet deep at high tide. It meanders north for approximately 7,000 feet, eventually flowing under the Turnpike. The bed of the channel is hard, gray clay while the bed along the shore and banks is composed of gray clay and brown mud. The vegetation along the banks is a mixture of common reed and salt marsh cordgrass. Water quality in this creek is dominated by relatively high salinity and low dissolved oxygen.

- **Deep Creek** – Located in Carteret, this 5,000 foot long tidal tributary of the Rahway River meanders south through numerous bulk storage tank farms. The mouth of the creek is approximately 30-feet wide and 3.5-feet deep at high tide. The creek bed is soft mud. Dominant vegetation along its banks is salt marsh cordgrass and common reed.

- **Rum Creek** – Rum Creek is located in Carteret and is a tidal tributary of the Arthur Kill. The mouth of the creek is approximately 1,000 feet south of the confluence of the Rahway River and Arthur Kill. The creek is approximately 750 feet long and meanders north into bulk storage tank farms managed by Kinder Morgan. The mouth of the creek is approximately 30-feet wide and 4-feet deep at high tide. The creek bed is soft mud and peat. Dominant vegetation along the banks is composed of a combination of salt marsh cordgrass and common reed.

4.1.4.2 Groundwater

Groundwater resources in the project area are limited in both quality and quantity. South of the project area, the major aquifer is the Brunswick Formation, which is overlain by glacial deposits. North of the project area, glaciolacustrine clays and organic deposits comprise the major water table. The regional groundwater flow is from the northwest to the southeast.

Wells in this area tap both the shale bedrock and glacial drift deposits when they are hydrologically connected. Saltwater intrusion has greatly deteriorated the quality of this water and the amount that can be pumped. There are no public supply wells located within the vicinity of the TPCR. As discussed in Section 4.1.9 - Hazardous Materials, organic and inorganic contamination of groundwater was detected to be within the project area due to the numerous hazardous waste sites that have been identified in the area.

4.1.4.3 Water Quality

The NJDEP Division of Water Resources has established water quality standards for the State. These standards classify streams according to their water quality and provide the basis for determining what uses are appropriate for those waters. In this classification system, waters are first classified as fresh (FW), saline/estuarine (SE), or saline/coastal (SC). These designations are followed by a number 1, 2, or 3, indicating the relative quality of the water; 1 being the highest quality and 3 being the poorest quality.

All of the waters within the project area are classified as SE waters. The Arthur Kill and the Rahway River and all of their non-freshwater tributaries are also classified as SE3 (NJDEP, 2005). The designated uses for SE3 waters are: secondary contact recreation; propagation and migration of fish populations; migration of diadromous fish; maintenance of wildlife; and other reasonable uses.

As discussed in Section 4.1.9 - Hazardous Materials, water quality in the project area has likely been adversely impacted with organic and inorganic contamination by the numerous hazardous waste sites that have been identified in this urbanized, highly industrial area. High concentrations of nutrients and suspended and dissolved solids are common. Biological and chemical oxygen demand (BOD and COD) loadings are also relatively high. In addition, previous sediment sampling in the project area showed elevated levels of petroleum hydrocarbons in Marshes Creek and elevated metals in the Rahway River (NJTA, 1986).

4.1.4.4 Floodplain

The extent of the 100-year tidal floodplain boundary as mapped by the Federal Emergency Management Agency (FEMA) for the project area is depicted on Figure No. 16**.** The tidal floodplain is the flood caused by the tide backing up a channel. As all of the watercourses within the project area are tidal, fluvial flooding (i.e., that which is caused entirely by runoff from rainfall) is not applicable to the project area.

4.1.4.5 Wetlands

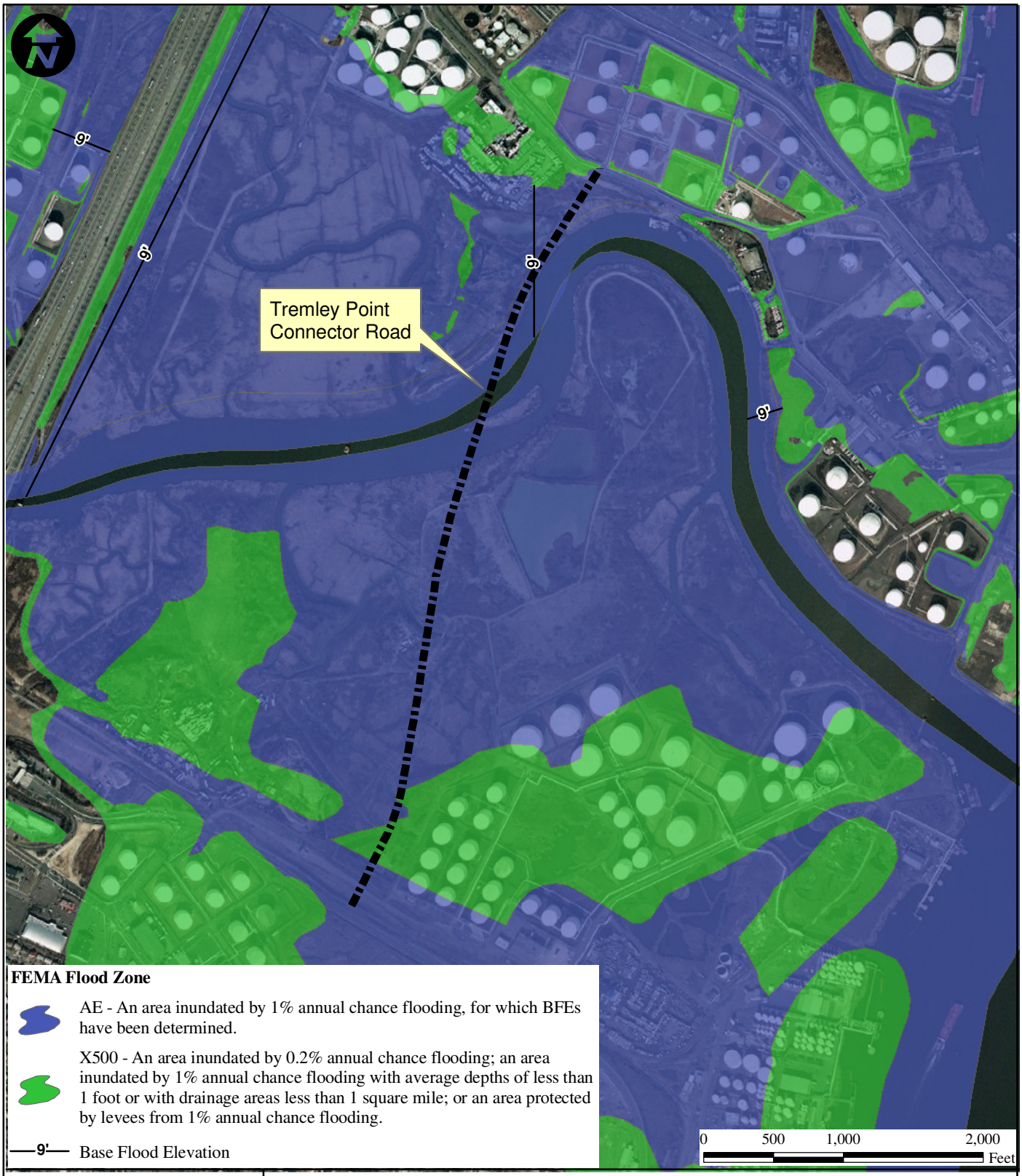
Wetlands are transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Under the USACE and NJDEP regulations, wetlands are defined as:

Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (USACE, 33 CFR 328.3 and NJDEP, N.J.A.C. 7:7A-1.4)

Based upon this definition, wetlands contain three basic environmental characteristics: hydrophytic vegetation; hydric soils; and wetland hydrology. The presence of all three of these criteria qualifies an area to be considered a wetland. The loss of one of these criteria, usually hydric soils, along a naturally occurring gradient forms the wetlands/upland boundary.

Under the Cowardin system adopted by the USFWS (Cowardin *et al*, 1979), wetlands are classified ecologically by the types of plants, soils and frequency of flooding. They are divided into five systems: Marine; Estuarine; Riverine; Lacustrine; and Palustrine. Within each system except Palustrine, wetlands are divided into subsystems, which are, in turn, divided into classes, that are based upon the substrate, flooding regime and vegetation form. The lowest level of the classification hierarchy is the Dominance Type, which is named for the dominant plant or animal forms found in the wetland. There are also numerous modifiers, which further define the specific system.

There are several types of wetlands within the various alternative right-of-ways that have been evaluated for the TPCR. Those wetlands in areas influenced by the tides are classified by the USFWS as Estuarine, inter-tidal, emergent wetlands (E2EM). Wetlands that receive predominantly freshwater from stormwater runoff are classified as Palustrine emergent wetlands (PEM). Figure Nos. 17 and 18 shows the location of the mapped wetlands within the project area and their Cowardin classification.



Legend

Tremley Point Connector Road

SOURCE:
Borough of Carteret
FIRM Panel 3402570005B, 4/15/92.
City of Linden
FIRM Panel 46, 9/20/06.
ArcGIS Online - Aerials Express, 2006.

FEMA FLOOD PLAIN MAP
NEW JERSEY TURNPIKE AUTHORITY
TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET, MIDDLESEX COUNTY
AND CITY OF LINDEN UNION COUNTY, NEW JERSEY

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Drawn By: JC	Scale: 1" = 1,000'	Project No. 02595.003.004
Chk'd By: IPD	Date: 8/15/08	Figure No. 16

Map Document: (P:\02595\003\Y\N\Maps\fig16_FEMA_060707_03.mxd)
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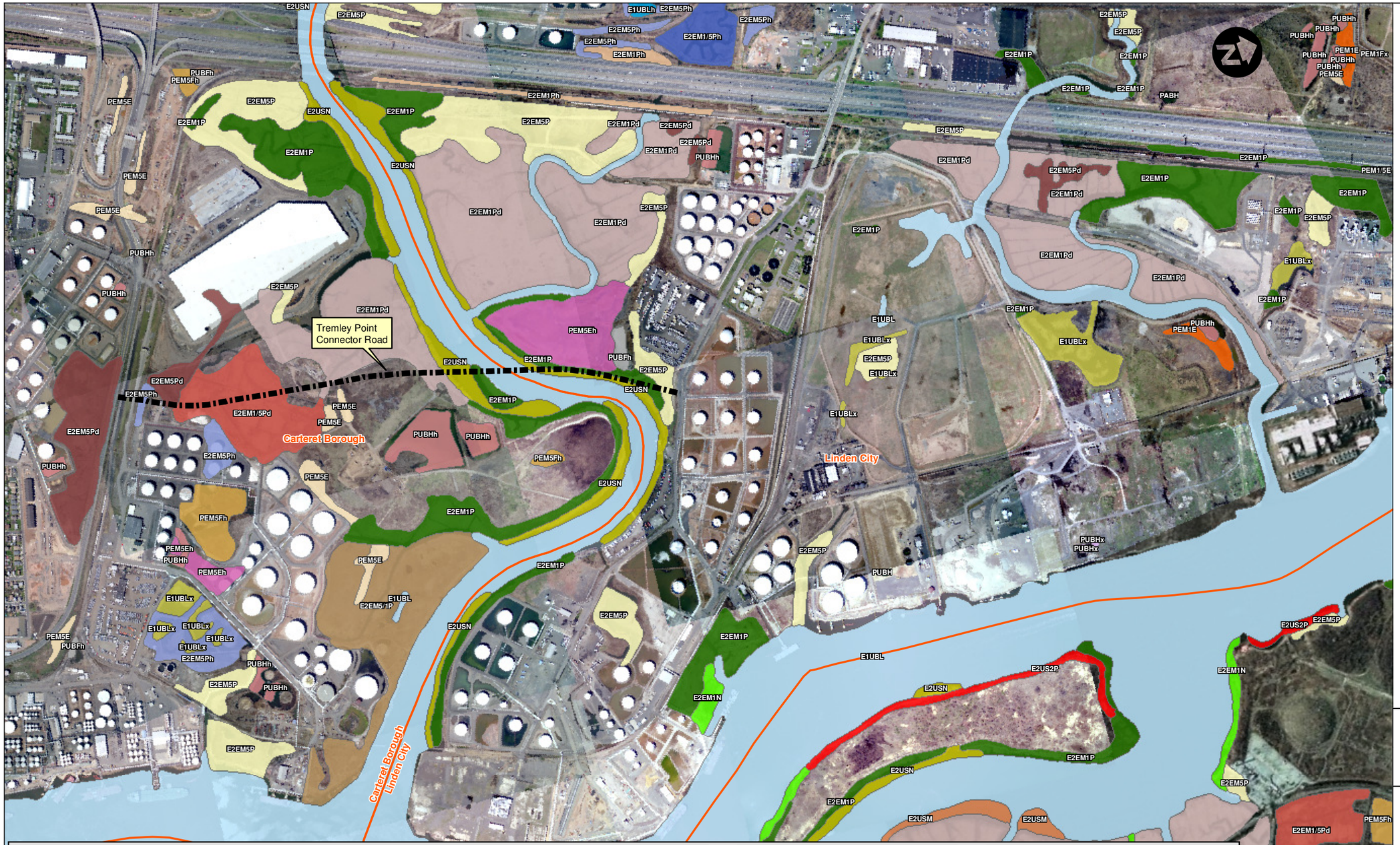

Legend

- Tremley Point Connector Road
- Municipal Boundary Line

Source:
U.S. Fish and Wildlife Service, 2008.

Orthoimagery Taken From Pictometry Online, 04/22/07.
ArcGIS Online - Aerials Express, 2006.

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TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET,
MIDDLESEX COUNTY AND
CITY OF LINDEN, UNION COUNTY,
NEW JERSEY

NATIONAL WETLANDS INVENTORY MAP (NWI)

National Wetlands Inventory (NWI)

- E1UBL-Estuarine Subtidal Unconsolidated Bottom Subtidal
- E1UBLh-Estuarine Subtidal Unconsolidated Bottom Subtidal Diked/Impounded
- E1UBLx-Estuarine Subtidal Unconsolidated Bottom Subtidal Excavated
- E2EM1/5Pd-Estuarine Intertidal Emergent Persistent Irregularly Flooded Partially Drained/Ditched
- E2EM1/5Ph-Estuarine Intertidal Emergent Persistent Irregularly Flooded Diked/Impounded
- E2EM1N-Estuarine Intertidal Emergent Persistent Regularly Flooded
- E2EM1P-Estuarine Intertidal Emergent Persistent Irregularly Flooded
- E2EM1Pd-Estuarine Intertidal Emergent Persistent Irregularly Flooded Partially Drained/Ditched
- E2EM1Ph-Estuarine Intertidal Emergent Persistent Irregularly Flooded Diked/Impounded
- E2EM5/1P-Estuarine Intertidal Emergent Persistent Irregularly Flooded
- E2EM5P-Estuarine Intertidal Emergent Irregularly Flooded
- E2EM5Pd-Estuarine Intertidal Emergent Persistent Irregularly Flooded Partially Drained/Ditched
- E2EM5Ph-Estuarine Intertidal Emergent Persistent Irregularly Flooded Diked/Impounded
- E2US2P-Estuarine Intertidal Unconsolidated Shore Sand Irregularly Flooded
- E2USM-Estuarine Intertidal Unconsolidated Shore Irregularly Exposed
- E2USMh-Estuarine Intertidal Unconsolidated Shore Irregularly Exposed Diked/Impounded
- E2USN-Estuarine Intertidal Unconsolidated Shore Regularly Exposed Diked/Impounded
- PEM1E-Palustrine Emergent Persistent Seasonally Flooded/Saturated
- PEM5E-Palustrine Emergent Seasonally Flooded/Saturated
- PEM5Eh-Palustrine Emergent Seasonally Flooded/ Saturated Diked/Impounded
- PEM5Fh-Palustrine Emergent Semipermanently Flooded Diked/Impounded
- PFO1/EM5E-Palustrine Forested Broad-Leaved Deciduous/ Emergent Seasonally Flooded/Saturated
- PFO1C-Palustrine Forested Broad-Leaved Deciduous Seasonally Flooded
- PFO1E-Palustrine Forested Broad-Leaved Deciduous Seasonally Flooded/Saturated
- PFO1R-Palustrine Forested Broad-Leaved Deciduous Seasonal-Tidal
- PFO1S-Palustrine Forested Broad-Leaved Deciduous Temporary-Tidal
- PUBFh-Palustrine Unconsolidated Bottom Semipermanently Flooded Diked/Impounded
- PUBH-Palustrine Unconsolidated Bottom Permanently Flooded
- PUBHh-Palustrine Unconsolidated Bottom Permanently Flooded Diked/Impounded
- PUBHx-Palustrine Unconsolidated Bottom Permanently Flooded Excavated

Drn By: RS	Scale: 1" = 1000'	Project: 02595.003.004
Ch'kd By: ID	Date: 08/15/08	Figure No. 17

Map Document: (P:\02595\003\Y\N\Maps\fig17_national_wetlands_inventory_map_043007_04.mxd)
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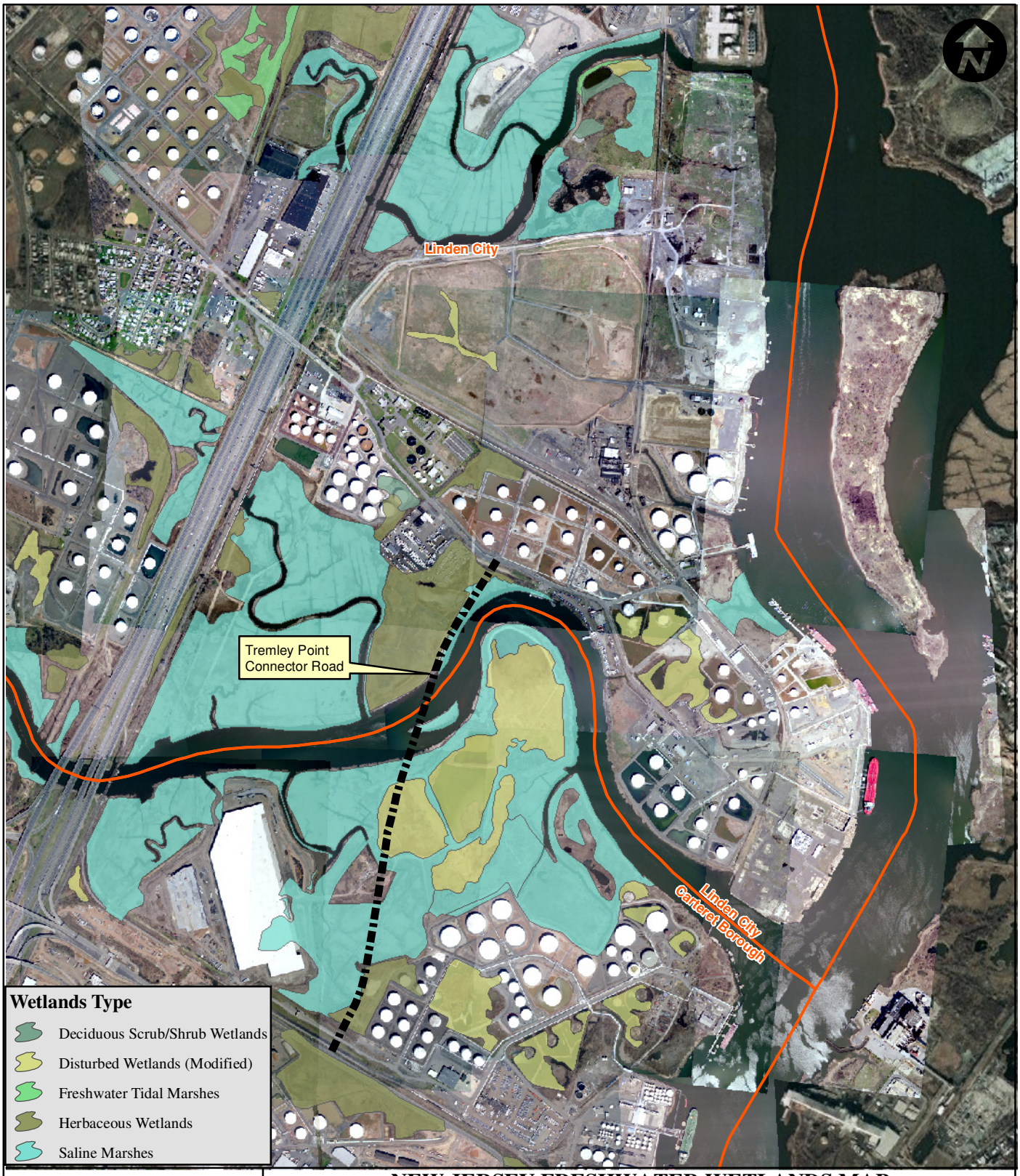

Legend

- Tremley Point Connector Road
- Municipal Boundary Line

SOURCE:
NJDEP Wetlands Of Middlesex County and Union County, 1986.
Orthoimagery Taken From Pictometry Online, 04/22/07.
ArcGIS Online - Aerials Express, 2006.

NEW JERSEY FRESHWATER WETLANDS MAP

NEW JERSEY TURNPIKE AUTHORITY
TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET, MIDDLESEX COUNTY
AND CITY OF LINDEN, UNION COUNTY, NEW JERSEY

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Drawn By: RS	Scale: 1" = 1,500'	Project No. 02595.003.004
Chk'd By: IPD	Date: 8/15/08	Figure No. 18

Map Document: (P:\02595\003\Y\N\Maps\fig18_freshwater_wetlands_map_101207_05.mxd)
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Paulus, Sokolowski and Sartor, LLC (PS&S) delineated a total of three wetland lines within the footprints of the proposed rights-of-way utilizing the required NJDEP and USACE methodology. The vast majority of the wetlands in the project area are tidally influenced and should be classified as E2EM. In addition, due to the wetlands having been identified as a foraging area for black-crowned night herons *(Nycticorax nycticorax)* and yellow-crowned night herons *(Nyctanassa violacea)*, the wetlands are considered exceptional resource value wetlands by the NJDEP.

Further information on the extent of regulated wetlands situated on the Tremley Point brownfield redevelopment area is provided on Figure No. 22 in Section 5.1.4.5. In contrast to the mapped information provided on Figures Nos. 17(National Wetlands Inventory Map) and 18 (NJDEP Freshwater Wetlands Map), an on-site wetlands delineation indicates that a total of 0.455 of wetlands occur in three small parcels on the redevelopment area. In accordance with City of Linden guidance, these wetland parcels are not to be impacted as part of the redevelopment of the brownfield site.

4.1.5 Biological Features

4.1.5.1 Vegetation

There are several associations of plants present within the project area that include both upland and wetland communities. The majority of the upland areas have been disturbed as the region was urbanized and industrialized. The following upland plant associations are found in this portion of the project area:

- Manicured Lawn And Ornamental Association – This association is very common within the project area. The residential areas are dominated by this plant association and consist of planted turf grasses and plantings of ornamental gymnosperms and angiosperms.

- Old Field Association – This diverse plant association is present in non-developed areas. Herbaceous vegetation dominating this association includes switch grass (*Panicum virgatum*), goldenrod (*Solidago* spp.), asters (*Aster* spp.), and blackberry (*Rubus allegheniensis*). Shrubs and small trees found in this association include staghorn sumac (*Rhus typhina*), shiny sumac (*Rhus glabra*), red cedar, (*Juniperus virginiana*), wild black cherry (*Prunus serotina*) and dogwood (*Cornus florida* and *Cornus stolonifera*).

- Common Reed Upland Association – This upland association is dominated by common reed and is commonly found in the area between the maintained Turnpike right-of-way, along Industrial Highway and Tremley Point Road, and adjacent wetlands. The soils in these areas are typically fill material over wetland soils. Soil saturation in these areas range from moist to dry resulting in low common reed density and vigor. This reduced vigor of the common

reed creates habitat opportunities for species typically excluded by dense stands of common reed. Species typically found in this association include goldenrod, bindweed (*Convolvulus arvensis*), mugwort (*Artemisia vulgaris*), fleabane (*Erigeron annuus*), bull thistle (*Cirsium vulgare*), and pokeweed (*Phytolacca americana*).

- Disturbed Field Association – This plant association is present along access roadways, pipeline and railroad track right-of-ways and other areas associated with heavy industrial/commercial use. Soils at these site areas consist of relatively dry, well-drained sandy fill. Vegetation observed in this association includes goldenrod, milkweed (*Asclepias* spp.), chicory (*Cichorium intybus*), knapweed (*Centaurea maculosa*), fleabane, plantains (*Plantago major* and *Plantago lanceolata*) and various grasses. Vegetation density and growth is typically sparse in this plant association.

The following wetland plant associations are also found within the project area:

- Inter-tidal Common Reed Marsh Association – The dominant wetland vegetation found in the inter-tidal wetland areas is common reed, which is found in almost pure stands with heights up to 16 feet. The common reed is found in areas above mean high tide and is periodically or irregularly flushed by saline waters of the Arthur Kill, Rahway River, their tributaries and numerous man-made canals and ditches. Other taxa occasionally found in this association include bindweed, marsh hibiscus (*Hibiscus palustris*), elderberry (*Sambucus canadensis*), and salt-marsh fleabane (*Pluchea purpurascens*).

- Non-tidal Common Reed Marsh Association – In non-tidal, freshwater wetland systems, common reed marsh, while typically found as a monoculture may also include the following species: bindweed; elderberry; goldenrod; jewelweed (*Impatiens capenis*); horsetail (*Equisetum* spp.); sensitive fern (*Onoclea sensibilis*); cut-leaved horehound (*Lycopus americanus*);and salt-marsh fleabane. In wet depressions that hold water throughout the growing season, cattail (*Typha latifolia*), water plantain (*Alisma triviale*), soft rush (*Juncus effuses*) and spike rush (*Eleocharis spp*.) can be found. In open water areas, duckweed (*Lemna* spp.) will form dense mats during the late summer months.

- Spartina Association – Salt-marsh cordgrass is found along the Arthur Kill, Rahway River and other tidal tributaries. This species prefers that portion of the inter-tidal zone below mean high water and more saline conditions. In areas above mean high water, not dominated by common reed, salt-meadow cordgrass (*Spartina patens*), salt-grass (*Distichlis spicata*), marsh elder and high-tide bush (*Baccharis halimifolia*) can be found.

- Mudflats – Mudflats are abundant along the tidally influenced Rahway River and its tributaries. They are exposed during every low tide, but are inundated

by water during the rest of the tidal cycle. Salt-marsh cordgrass, marsh elder and high-tide bush commonly occur along the upper edges of mudflats.

4.1.5.2 Wildlife Habitat

The project area is situated adjacent to the confluence of the Rahway River and Arthur Kill and is a combination of a highly urbanized and industrialized environment and undeveloped tidally influenced and freshwater wetlands that have been impacted by past industrial activities (i.e., filling of adjacent tidal wetlands, stormwater runoff from landfills and industrial sites, and construction of storage lagoons within floodplain). Wildlife species found in urban environments are capable of adapting to human modified environments. In an urban environment, there is typically an absence of the basic habitat components, food, water, cover and space. In addition, there are human induced limiting factors such as cars, pets (particularly feral cats and dogs), overhead wires, towers and windows.

Reptiles and Amphibians - The wetlands areas are undeveloped. However, contaminated lagoons and a former landfill that has been redeveloped into a warehouse distribution facility are adjacent to most of the wetlands and tidal river systems. Amphibians and reptiles are less mobile than birds and mammals and thus have more difficulty dispersing to urban habitats once extirpated. These characteristics make them vulnerable to urbanization. Consequently, localized distributions of amphibians and reptiles tend to be disjunct rather than continuous populations. The majority of the open water is saline. Amphibians and most reptiles have a narrow tolerance range for salinity. Consequently, amphibians and reptiles are not strongly represented regionally in this area. The species anticipated to be found are listed in Table 4-1.

Birds - There are two basic groups of birds found in the project area. There are migrants that pass through the area while traveling the Atlantic Flyway, and residents. The resident species are typically species known as habitat generalists. These species are usually edge species and can adapt to a rapidly changing environment. Table 4-2 lists the species of birds that could be observed within the general area of the proposed TPCR.

Mammals - Mammals show a similar pattern in habitat specialization. The majority of the mammals in an urban environment are small to medium sized herbivores. This includes mice, rats, squirrels, rabbits and woodchucks. These species tend to be edge living habitat generalists capable of adapting to the rapidly changing urban environment. Table 4-3 lists the mammals anticipated to be found in the area.

Fish - Urbanization of the Arthur Kill and Rahway River included modification of the shoreline, filling of tidal wetlands, stormwater runoff pollution, water quality contamination from the numerous hazardous waste sites in this urbanized/highly

industrial area, increased sedimentation and exploitation of fish resources. Recent efforts by the USEPA and NJDEP to clean up stormwater runoff to the river by the closing of combined sewer outfalls and new engineering requirements for stormwater discharges have resulted in better water quality as compared to the past. In addition, commercial and recreational fishing restrictions on fishery resources have resulted in a rebounding of fish populations in recent years (i.e., striped bass). Table 4-4 lists the fish species previously collected in the adjacent waterways. Also attached to this EA as Appendix I is a project specific Essential Fish Habitat (EFH) assessment that demonstrates no adverse impacts to fishery resources from the implementation of the TPCR project.

The Arthur Kill is defined as a tidal gut and its tributaries are deemed by the NJDEP to be a finfish migratory pathway. Alewife *(Alosa pseudoharengus)*, American shad *(Alosa sapidissima)*, striped bass *(Morone saxatilis)*, blueback herring *(Alosa aestivalis)*, Atlantic sturgeon *(Acipenser oxyrhnychus)*, shortnose sturgeon *(Acipenser brevirostrum)* and American eel *(Anguilla rostrata)* have historically been known to use the Arthur Kill, in limited numbers, as a migration route to upper New York Harbor, including Newark Bay, and the Passaic, Hackensack and Hudson Rivers. Juveniles of these migratory species use the Arthur Kill estuary for feeding prior to moving to marine waters. Neither the Atlantic nor shortnose sturgeon has been found in recent years in the Arthur Kill and its associated tributaries. In general, the limited number of the aforementioned species within the waters of the Arthur Kill demonstrates the limited use of this waterway for finfish migratory purposes.

The Arthur Kill and Rahway River are not major migratory pathways for finfish. The predominant migratory pathway is the Arthur Kill in the deeper, federally maintained navigation channel and along the opposite (Staten Island) shoreline of the Arthur Kill, which consists of a relatively undisturbed tidally influenced saltmarsh cordgrass wetlands. The areas utilized as migratory pathways are outside of the influence of the proposed TPCR.

Benthic Resources – The lower Rahway River is utilized by a number of species living in the intertidal zone. Many invertebrate species, including abundant fiddler crabs (*Uca* spp.), ribbed mussels (*Geukensia demissus*), and marsh snails (*Melampus bidentatus*), live in this area and are essential components of the food chain. The intertidal mudflat community below the tidal marsh area is home to a variety of benthic animals including worms, shellfish, snails, sponges, and jellyfish. The intertidal community is complemented by a number of organisms that use the existing maritime structures (e.g., piers, bulkheads, and concrete) as habitat. The abundance and distribution of benthic invertebrates are influenced by human disturbance, toxics, and natural environmental stress, and generally show a low species diversity. Highly sensitive species are absent, while high population levels of species tolerant to pollution or disturbance, such as polychaete, tubificid, and nematode worms, are common.

TABLE 4-1
TREMLEY POINT CONNECTOR ROAD PROJECT
AMPHIBIANS AND REPTILES
POTENTIALLY FOUND IN THE PROJECT AREA

		Habitat	
Common Name	**Scientific Name**	**Uplands**	**Wetlands**
American toad	*Bufo terrestris americanus*	X	X
Fowler's toad	*Bufo woodhousei fowleri*	X	X
Northern leopard frog	*Rana pipiens*	X	X
Red-backed salamander	*Plethodon cinereus*	X	X
Eastern garter snake	*Thamnophis sirtalis*	X	
Eastern ribbon snake	*Thamnophis sauritus*		X
Northern ring-necked snake	*Diadophis punctatus edwardsi*	X	
Northern water snake	*Nerodia sipedon*		X
Common musk turtle	*Sternotherus odoratus*		X
Northern diamondback terrapin	*Malaclemys t. terrapin*		X
Snapping turtle	*Chelydra serpentina*		X
Eastern box turtle	*Terrapene carolina*	X	
Eastern painted turtle	*Chrysemys picta picta*		X

Source: Conant, 1975.

TABLE 4-2 TREMLEY POINT CONNECTOR ROAD PROJECT BIRDS POTENTIALLY FOUND IN THE PROJECT AREA			
Common Name	**Scientific Name**	**Occurrence[1]**	**Seasonality[2]**
Common Loon	*Gavia immer*	R	M
Double Crested Cormorant	*Phalacrocorax auritus*	U	PR
Great Blue Heron	*Ardea herodias*	U	SR
Little Blue Heron	*Florida caerulea*	C	PR
Cattle Egret	*Bubulcus ibis*	C	PR
Great Egret	*Casmerodius albus*	U	SR
Snowy Egret	*Egretta thula*	U	SR
Glossy Ibis	*Plegadis falcinellus*	C	SR
Black-Crowned Night Heron	*Nycticorax nycticorax*	R	SR
Yellow-Crowned Night Heron	*Nyctanassa violacea*	R	SR
Least Bittern	*Ixobrychus exilis*	U	SR
American Bittern	*Botaurus lentiginosus*	U	SR
Canada Goose	*Branta canadensis*	AB	PR
Brant	*Branta bernicla*	R	M
Mallard	*Anas platyrhynchos*	AB	PR
Black Duck	*Anas rubripes*	U	WR
Common Goldeneye	*Bucephala clangula*	X	-
Bufflehead	*Bucephala albeola*	X	-
Turkey Vulture	*Cathartes aura*	C	PR
Sharp-shinned Hawk	*Accipiter striatus*	U	M
Cooper's Hawk	*Accipiter cooperii*	R	M
Red-tailed Hawk	*Buteo jamaicensis*	C	PR
Red-shouldered Hawk	*Buteo lineatus*	R	M
Broad-winged Hawk	*Buteo platypterus*	U	SR
Rough-legged Hawk	*Buteo lagopus*	R	WR
Bald Eagle	*Haliaeetus leucocephalus*	R	M
Northern Harrier	*Circus cyaneus*	U	M
Osprey	*Pandion haliaetus*	U	SR
Killdeer	*Charadrius vociferus*	U	SR
Spotted Sandpiper	*Actitis macularia*	C	SR
Greater Yellowlegs	*Tringa melanoleuca*	C	M
Lesser Yellowlegs	*Tringa flavipes*	C	M
Iceland Gull	*Larus glaucoides*	C	PR
Herring Gull	*Larus argentatus*	C	PR
Laughing Gull	*Larus atricilla*	C	PR
Ring-billed Gull	*Larus delawarensis*	C	SR
Black-backed Gull	*Larus marinus*	C	PR
Common Tern	*Sterna hirundo*	U	SR
Rock Dove	*Columba livia*	AB	PR
Mourning Dove	*Zenaida macroura*	AB	PR
Barn Owl	*Tyto alba*	R	PR
Common Nighthawk	*Chordeiles minor*	C	M
Chimney Swift	*Chaetura pelagica*	C	M
Ruby-throated Hummingbird	*Archilochus colubris*	C	M
Belted Kingfisher	*Megaceryle alcyon*	C	PR
Common Flicker	*Colaptes auratus*	AB	SR
Yellow-bellied Sapsucker	*Sphyrapicus varius*	U	M
Hairy Woodpecker	*Picoides villosus*	C	PR

TABLE 4-2 TREMLEY POINT CONNECTOR ROAD PROJECT BIRDS POTENTIALLY FOUND IN THE PROJECT AREA			
Downy Woodpecker	*Picoides pubescens*	C	PR
Eastern Kingbird	*Tyrannus tyrannus*	C	SR
Great Crested Flycatcher	*Myiarchus crinitus*	R	SR
Eastern Phoebe	*Sayornis phoebe*	U	SR
Least Flycatcher	*Empidonax minimus*	R	SR
Tree Swallow	*Iridoprocne bicolor*	C	SR
Bank Swallow	*Riparia riparia*	U	SR
Rough-winged Swallow	*Stelgidopteryx ruficollis*	U	SR
Barn Swallow	*Hirundo rustica*	C	SR
Blue Jay	*Cyanocitta cristata*	AB	PR
Common Crow	*Corvus brachyrhynchos*	AB	PR
Fish Crow	*Corvus ossifragus*	AB	M
Black-capped Chickadee	*Parus atricapillus*	AB	PR
Tufted Titmouse	*Parus bicolor*	AB	PR
White-breasted Nuthatch	*Sitta carolinensis*	U	PR
Red-breasted Nuthatch	*Sitta canadensis*	U	WR
Brown Creeper	*Certhia familiaris*	U	PR
House Wren	*Troglodytes aedon*	U	SR
Winter Wren	*Troglodytes troglodytes*	U	M
Carolina Wren	*Thryothorus ludovicianus*	U	PR
Mockingbird	*Mimus polyglottos*	C	PR
Gray Catbird	*Dumetella carolinensis*	C	SR
Brown Thrasher	*Toxostoma rufum*	C	SR
Robin	*Turdus migratorius*	AB	SR
Wood Thrush	*Hylocichla mustelina*	AB	SR
Hermit Thrush	*Catharus guttatus*	C	M
Golden-crowned Kinglet	*Regulus satrapa*	U	M
Ruby-crowned Kinglet	*Regulus calendula*	C	M
Cedar Waxwing	*Bombycilla cedrorum*	U	SR
Starling	*Sturnus vulgaris*	AB	PR
White-eyed Vireo	*Vireo griseus*	U	SR
Yellow-throated Vireo	*Vireo flavifrons*	U	SR
Solitary Vireo	*Vireo solitarius*	U	M
Black & White Warbler	*Mniotilta varia*	C	SR
Tennessee Warbler	*Vermivora peregrina*	U	M
Orange-crowned Warbler	*Vermivora celata*	U	M
Yellow Warbler	*Dendroica petechia*	U	SR
Magnolia Warbler	*Geothlypis magnolia*	U	M
Cape May Warbler	*Dendroica tigrina*	U	M
Black-throated Blue Warbler	*Dendroica caerulescens*	U	M
Yellow Rumped Warbler	*Dendroica coronata*	U	M
Black-throated Green Warbler	*Dendroica virens*	U	M
Chestnut-sided Warbler	*Dendroica pensylvanica*	U	SR
Blackpoll Warbler	*Dendroica striata*	C	M
Connecticut Warbler	*Oporornis agilis*	R	M
Yellowthroat	*Geothlypis trichas*	C	SR
Hooded Warbler	*Wilsonia citrina*	U	M
American Redstart	*Setophaga ruticilla*	C	SR
House Sparrow	*Passer domesticus*	AB	PR
Red-winged Blackbird	*Agelaius phoeniceus*	C	SR
Baltimore Oriole	*Icterus galbula*	C	SR
Common Grackle	*Quiscalus quiscula*	AB	SR
Brown-headed Cowbird	*Molothrus ater*	C	SR
Scarlet Tanager	*Piranga olivacea*	U	SR

TABLE 4-2
TREMLEY POINT CONNECTOR ROAD PROJECT
BIRDS POTENTIALLY FOUND IN THE PROJECT AREA

Cardinal	*Cardinalis cardinalis*	AB	PR
Purple Finch	*Carpodacus purpureus*	C	PR
House Finch	*Carpodacus mexicanus*	AB	PR
American Goldfinch	*Carduelis tristis*	C	PR
Rufous-sided Towhee	*Pipilo erythrophthalmus*	C	SR
Slate-colored Junco	*Junco hyemalis*	C	WR
Tree Sparrow	*Spizella arborea*	C	WR
Field Sparrow	*Spizella pusilla*	C	PR
Song Sparrow	*Melospiza melodia*	C	PR
Snow Bunting	*Plectrophenax nivalis*	U	M

Reference Notes:
Occurrence (1): AB - Abundant - hard to miss in season
C - Common - easy to find almost any day in season
U - Uncommon - probably can be found on most days in season
R - Rare - probably cannot be found on a given day, even in season
Seasonality (2): PR - Permanent Resident - some individuals present all year
WR - Winter Resident - in study area during this season only
SR - Summer Resident - probably breeds in our area
M - Migrant - is in study area only during spring and fall
- - Unknown
SOURCE: Peterson, 1984.

TABLE 4-3 TREMLEY POINT CONNECTOR ROAD PROJECT MAMMALS POTENTIALLY FOUND IN THE PROJECT AREA			
Common Name	**Scientific Name**	**Habitat**	
		Uplands	**Wetlands**
Opossum	*Didelphis marsupialis*	X	
Masked shrew	*Sorex cinereus*	X	X
Short-tailed shrew	*Blarina brevicauda*	X	X
Eastern mole	*Scalopus aquaticus*	X	X
Little brown bat	*Myotis lucifugus*	X	
Eastern pipistrel bat	*Pipistrellus subflavus*	X	X
Big brown bat	*Eptesicus fuscus*	X	X
Hoary bat	*Lasiurus cinereus*	X	X
Cottontail	*Sylvilagus floridanus*	X	
Chipmunk	*Tamias striatus*	X	
Woodchuck	*Marmota monax*	X	
Gray Squirrel	*Sciurus carolinensis*	X	
Flying squirrel	*Glaucomys volans*	X	
White-footed mouse	*Peromyscus leucopus*	X	
Deer mouse	*Peromyscus maniculatus*	X	
Red-backed vole	*Clethrionomys gapperi*	X	
Meadow vole	*Microtus pennsylvanicus*		X
Pine vole	*Pitymys pinetorum*	X	
Muskrat	*Ondatra zibethicus*		X
Raccoon	*Procyon lotor*	X	X
Striped skunk	*Mephitis mephitis*	X	
House mouse	*Mus musculus*	X	
Norway rat	*Rattus norvegicus*	X	
White-tailed deer	*Odocoileus virginianus*	X	X
Source: Burt and Grossenheider, 1976 and Chapman and Feldhamer, 1987.			

Table 4-4 Tremley Point Connector Road Project Fish Collected from the Arthur Kill		
Species	**Scientific Name**	**Abundance**
Marine Species		
Winter flounder	*Pleuronectes americanus*	Abundant
Weakfish	*Cynoscion regalis*	Common
Pollock	*Pollachius virens*	Common
Red hake	*Urophycis chuss*	Common
Spotted hake	*Urophycis regia*	Uncommon
Silver hake	*Merluccius bilinearis*	Abundant
Windowpane flounder	*Scophthalmus aquosus*	Abundant
Summer flounder	*Paralicthys dentatus*	Seasonally Abundant
Fourspot flounder	*Paralichthys oblongus*	Common
Smallmouth flounder	*Etropus microstomus*	Common
Spot	*Leiostomus xanthurus*	Erratic
Grubby	*Myoxochalus aenaeus*	Common
Bay anchovy	*Anchoa mitchilli*	Abundant
Striped anchovy	*Anchoa hepsetus*	Erratic
Seaboard goby	*Gobiosoma ginsburgi*	Locally Common
Naked goby	*Gobiosoma bosc*	Common
Striped searobin	*Prionotus evolans*	Abundant
Northern searobin	*Priondius carolinus*	Abundant
Tautog	*Tautoga onitis*	Abundant
Atlantic menhaden	*Brevoortia tyrannus*	Abundant
Cunner	*Tautogolabrus adspersus*	Abundant
Oyster toadfish	*Opsanus tau*	Abundant
Northern kingfish	*Menticirrhus saxatilis*	Common
Bluefish	*Pomatomus saltatrix*	Abundant
Rock gunnel	*Pholis gunnellus*	Common
Atlantic silverside	*Menidia menidia*	Abundant
Rough silverside	*Membras martinica*	Common
Atlantic butterfish	*Peprilus triacanthus*	Abundant
Scup	*Stenotomus chrysops*	Abundant
Northern puffer	*Sphoeroides maculatus*	Common
Feather blenny	*Hypsoblennius hentz*	Uncommon
Fourbeard rockling	*Enchelyopus cimbrius*	Common
Tilefish	*Lopholatilus chamaeleonticeps*	Rare
Crevalle jack	*Caranx hippos*	Common
Rough scad	*Trachurus lathami*	Not Uncommon
Black sea bass	*Centropristus striata*	Common
Northern sennet	*Sphyraena borealis*	Common - Summer
Sea horse	*Hippocamus erectus*	Common
Atlantic needlefish	*Stongylura marina*	Common
American sandlance	*Ammodytes americanus*	Abundant
Atlantic herring	*Clupea harengus*	Abundant
Conger eel	*Conger oceanicus*	Common
Northern stargazer	*Astroscopus guttatus*	Uncommon
Goosefish	*Lophius americanus*	Common

Table 4-4 Tremley Point Connector Road Project Fish Collected from the Arthur Kill		
Species	**Scientific Name**	**Abundance**
Estuarine Species		
Northern pipefish	*Syngnathus fuscus*	Abundant
Striped killfish	*Fundulus majalis*	Abundant
Mummichog	*Fundulus heteroclitus*	Abundant
White perch	*Morone americana*	Common
Hogchoker	*Trinectes maculatus*	Abundant
Threespine stickleback	*Gastrosteus aculeatus*	Abundant
Fourspine Stickleback	*Apeltes quadracus*	Abundant
Inland silverside	*Menidia beryllina*	Common
White Mullet	*Mugil curema*	Common
Striped mullet	*Mugil cephalus*	Common
Diadromous Species		
Atlantic tomcod	*Microgadus tomcod*	Locally Common
American shad	*Alosa sapidissima*	Common
Alewife	*Alosa pseudoharengus*	Common
Striped bass	*Morone saxatilis*	Common
American eel	*Anguilla rostrata*	Abundant
Blueback herring	*Alosa aestivalis*	Common
Freshwater Species		
Gizzard shad	*Dorosoma cepedianum*	Rare
Yellow perch	*Perca flavescens*	Stray
Comely shiner	*Notropis amenus*	Stray
Source: EA, 1989. Abundance based on P. Briggs & J. Waldman 2002. Marine Fishes of Long Island		

4.1.5.3 Threatened or Endangered Species

A Natural Heritage Database search was conducted for the project area (Appendix D). The search indicated that there are known occurrences of threatened or endangered species within the project area, specifically the yellow-crowned and black-crowned night heron. Suitable foraging habitat for these species is present within this highly urbanized area and is primarily situated within the existing common reed and salt marsh dominated wetland plant communities.

4.1.6 Traffic

4.1.6.1 Tremley Point Connector Road

As the TPCR will be constructed subsequent to the completion of the improvements to Interchange 12, comprehensive modeling was conducted by Edwards and Kelcey (E&K) for Interchange 12 improvements along with the development of the TPCR. A TRANPLAN model was created for the TPCR representing the existing conditions. To develop and calibrate the model, existing traffic volumes were collected for the study area. Data collection included two

Automatic Traffic Recorder (ATR) locations and one manual traffic classification count. ATRs were placed at the following locations (See Figure No. 19):

A5. Industrial Highway just east of Salt Meadow Road; and
A6. Tremley Point Road just east of the New Jersey Turnpike (NJTP).

The manual traffic count was performed at the following intersection:

M3. Industrial Highway and Salt Meadow Road.

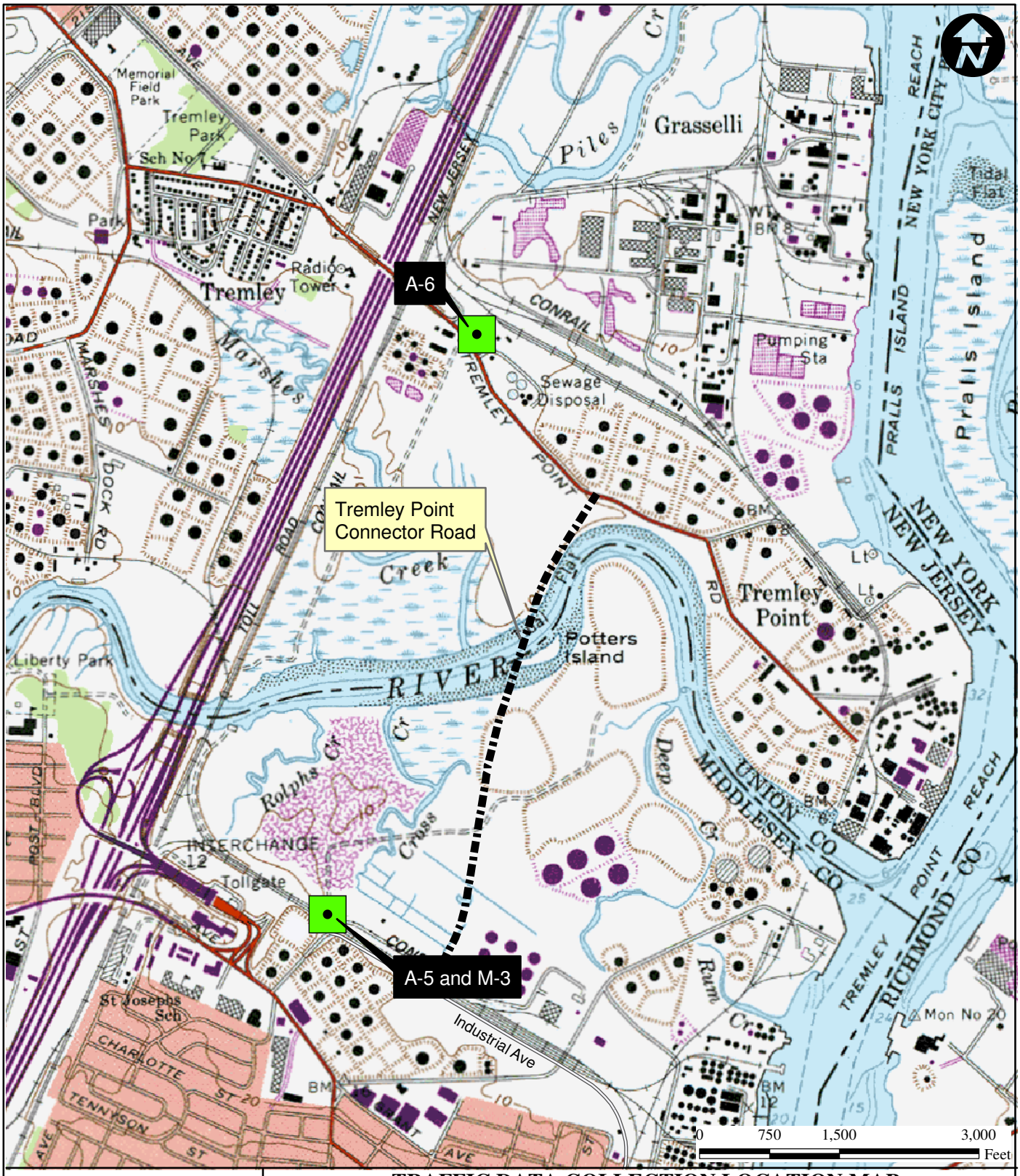
These data were used to create networks (autos and trucks for AM and PM peak periods). The raw volumes were then adjusted to obtain a balanced network (i.e., volumes exiting at an intersection up stream match of the volumes entering the downstream intersection). The balanced volumes are shown in Appendix A - Traffic Report.

4.1.6.2 South Wood Avenue/Roosevelt Avenue

Presently vehicular access to industrial and commercial areas along the Arthur Kill in Linden and Carteret are somewhat limited. This is especially true in Linden where the only access to Tremley Point is across the South Wood Avenue Bridge over the New Jersey Turnpike. Automobile as well as truck traffic destined to the U.S. Route 1 and 9 Corridor and beyond have as an only recourse to use South Wood Avenue for a certain part of the trip. In Carteret, in addition to Roosevelt Avenue, access to the outside areas is also provided to the New Jersey Turnpike at Interchange 12. The proposed TPCR roadway/bridge across the Rahway River between Tremley Point in Linden and Industrial Highway in Carteret will positively alter existing traffic patterns both along South Wood Avenue and within the vicinity of Turnpike Interchange 12 by intercepting traffic that otherwise would have to travel seven miles to get from Tremley Point to Interchange 12 (see Section 2.2.2).

4.1.6.3 Model Development and Calibration

To determine the change in traffic patterns resulting from the construction of the proposed TPCR, as well as the planned developments on Tremley Point, a transportation planning model was created by E&K. The study area network and trip tables were extracted from the recently completed PANY/NJ Portway Extensions model and cover an area extending from the Arthur Kill on the east to approximately half a mile west of the U.S. Route 1 and 9 Corridor on the west and from the Goethals Bridge on the north to the New Jersey Turnpike Interchange 11, Garden State Parkway and Route 9 interchange complex to the south. The extracted model was further refined by the addition of local arterials, the subdivision of large traffic analysis zones and the review and update of link speed and capacity data. The Portway Extensions model contained detailed truck trip purposes that were combined resulting in a two purpose model: 1) all light



Legend

- Tremley Point Connector Road
- Traffic Data Collection Location

SOURCE:
USGS Topographic Map
Arthur Kill Quadrangle, 1981

TRAFFIC DATA COLLECTION LOCATION MAP
NEW JERSEY TURNPIKE AUTHORITY
TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET, MIDDLESEX COUNTY
AND CITY OF LINDEN, UNION COUNTY, NEW JERSEY

PS&S
integrating design & engineering

Drawn By: JC	Scale: 1" = 1,500'	Project No. 02595.003.004
Chk'd By: IPD	Date: 8/15/08	Figure No. 19

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vehicles; and 2) all single unit and combination trucks with six or more tires. Separate trip tables were developed for the morning and evening peak hours.

Model calibration consisted of two steps. The first involved the review of minimum time paths between all key points in the base network with adjustments made to link travel times/speeds until the desired routing was obtained. The second calibration step involved trip table adjustments until observed traffic conditions were obtained. For the second step, three locations were selected that intercepted all traffic entering and exiting the study area east of the New Jersey Turnpike. Specific locations were: South Wood Avenue/Tremley Point Road overpass over the Turnpike; Roosevelt Avenue overpass over the Turnpike; and the Interchange 12 Toll Plaza. Traffic volumes for the South Wood Avenue control point were obtained from traffic counts conducted by E&K in mid December 2005. The control volumes for the Roosevelt Avenue and Interchange 12 check points were taken from an Interchange 12 traffic study prepared for the Authority in 2003.

The base condition trip tables were assigned to the existing network using the equilibrium assignment procedures. The assigned volumes were compared to the control volumes and the trip levels adjusted until the assigned volumes were in reasonable agreement (within 10%) with the control volumes. Truck and light vehicle trip tables were calibrated independently. Table 4-5 lists the control volumes for the three checkpoint locations and the calibrated volumes after seven iterations. This trip level approximates the existing (late 2005 or early 2006) conditions and serves as a base of comparison for trips generated by proposed developments.

The base condition trip table contains 49,201 light vehicle trips and 2,771 truck trips for the morning peak hour. For the evening peak hour the trip levels are 47,786 light vehicle trips and 1,996 truck trips.

TABLE 4-5							
Model Control Volumes							
Calibration Location		**AM Peak Hour**			**PM Peak Hour**		
		Control Volume	**Assigned Volume**	**% Difference**	**Control Volume**	**Assigned Volume**	**% Difference**
South Wood	WB Trucks	61	61	0%	37	40	8%
Avenue	WB Light Vehicles	75	76	1%	208	207	0%
	EB Light Vehicles	175	173	-1%	50	48	-4%
	EB Trucks	28	26	-7%	44	47	7%
Roosevelt	WB Trucks	198	198	0%	93	95	2%
Avenue	WB Light Vehicles	967	968	0%	950	952	0%
	EB Light Vehicles	637	634	0%	1039	1037	0%
	EB Trucks	143	141	-1%	72	76	6%
Interchange 12	WB Trucks	273	273	0%	105	105	0%
Toll Plaza	WB Light Vehicles	1005	1066	6%	909	946	4%
	EB Light Vehicles	823	850	3%	923	986	7%
	EB Trucks	265	265	0%	163	163	0%
	Total Screenline	**4650**	**4731**	**2%**	**4593**	**4702**	**2%**
Source: E&K, 2006							

4.1.7 Noise

A study of existing noise associated with traffic in the project area was performed to characterize the existing ambient sound environment in the vicinity of the site for use in assessing potential noise impacts associated with the projected traffic flow related to the TPCR. Noise monitoring was performed by PS&S in the Linden and Carteret, New Jersey areas to identify current environmental noise conditions in the vicinity of the proposed TPCR and for verification of the noise model. The area in Carteret is dominated by the traffic associated with Interchange 12. In Linden, South Wood Avenue is composed of residential and commercial properties while Tremley Point Road is predominantly used by tanker trucks for the acceptance of refined fuel products. The complete Mobile Source Noise Impact Assessment is provided as Appendix B.

4.1.7.1 Noise Monitoring Equipment

A sound level meter is the conventional instrument used to measure instantaneous sound pressure levels in decibels (dB) of sound energy. The sound level meter contains a microphone, amplifier, frequency rating networks and digital display indicators.

A Brüel and Kjær (B&K) Modular Precision Sound Level Meter Type 2231 was used to measure and analyze noise levels for this noise study. A B&K Microphone Type 4189 was used in conjunction with the B&K 2231. The B&K 2231 is a general purpose, Type 1 sound level meter. It conforms to the American National Standards Institute, Inc. (ANSI) Standard Specification for sound meters (S1.4-1983) and the International Electrotechnical Commission Standard (IEC 804 and relevant sections of IEC 651) for sound level meters.

Calibration of the B&K 2231 was performed using the B&K 4230, which allows calibration of the sound level meter in accordance with ANSI (S1.40-1984) and IEC (942-1988, Class 2) Standards.

4.1.7.2 Noise Monitoring Methodology

There are a number of noise monitoring methodologies available for performing baseline noise studies. Most consist of various data acquisition and analysis procedures (Greenberg, *et al.* 1979). The approach utilized for this noise impact assessment follows appropriate general guidelines and recommended practices for noise measurement studies.

The methodology and procedures utilized during the noise monitoring conform to USEPA and New Jersey procedures for noise determination (N.J.A.C. 7:29B-1.1 *et seq*.). The measurement procedure utilized an A-weighted frequency response that simulates the response of the human ear to sound levels and has been given

prominence as a means for estimating annoyance caused by noise, for estimating the magnitude of noise-induced hearing damage, in hearing conservation criteria, for speech interference measurements, and in procedures for estimating community reaction to general wide band noise (Clayton, *et al.* 1978, Cheremisinoff, *et al.* 1977). A-weighting is the accepted frequency response for evaluating subjective and physiological effects of sound.

In accordance with New Jersey guidelines and procedures, the sound level meter was set on a tripod approximately three to four feet above the ground. The microphone was positioned at a location for obtaining representative noise measurements with the monitoring location being away from obstructions, large reflecting surfaces and other noise sources not representative of the area. Calibration of the sound level meter was performed periodically and the recorded data were examined for unusual or potentially erroneous readings.

During noise measurement periods, observations of roadway noise sources, identifiable noises (e.g., air traffic) and temperature/wind speed readings were recorded in the field notes. Noise measurements were collected for 15 to 20 minutes per sampling event at each noise monitoring location during similar time frames when traffic volume counts were recorded. Ten second integrated noise values were recorded during the noise monitoring periods and were used to compute Leq values for each 15 to 20 minute monitoring period. Atmospheric conditions such as rainfall, high humidity (greater than 90 percent), and high wind (greater than around 12 to 15 miles per hour) were avoided during field monitoring because of their adverse effect on noise measurements. Precautions were taken to prevent data from being unduly influenced by extraneous noise sources, the most common of which are wind and wind-induced noises. A wind screen was utilized to cover the microphone during noise monitoring to minimize potential wind effects.

4.1.7.3 Noise Monitoring Locations

Portions of the project area are zoned residential and some are zoned industrial. The area contains commercial traffic (i.e., trucks and buses) on the local roadways. The New Jersey Turnpike is audible from some local streets. The area also contains several motels and some residential receptors that may be considered sensitive to noise impacts. Additional noise sources in the area include air traffic and commercial operations.

Within Carteret, the sensitive noise locations (i.e., Holiday Inn and residential apartments) are located on Roosevelt Avenue, just south of Interchange 12. In Linden, the nearest sensitive noise location is the neighborhood at the intersection of South Wood Avenue and Tremley Point Road, which is approximately one mile from where the TPCR will intersect Tremley Point Road. The neighborhood in Linden is also adjacent to the Linden Airport.

Noise monitoring was performed in the vicinity of the TPCR site. Locations were selected based on proximity to locations where traffic volume counts were recorded, as well as locations of potentially sensitive receptors. Table 4-6 provides a list of these noise monitoring locations. Figure No. 20 shows the noise monitoring locations on a Hagstrom county map.

TABLE 4-6
Noise Monitoring Locations

Location Number	Description of Location
NM-3	The park located where Grant Avenue meets Roosevelt Ave.
NM-4a & NM-4b	The open lots on the northern side of Beverly Street.
NM-6	Memorial Park located on South Wood Avenue, Linden.

Note: NM-4a was moved half a block up Beverly Street to NM-4b on June 11 (the second day of monitoring) because construction equipment was obstructing the original site.

4.1.7.4 Noise Monitoring Results

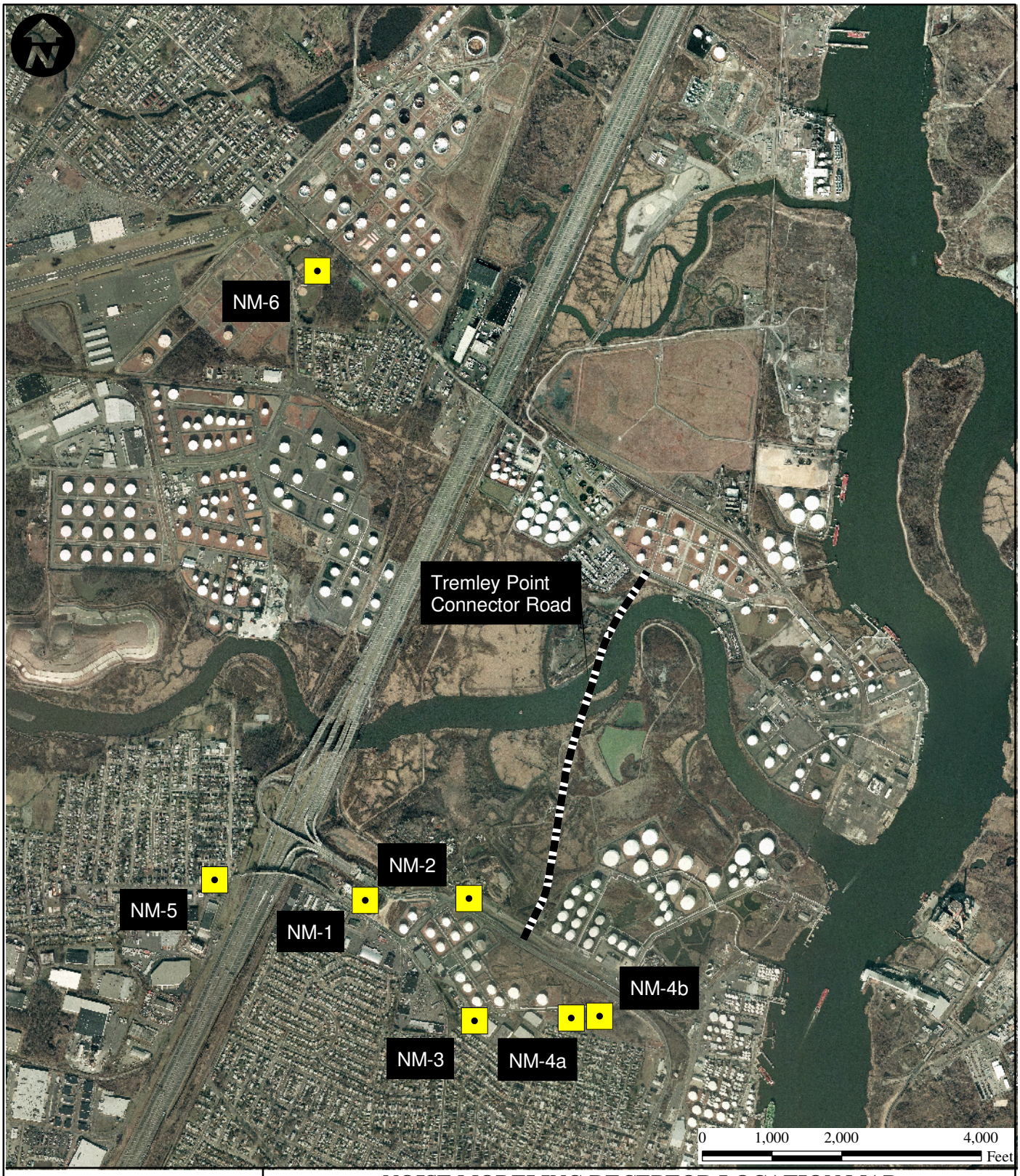
This EA includes noise monitoring results for monitoring locations NM-3, NM-4 and NM-6 (see Table 4-6 - Noise Monitoring Locations). Noise levels at NM-6 are expected to be reduced by the diversion of truck traffic from South Wood Avenue to the TPCR and Industrial Highway. Noise monitoring results for NM-1, NM-2 and NM-5 are included in the Mobile Source Noise Impact Assessment for the Interchange 12 Improvements (PS&S 2002). NM-1 was used in the noise model verification analysis.

The noise monitoring results are summarized in Table 4-7. The table provides the Leq noise levels in dBA for each sampling period (15 to 20 minutes) for each noise monitoring location.

TABLE 4-7
Noise Monitoring Results (a)

Noise Monitoring Location	Monitoring Time Period	Noise Level Leq (b) (dBA)
NM3	8:12 – 8:29	66.5
	17:04 – 17:21	64.9
NM4	9:14 – 9:34	55.7
	16:03 – 16:19	56.3
NM6	10:00 – 10:19	71.6
	15:05 – 15:23	72.7

Notes:
(a) Noise monitoring was performed on June 4th, June 11th & June 21st, 2002
(b) Noise results are Leq values over the 15 to 20-minutes monitoring period



Legend

Tremley Point Connector Road

Noise Modeling Receptor Location

SOURCE:
Aerials Express, 2006

NOISE MODELING RECEPTOR LOCATION MAP
NEW JERSEY TURNPIKE AUTHORITY
TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET, MIDDLESEX COUNTY
AND CITY OF LINDEN, UNION COUNTY, NEW JERSEY

PS&S
integrating design & engineering

Drawn By: ML	Scale: 1" = 2,000'	Project No. 02595.003.004
Chk'd By: IPD	Date: 8/15/08	Figure No. 20

Map Document: (P:\02595\003\Y\N\Maps\Fig20_NoiseModelingReceptorLocations_043007_02.mxd)
8/14/2008 -- 4:00:38 PM

The noise monitoring data are presented in Appendix B. A data sheet for each noise monitoring location contains a listing of ten second integrated records of sound pressure level readings for L_{10}, L_{70}, L_{90} and Leq noise descriptors. Comments are also provided, which make note of observations of extraneous or exceptionally loud noises occurring during the monitoring.

4.1.8 Air Quality

4.1.8.1 North Jersey Transportation Improvement Program

The TPCR project was recently listed on the North Jersey Transportation Planning Authority's (NJTPA) Transportation Improvement Program (TIP) for Fiscal Year (FY) 2009-2012. The NJTPA has determined that the FY 2009-2012 TIP for northern New Jersey conforms with the State Implementation Plan (SIP) established by the NJDEP. Conformity is the process that has been established by joint guidance from the USDOT and USEPA that ensures transportation investments will contribute to improving air quality in areas where concentrations of certain pollutants, including carbon monoxide, ozone and particulate matter, exceed national standards. Based upon the emission modeling results presented in the NJTPA's *"Air Quality Conformity Determination"* for FY 2009-2012, the NJTPA has satisfied all requirements of the federal final conformity rule for the TPCR.

4.1.8.2 Air Pollutants and Ambient Air Quality Standards

National and New Jersey Ambient Air Quality Standards (AAQSs) have been adopted in accordance with requirements of the Clean Air Act for several pollutants to protect public health and welfare allowing for an adequate margin of safety. These AAQSs are shown in Table 4-8. Primary AAQSs have been established to protect public health, while Secondary AAQSs have been established to protect public welfare.

As the proposed TPCR involves roadway construction and subsequent vehicular use, the air pollutants of potential concern include fugitive dust emissions during construction and carbon monoxide (CO) emissions from vehicular traffic during the use of the TPCR. The NJDEP and USEPA have identified CO as the primary pollutant of concern for evaluating potential air quality impacts from traffic related motor vehicle emissions because: CO is the most significant component of motor vehicle emissions; can be observed at elevated concentrations near roadways; and can cause adverse health effects at relatively low concentrations and short exposure periods. In addition, increased concentrations of CO can occur at congested intersections where traffic delays are common during peak hour traffic periods (i.e., because CO emissions from vehicles are greater during periods of vehicle acceleration/deceleration and idling, which typically occurs much more at congested intersections).

The existing background ambient air quality for the TPCR area can be characterized based upon air quality monitoring data collected by the NJDEP. Ambient air quality monitoring data are collected by the NJDEP at several monitoring locations throughout New Jersey. These data are compiled, analyzed and summarized quarterly, and reported to the USEPA. NJDEP monitoring stations in the vicinity of the TPCR include monitors in Perth Amboy and Elizabeth, New Jersey. The CO monitoring data for the year 2005 for these locations as presented in Table 4-8 can be considered representative of conditions in the general area. No exceedances of the National AAQS or New Jersey AAQS for CO were reported in 2005. For other monitored pollutants at the indicated monitoring locations, exceedances of the AAQSs for PM 2.5 (fine particulate matter) and ozone were reported in 2005. The entire State of New Jersey is classified as being in "moderate nonattainment" of the 8-hour AAQS for ozone. This is a regional air quality designation made by USEPA, which represents the impact of many sources in the northeast, and the interstate transport of pollution into New Jersey is considered a major contributor of this nonattainment status.

Table 4-8
National and New Jersey Ambient Air Quality Standards and Background Ambient Air Data

Pollutant	Averaging Period	AAQS (a)	2003		2004		2005		Monitoring Location
			Maximum	2nd High	Maximum	2nd High	Maximum	2nd High	
TSP ($\mu g/m^3$)	24-hr	150	74	(b)	(b)	(b)	(b)	(b)	New Brunswick, Middlesex County (c)
	12-month geo. mean	60	27.6	---	(b)	---	(b)	---	
PM10 ($\mu g/m^3$)	24-hr	150	89	61	68	54	69	66	Jersey City, Hudson County
	Annual Mean	50	32	---	27	---	30	--	
PM2.5 ($\mu g/m^3$)	24-hr	65	59	49	56	46	180	116 (d)	Elizabeth, Union County
	Annual Mean	15	16.0	---	15.1	---	16.1	---	
Lead ($\mu g/m^3$)	Quarterly Mean	1.5	0.04	---	0.12	---	0.16	---	New Brunswick, Middlesex County
SO_2 (ppm)	3-hr	0.5	0.059	0.055	0.047	0.047	0.050	0.045	Jersey City, Hudson County
	24-hr	0.14	0.034	0.034	0.030	0.028	0.033	0.029	
	Annual Mean	0.03	0.009	---	0.008	---	0.008	---	
NO_2 (ppm)	Annual Mean	0.05	0.032	---	0.031	---	0.032	---	Elizabeth, Union County
Ozone (ppm)	1-hr	0.12	0.122	0.120	0.119	0.112	0.132	0.125	New Brunswick, Middlesex County
	8-hr	0.08	0.117	0.113	0.099	0.088	0.097	0.094	
CO (ppm)	1-hr	35	4.6	4.0	4.6	4.1	5.8	4.8	Jersey City, Hudson County
	8-hr	9	3.0	2.9	3.2	3.2	3.0	2.8	

Sources:
2003 *Air Quality Report,* NJDEP Bureau of Air Monitoring, October 2005
2004 *Air Quality Report,* NJDEP Bureau of Air Monitoring, March 2006
USEPA AIRData, extracted April 3, 2006

Notes:
(a) Most stringent of Primary or Secondary National or New Jersey Ambient Air Quality Standards
(b) Data not reported by NJDEP
(c) Lead monitoring site
(d) NAAQS is met based on 98th percentile value (48 $\mu g/m^3$ for 2005)

4.1.9 Hazardous Materials

4.1.9.1 Database Search

Several databases containing listings of hazardous waste sites or potential hazardous waste sites were searched through Environmental Data Resources (EDR, 2005). The EDR databases included the National Priority List (NPL), Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS), Resource Recovery and Conservation Information System (RCRIS) and State listings for Hazardous Waste Sites, Solid Waste Facilities/Landfill Sites, Leaking Underground Storage Tanks (LUST) and New Jersey Spills of hazardous materials. From these databases, a total of 41 potential hazardous waste sites were identified in the study area.

Several of the proposed alignment alternatives (see Section 3.0) encounter areas that have been previously impacted by hazardous materials due to the highly industrial nature (major facilities), former municipal landfills and former American Cyanamid sludge lagoons located in the area. The proposed alignments traverse or are adjacent to several petroleum bulk storage facilities with docking facilities/pipelines (BP/Amoco, GATX, Kinder Morgan, Phillips Petroleum, Citgo and Tosco) (see Figure No. 3). Also located in the project area are the former Carteret municipal solid waste landfill that has been recently redeveloped into a warehouse distribution facility and the closed American Cyanamid sludge lagoons (impacted by the disposal of sludge containing cyanide). Organic and inorganic contamination of soils, groundwater and surface waters is expected to be encountered in the area of the proposed alignment alternatives.

Available information regarding environmental site conditions of properties in the project area was obtained via NJDEP Site Remediation file reviews for sites where easements may be obtained. Information obtained from the NJDEP files is summarized below.

4.1.9.2 Tosco Terminal, Linden

Limited information regarding the TOSCO facility was located during review of NJDEP files at the Division of Discharge Prevention Cleanup and Countermeasures (DPCC). No information regarding current soils and groundwater quality was located for this site. According to the available information contained in the Tremley Point DPCC Plan Renewal, dated March 2002, TOSCO acquired the Tremley Point Terminal on February 2, 1996 from BP Oil. TOSCO Corporation is currently a wholly owned subsidiary of Phillips Petroleum Company (Phillips purchased TOSCO in 2001). The Tremley Point Terminal consists of 117 acres on the west bank of the Arthur Kill. The terminal has been in operation since 1918. Products received, stored and distributed include gasoline, No. 2 heating oil, low sulfur diesel, jet fuel and kerosene. Total terminal volume in 2001 was 1.113 billion gallons.

The Plan Renewal report states that four discharge events occurred at the facility from March 1, 1999 to February 28, 2002. Three of these spill events reportedly consisted of minor quantities (2 to 20 gallons) and were immediately cleaned up. The forth event reportedly involved 500 gallons of gasoline at the truck loading rack.

The sale of the property in 1996 and the 2001 purchase of TOSCO by Phillips should have resulted in Industrial Site Recovery Act (ISRA) site review, however, the NJDEP Division of Responsible Party Site Remediation could not locate the requested files for this site. The Tosco Tremley Point Terminal is a bulk petroleum storage facility. The Tosco Terminal is not identified on the Environmental Data Resources database as a potentially contaminated site. However, hazardous material impacts to the site may be anticipated due to the long history of the facility being a bulk storage facility, which has been in existence since 1918.

4.1.9.3 Tremley Point Industries, 4700 Tremley Point Road, Linden

This property is occupied by a trucking facility and is currently undergoing ISRA review due to the purchase of the property by 4700 Tremley, LLC. A combination Preliminary Assessment Report, Site Investigation Report and Remedial Action Report, dated February 2001, prepared by Pennjersey Environmental Consulting, Inc., was submitted to the NJDEP on behalf of Tremley Point Industries, Inc. A PS&S representative spoke with Mr. Walter Kokola, NJDEP Case Manager, who stated that the NJDEP had reviewed the February submission and that additional investigations were being requested.

The February 2001 report states that contamination noted at the site consists of: residual total petroleum hydrocarbons and priority pollutant heavy metals related to a former sandblasting operation; minor volatile organic exceedances in one portion of the septic system leach field; and petroleum product contamination of the groundwater migrating onto the site from an unidentified upgradient source. The total petroleum hydrocarbon and metals impacted soils in the area of the sandblasting operations were removed (~5 cubic yards) and disposed of off-site. Groundwater sampling of temporary well installations along Tremley Point Road (upgradient) reportedly detected chlorobenzene and total petroleum hydrocarbons above (i.e., exceeding) the Ground Water Quality Criteria (GWQC) values/thresholds.

4.1.9.4 Citgo Petroleum, 4801 Tremley Point Road, Linden

The Citgo Linden Terminal Facility consists of the Tremley Tank Farm and Warners Tank Farm. The Warner Tank Farm (4801 Tremley Point Road) consists of approximately 75 acres located between the Arthur Kill and Rahway River on both sides of South Wood Avenue. The Tremley Tank Farm is located on the

west side of the New Jersey Turnpike and is not located within the proposed alignments. The two tank farms are connected by pipelines that run along Tremley Point Road. Both Citgo sites underwent ISRA review (ISRA Case # 89A18) and shortly thereafter Citgo entered into an Administrative Consent Order (ACO) with the NJDEP.

The Warners Tank Farm was operated as an asphalt refinery from the early 1900s to 1960. As of the mid-1960s, the tank farm has been used solely for petroleum product storage and distribution. Soils of the subject site have been impacted by residual product. The residual product in soil is extensive in many areas of the site. There is an estimated 430,000 cubic yards of in-place impacted soils in the east yard of the Warners Tank Farm (in the area of the former asphalt plants). The residual product is believed to be the result of releases from previous asphalt plants and the nature of the contamination is described as an extremely viscous, high density, soil-sorbed substance. Isolated areas of soil impacted by metals, polycyclic aromatic hydrocarbons (PAHs), pesticides and PCBs were also detected. Portions of the impacted soils have been remediated by soil removal and off-site disposal. Citgo proposes to establish a Declaration of Environmental Restriction (now referred to as a Deed Notice) with the impacted soils remaining on the site.

Five waste disposal areas were identified on the subject site used for disposal of tank bottom sludge, used product and construction debris generated at the facility. Two areas of floating product on the groundwater are located at the tank farm; free product recovery has been ongoing since October 1996. The groundwater of the site has been impacted by gasoline constituents (BTEX), gasoline additives (MTBE and TBA), cyanide and arsenic. Citgo performs semi-annual groundwater sampling of perimeter and source wells. Citgo proposes to establish a Classification Exception Area (CEA) with an indeterminate duration.

4.1.9.5 Cytec (American Cyanamid Warners Plant), 4900 Tremley Point Road, Linden

The American Cyanamid Warners Plant has been operated by American Cyanamid since 1917 producing a variety of chemical and agricultural products. The site consists of approximately 32 acres located at the eastern end of Tremley Point. In May 2000, the property was transferred to Tremley Point Marine Terminals LLC and was proposed as the site of a solid waste transfer station. According to a Remedial Investigation Report prepared by Blasland, Bouck & Lee, dated September 8, 1992, American Cyanamid applied for a RCRA Part B permit in 1986, which triggered the investigation of the potential for continuing releases of hazardous materials from solid waste management units located at the site.

The NJDEP performed a Facility Assessment and in September 1990, the NJDEP and American Cyanamid entered into an ACO requiring the investigation of the subject site.

The Remedial Investigation Report (RIR) contains the results of initial soil sampling conducted to assess Solid Waste Management Units (as referred to by RCRA). Piezometers were installed to assess the hydrology of the site, however, no groundwater sampling and analysis was conducted. Results of soil sampling found soils impacted by DDT, PAHs, and American Cyanamid products such as ThimetR, 2,4-dimethylphenol and volatile organic compounds. A Phase II workplan contained in the file states that the impacted soils and shallow groundwater of the site would be further assessed. In 1997, a Declaration of Environmental Restriction was established for five affected areas of soils at the Warners Plant.

A five-year groundwater monitoring program (semi-annual from 1996 to 2000) was conducted at the Warners Plant. The groundwater samples were analyzed for constituents of concern that were identified as six volatile organic compounds (carbon disulfide, methylene chloride, acetone, benzene, chlorobenzene and xylene) and six inorganic compounds (aluminum, arsenic, iron, lead, manganese and sodium). The final groundwater monitoring report was submitted in March 2001. The groundwater sampling data are summarized in a letter report, dated March 6, 2001, prepared by Cytec and submitted to the NJDEP. The report states that the laboratory analytical results for groundwater sampling over the past five years indicates concentrations of site-specific contaminants of concern that have been consistently below the site-specific quality criteria established for the site. Based upon the results of the five-year monitoring program, Cytec requested a No Further Action determination for groundwater beneath the Warners Plant. Correspondence from the NJDEP, dated October 4, 2000, states that the establishment of a Classification Exception Area (CEA) is not necessary as the site groundwater is classified as Class III-B due to high concentrations of total dissolved solids and chloride, and site-related contaminants of concern do not exceed site-specific quality criteria.

A half-acre of sediment was found to have elevated levels of DDT, DDD and DDE. This area was remediated by repairing the bulkhead and installation of an armoring system (capping) over the sediments in the Rahway River. A three-year sediment monitoring program was implemented by Cytec following installation of the armoring system. The sixth and final semi-annual sampling report was submitted in March 2001. The report states that the analytical results for the sediment monitoring program indicated that the concentrations of pesticides and metals in the Rahway River sediments have either remained stable or decreased since installation of the armoring system.

In January 2000, an additional site investigation was conducted as part of a due diligence related to the sale of the property (Cytec to Tremley Point Marine

Terminals). An additional 23 soil borings were performed at areas of concern previously not investigated; particularly areas of transformer pads and under buildings and structures, which had been demolished. The results of this site investigation are contained in a report entitled, Site Closure RI/RA Report, prepared by Blasland, Bouck & Lee, Inc., dated October 2001. Additional areas of soil contamination were discovered (primarily PCB-impacted soils). Some soils were excavated for off-site disposal. A site-wide deed restriction is proposed to address the presence of historic fill throughout the site. The area-specific deed restriction is being modified to incorporate additional affected areas. A draft deed restriction was submitted to the NJDEP on January 21, 2002.

4.1.9.6 Cytec (American Cyanamid) Carteret Impoundments, Carteret

According to a Preliminary Assessment performed by the NJDEP, dated 1991, the Cytec (American Cyanamid) Carteret Impoundments is a 110 acre site that occupies Block 9.03, Lot 21; Block 10, Lots 8, 9, 10, 12 through 21; and Block 11.01, Lots 8, 10 through 14 and 28 in Carteret, New Jersey. The impoundments accepted wastes from two chemical manufacturing processes at the adjacent Warners Plant in Linden, New Jersey. The sludge wastes were piped via above-ground lines from the Warners Plant, across the Rahway River and into a series of six impoundments. The impoundments were constructed of both soil and wooden dikes and eventually covered approximately 100 acres. The impoundments are estimated to contain approximately 2,000,000 tons of sludge. The two products manufactured were alum and yellow prussiate of soda (YPS). The production of YPS involved the reaction of calcium cyanide with ferrous sulfate and soda ash to form sodium ferrocyanide. The disposal of YPS sludge ceased in 1970 and the disposal of alum sludge ceased in 1973. The impoundments that accepted these wastes from 1939 to 1973 were unlined.

In 1981, American Cyanamid collected water and sludge samples from the impoundments that were analyzed for cyanides and metals. Complex cyanides were detected at levels up to 3,500 parts per million (ppm) in the sludge. In 1986 eight aqueous samples and five sludge samples were obtained. Total cyanides in the aqueous samples reached 124 ppm; a maximum of 3,600 ppm was detected in the sludge samples. The impoundments have been covered with composted sewage sludge and partially vegetated to control soil erosion from wind that, in the past, had blown across roadways. The vegetating work was completed in 1987. Roads were installed throughout the impoundments with the remains of two demolished buildings from the Warners Plant.

Ten monitoring wells were installed and sampled quarterly from July 1987 to October 1990 for metals, cyanide, phenols and volatile organic compounds. There were many permit exceedances (NJPDES Permit No. NJ0061611). Metals such as arsenic, cadmium, iron and manganese were reported, as well as high levels of total cyanide (up to 279 ppm). Volatile organic compounds were also

detected, including benzene (up to 375 ppb), 1,1-dichloroethane (up to 127 ppb), methylene chloride (up to 150 ppb) and toluene (up to 6,490 ppb).

According to a Remedial Action Plan Addendum (RAPA), prepared by Blasland, Bouck & Lee, Inc., (February 1995), in September 1990 American Cyanamid signed an ACO that required them to investigate and remediate potential contaminants at the Warners Plant (including the Carteret impoundments). The RAPA proposed a monitoring program that included the semi-annual sampling of groundwater and surface water quality for the first two years (1995 and 1996) and annually for three years (1997 through 1999). A copy of the Annual Monitoring Report for 1999 was obtained from the NJDEP files. The report's transmittal letter states that monitoring data consistently indicates concentrations of constituents below criteria and that based on the trend, additional groundwater and surface water monitoring appears to be unwarranted. The monitoring wells utilized in this monitoring program are located around the perimeter of the impoundments and not within the impoundments.

In April 1995, a Declaration of Environmental Restriction (now known as a Deed Notice) was established for the subject site. Alternations, improvements and disturbances cannot be performed without consent from the NJDEP. A copy of NJDEP correspondence dated October 4, 2000 states that the NJDEP concurs that a Classification Exception Area (CEA) is not necessary as: the site's groundwater is classified as Class III-B due to its high concentrations of total dissolved solids and chloride; and site-related contaminants of concern do not exceed the applicable site-specific groundwater quality criteria.

As part of the investigations that are needed to support the initial design of the TPCR, the Authority applied for and received from the NJDEP a GP No. 12 permit to conduct geotechnical borings within the approximate route of several alternative alignments for the TPCR. As the preferred alignment had not been determined by the USCG, in consultation with the NJDEP, the Authority was able to combine several of the alignments that had some of the lowest wetlands impacts, lower costs and shared similar footprints for a portion of the route. Within this expanded footprint, the NJDEP authorized the Authority to take limited geotechnical borings in the wetlands and open water of the Rahway River As part of the authorization from the NJDEP, the Bureau of Operations, Maintenance and Monitoring approved the Authority to conduct the geotechnical borings within the Deed Notice identified areas and the lagoons on the Cytec property. In addition, the NJDEP Land Use Regulation Program provided the following guidance on conducting geotechnical borings in the westernmost Cytec lagoon "*…based upon best professional judgment, it's determined not (Cytec lagoon) to be wetlands since the DEP has not made a decision and has not requested additional information."* The geotechnical boring program was completed in early 2006.

4.1.9.7 American Oil Company (BP/Amoco), 760 Roosevelt, Carteret

The BP/Amoco Carteret Terminal consists of two facilities referred to as the Upper Plant and Lower Plant. The Upper Plant, which is in the vicinity of the southern terminus of the proposed TPCR, is used for above-ground storage of refined petroleum products and loading of tanker trucks. The Upper Plant is bounded by Roosevelt Avenue, Industrial Highway and a private road referred to as Plant Road. The Lower Plant serves as a marine transfer facility and is located on the Arthur Kill just south of its confluence with the Rahway River. The Lower Plant is accessible by the Plant Road (a private road).

Upper Plant

In 1986, the Environmental Cleanup and Recovery Act (ECRA) was triggered for the Amoco facility following the condemnation of a portion of the Upper Plant property by the New Jersey Department of Transportation (NJDOT) for the construction of Industrial Highway (ECRA Case # 86A85). In May 1987, Amoco entered into an ACO with the NJDEP.

The results of an October 1992 Groundwater and Soil Investigation found free phase floating hydrocarbons, primarily a mixture of No. 2 fuel oil and gasoline, existed on the groundwater in the central portion of the Upper Plant. Over eight feet of petroleum product was detected in a monitoring well. Amoco initially collected free phase product from on-site recovery wells and the monitoring well. The above-ground storage tanks (ASTs) in the area of the plume were inspected with many of the ASTs failing to meet American Petroleum Institute (API) standards. Several of the ASTs were permanently removed or taken out of service for repair. Dissolved phase groundwater contamination and soils impacted by residual product were also found at the Upper Plant.

Groundwater is currently collected on site in two trenches: one 360-foot long trench located on the northeast side of the Upper Plant along Industrial Highway; and one 80-foot long trench located near the center of the plant. According to the April 26, 2002 progress report, 2,800 gallons of product have been recovered by the system and 6,238,740 gallons of groundwater were recovered and treated. The extracted groundwater is directed through the treatment system and discharged to surface water through NJPDES permit #NJ0107727.

Other Incidents at the Upper Plant

On February 5, 2000, approximately 3,500 gallons of high sulfur fuel oil and Unisol Liquid Red B-50 leaked into the dike area of AST #28 (NJDEP Case #00-02-05-1739-48). Approximately 3,300-gallons of fuel oil and red dye were recovered by vacuum truck and transferred to an on-site oil-water separator. Hydrocarbon impacted soil was excavated to a depth of 1.5 feet and post-excavation soil samples were obtained. Based upon the results of the post-

excavation soil sampling, no further action was proposed for AST #28. The NJDEP approved the No Further Action request at this time stating that if product is observed in wells in the area of AST #28, further investigations may be required.

On June 12, 2000, a gasoline leak occurred from AST #95. It was estimated that 34,000-gallons had leaked out of the AST through holes in the floor of the tank. AST #95 is up-gradient of the 360 foot long recovery trench.

In March 1997, a release occurred at the Buckeye Pipeline transfer pump station along the private Plant Road. In April 2001, four temporary monitoring points were installed and sampled. Dissolved phase hydrocarbons were found in two well points above groundwater quality criteria. Installation of monitoring wells and groundwater sampling and analysis were recently proposed to delineate hydrocarbon impacts resulting from this release.

Lower Plant

A Remedial Investigation Report (RI) for the Lower Plant, dated March 26, 2001, prepared by Handex, was submitted to the NJDEP that summarizes site investigations since the submittal of a Remedial Investigation Workplan dated October 21, 1997. The RI focused on the delineation of the free product plume, hydrocarbon impacted soil and the dissolved phase hydrocarbons in the groundwater. In 1999, the plume extended north onto the adjacent Phillips Petroleum site and GATX terminal to the north. Amoco proposed additional monitoring wells, soil borings and continued gauging of wells for free product. No interim product recovery system is mentioned in the RI. The groundwater flow is to the south-southeast. Amoco believes the plume and associated dissolved phase groundwater impact is from an up gradient source. Correspondence from the NJDEP, dated July 17, 2001, following review of the RI, required Amoco to perform additional investigations.

4.1.9.8 Kinder Morgan Inc. (former Philips Petroleum and General American Transport Corp. (GATX)) 78 Lafayette Street, Carteret

The files made available by the NJDEP regarding the GATX site were for 99 Lafayette Street (18.5 acres) and not the entire GATX terminal facility (approximately 200 acres). According to GATX Terminal Corporation correspondence to the NJDEP, dated March 5, 1996, evidence of product leakage from the P-Pipelines was detected in the Gateway property in 1995. Findings of site investigations conducted found that the P-Pipelines had leaked resulting in the accumulation of a free-product (gasoline) plume beneath the south central portion of the Gateway Terminal Service Corporation. The site investigations were conducted on the Gateway Terminal Service Corporation's leasehold property that had been impacted by the pipeline leak and not the entire GATX terminal facility. The Gateway Terminal Service Corporation leasehold property is

identified as Block 9.3, Lots 14.01, 17.04 and 17.05, Block 9.04, Lots 13 and 14, Block 9.06, Lot 4 and Block 600, Lot 5, Carteret, New Jersey. Gateway washes, repairs and stores empty tanker trucks and intermodal containers. GATX owns much of the property adjacent to Gateway.

A RIR, Remedial Action Selection Report, and Remedial Action Work Plan, dated May 1998, prepared by H2M Group was submitted to the NJDEP by GATX. According to the RI, odors were identified as emanating from a hole in the floor of the Gateway truck bay. The P-Pipelines and the Buckeye pipeline were tested and P-Pipelines 1 and 4 were found to be leaking approximately 200 feet south of the Gateway building. The P-Pipelines were removed from service. On July 31, 1995, an ACO was executed by GATX and the NJDEP. According to the RI, with the exception of the transfer of diesel fuel in the early 1970's when the pipelines were constructed, the P-Pipelines have been used exclusively for the transfer of gasoline and MTBE.

A free product plume of diesel/No. 2 fuel oil was discovered during the RI. Delineation of both plumes was achieved during the RI and the plumes were identified as being limited to an area south of the Gateway building, surrounding the P-Pipelines. Gasoline in the free product zone was estimated to range from 30,580 to 32,770 gallons. The total volume of diesel fuel was estimated to range from 35,398 to 70,010 gallons. GATX did not consider contaminants other than gasoline attributable to the P-Pipelines and therefore, they were not included as part of the ACO. In 1998, the delineation of dissolved groundwater contaminants and free product recovery were ongoing. The groundwater was also determined to have elevated concentrations of lead believed to be from an up gradient source. Soils in the area of the plumes are impacted by residual product. A RAW was submitted to the NJDEP to obtain approval for remediation of the Gateway site.

Two different types of fill were encountered at the site. The first, described as a white slurry, reportedly consisted of fertilizer manufacturing residual. The second, described as black sand to gravel-sized plastic-like grit may be pulverized plastic telephones.

4.1.9.9 Titan PDC (Former Carteret Borough Sanitary), Roosevelt Avenue and Driftway Street, Carteret

The landfill was constructed on natural marshland that originally had a surface elevation of approximately four feet. The elevation of the former landfill (i.e., recently remediated by Titan PDC for a warehouse distribution facility) surface had varied from four feet at the perimeter to 48 feet at the center. Landfilling operations were initiated in 1959 and extended through the mid-1980s. The landfill materials consist of a very heterogeneous mixture of wood, soils, household refuse and construction and demolition debris. This site was identified in the NJDEP files as the Carteret Borough Sanitary Landfill. According to a Phase II Investigation Report, Carteret Landfill Closure and Redevelopment

Project, Carteret, New Jersey, prepared by Dan Raviv Associates, Inc., dated February 15, 2000, groundwater/leachate of the landfill has been found to be impacted by gasoline constituents (BTEX), chlorobenzene and metals (antimony, arsenic, cadmium, lead and mercury) above (i.e., exceeding) Ground Water Quality Criteria (GWQC). Groundwater in the landfill appears to be mounded and moves radially towards the surface water bodies to the north, east and west. Groundwater contour maps and cross section maps are included in the report. The site is currently nearing final redevelopment and had utilized capping and dynamic compaction. The redevelopment, now known as Titan PDC, is a warehouse distribution center that is nearly completed.

4.1.9.10 Borough of Carteret, Block 11.1, Lots 6, 7, 18 and 19, Carteret

These lots are part of the former Carteret Borough Sanitary Landfill that is now a warehouse distribution facility managed by Titan PDC. See Item 4.1.9.9, above, for information regarding this site.

4.1.9.11 Industrial Highway

This roadway project involved the construction of the 2.16 mile Industrial Highway from Middlesex Avenue to Roosevelt Avenue in Carteret. Contained in the Industrial Highway Environmental Report, dated May 21, 1992, prepared by James C. Anderson Associates, Inc., was one area of concern identified through soil sampling along or near the Industrial Highway right-of-way that is in the area for the TPCR. The area was identified as Amoco Wetlands (Stations 73+00 to 144+00). Historical sampling indicated that petroleum hydrocarbons, cyanide, organic compounds and heavy metals were present in the soils in the indicated areas. In addition, eleven abandoned drums were discovered in the wetlands areas.

Contamination found in the Amoco Wetlands, Stations 73+00 to 114+00, were related to the presence of coal ash, contaminated surface water and contaminated groundwater. Soil and sediments were found to contain elevated levels of petroleum hydrocarbons, cyanide, phenol and heavy metals. A layer of free product on the groundwater was also identified on the groundwater surface near stations 96+00 through 144+00.

A total of 9,131 tons of contaminated soil were removed from the site and disposed of off-site as ID-27 waste. The project report indicates numerous post-excavation soil and waste classification samples were obtained and analyzed, however, no tables summarizing the laboratory results were presented. The report contains a Table of Milestone Dates that outlines the activities conducted at the site relative to soil removal and sampling from September 1988 through November 1991.

4.1.9.12 Environmental Sampling

4.1.9.12.1 Introduction

Based upon the history of prior activities though the areas of the proposed alignments, described in the Sections 4.1.9.1.2 to 4.1.9.1.11 herein, it was determined that a Memorandum of Agreement (MOA) should be sought and obtained from NJDEP to further investigate the areas of the alignments for contamination. This information on contamination could then be factored into the evaluations of the alignments. An application for an MOA was issued to the NJDEP and was accepted by the NJDEP on November 8, 2005. An early action task, listed in the MOA was the preparation of a Remedial Investigation Work Plan (RIW).

The RIW was intended to supplement the previous Authority report, Environmental Soil and Groundwater Sampling Report for Interchange 12 Improvements Project, prepared by Paulus, Sokolowski and Sartor, LLC (PS&S) and dated December 2003. The PS&S Report identified minor impacts to soil and shallow groundwater. Analytical results were generally above (i.e., exceeding) the NJDEP Residential Direct Contact Soil Cleanup Criteria (RDSCC) for soils, but below the NJDEP Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC). Shallow groundwater results were above the NJDEP GWQC for some heavy metals and semi-volatile organic compounds.

E&K retained an environmental remediation consultant to assist in the preparation of the MOA and then to complete services for the tasks identified in the MOA. Through competitive bidding, an NJDEP-licensed drilling contractor was retained by E&K to provide the necessary services to implement the field work identified in the RIW.

A copy of the RIR dated July 21, 2006, is included in Appendix F. This RIR also includes a location plan for the investigative activities (see Plate 2).

4.1.9.12.2 Remedial Investigation Work Plan

In accordance with The Technical Requirements for Site Remediation, N.J.A.C. 7:26E, a RIW was prepared to complete a limited environmental investigation of soil and groundwater. A total of 32 soil borings were planned, covering the areas of TPCR Alternates 5, 6, 7 and parts of 9 and 10. Temporary groundwater sampling points (one-inch slotted PVC) were installed in nine of the borings and four surface water samples were obtained from the Rahway River. Soil and groundwater samples were analyzed for total petroleum hydrocarbons (TPHC), priority pollutants plus 40 peaks library search (PP+40) and PCBs. Surface water samples were analyzed for PP+40. All samples were transferred under chain of custody to an NJDEP-licensed laboratory for the required analyses. Sampling was

conducted in accordance with the NJDEP Field Sampling Procedures Manual, August 2005. Field and trip blanks were used for quality assurance purposes.

Soil samples were obtained from split spoon samples acquired during each of the borings. Borings were advanced, using mud rotary drilling techniques, to a maximum depth of approximately 12 feet below grade surface (bgs) for environmental sampling. After completion of environmental sampling, the borings were advanced to bedrock, at approximately 50 feet bgs, for geotechnical purposes. One soil sample was acquired from one of the following intervals: in fill materials; at the transitions between soil stratigraphic zones; at the 0 to 6 inches depth or 0 to 6 inches above the groundwater interface. In addition at the river boring locations, shallow sediment samples were also collected.

Groundwater samples were acquired from the temporary groundwater sampling points through the use of disposable balers. Surface water samples were also acquired with balers.

4.1.9.12.3 Implementation

During the period from November 8, 2005 to January 31, 2006, the licensed drilling contractor and environmental remediation consultant completed the field investigation activities. These activities were generally completed in accordance with the RIW.

4.1.9.12.4 Findings

Laboratory results were received from an NJDEP-licensed laboratory and are contained in Appendix F. These results were compared to RDSCC and NRDSCC for soils, NJDEP Marine/Estuarine Sediment Screening Criteria for river sediments (SSG), the NJDEP GWQC for groundwater samples and the NJDEP Surface Water Quality Standards (SWQS) for surface water samples. The results of this comparison are displayed on Plate 5 in Appendix F.

Based upon the review and comparison of analytical results to the NJDEP criteria, the following findings are offered:

- Analytical results from one sample from the upland soil borings had concentrations that were in excess of the NRDSCC for base neutrals. The location of this boring is near a pallet recycling facility that uses construction equipment powered by diesel engines.
- Analytical results from three of the six Rahway River borings had concentrations that were in excess of the SSG for base neutrals and heavy metals. One river boring sample for TPCR Alternate 6 also had concentrations that were in excess of the NRDSCC for base neutrals and heavy metals, and were in excess of the RDSCC for PCBs.

- Analytical results from one of the soil samples acquired from the Cytec Lagoons, part of TPCR Alternates 9 and 10, had concentrations of base neutrals and heavy metals that were in excess of the NRDSCC.
- The analytical results from three of the surface water samples were in excess of the SWQS. One of the sample results from the Cytec Lagoons had a concentration above the SWQS for a common plasticizer. A sample acquired near the Cytec lagoons had concentrations of base neutrals, a pesticide and heavy metals that were in excess of the SWQS. A sample acquired from a third location near the Cytec Lagoons also had a concentration for a heavy metal in excess of the SWQS.
- Exceedances of the GWQC were identified at three of the groundwater sampling locations. Two of the locations had concentrations above the GWQC for a common plasticizer and for lead and one location had concentrations of two volatile organics that were in excess of the GWQS.

4.2 Relationship of Project to Other Plans

4.2.1 New Jersey State Development and Redevelopment Plan

The TPCR is located within the Metropolitan Planning Area. The Metropolitan Planning Area includes communities with strong ties and influences from major metropolitan regions – such as the New York/Newark/Jersey City region and the Philadelphia/Camden/Trenton region. The intent and goals of the New Jersey State Development and Redevelopment Plan (State Plan) within the Metropolitan Planning Area is to:

- Provide for much of the state's future redevelopment;
- Revitalize cities and towns;
- Promote growth in compact forms;
- Stabilize old suburbs;
- Redesign areas of sprawl; and,
- Protect the character of existing stable communities.

The State Plan states that these goals would be met by strategies to upgrade or replace aging infrastructure, expand employment opportunities, upgrade and expand housing to attract a balanced residential population, restore or stabilize a threatened environmental base through Brownfield redevelopment, manage traffic effectively and provide greater opportunities for public transportation connections.

The proposed TPCR would aid in providing for the state's future redevelopment at Tremley Point and aid in meeting the goals of the State Plan. The TPCR connection would enable the redevelopment of a 400-acre Brownfield tract that is otherwise inaccessible, with the exception of using South Wood Avenue. Upgrading the road infrastructure and managing new traffic effectively would provide for a smooth connection from the Turnpike's Interchange 12 without

significantly disrupting existing neighborhoods. Redevelopment of the 400-acre Brownfield tract would promote public health by remediating known contaminated sites. Additionally, opening this area to redevelopment and, ultimately an expansive modern warehousing distribution facility, would concentrate new light industry opportunities within an area that is already heavily industrialized with extensive chemical and petroleum bulk storage facilities, thus discouraging the establishment of warehousing in a less developed area of the state. New employment opportunities and an increased tax base would be created as warehousing establishes itself within Tremley Point.

4.2.2 Union County Master Plan

The Draft Union County Master Plan has identified goals in four distinct areas:

- Housing;
- Development;
- Transportation/Circulation; and,
- Economic Development.

The economic development, transportation and circulation, and development goals apply to the TPCR project and its objectives.

The economic development goal is to continue *"efforts to reduce unemployment, provide year-round employment opportunities and enhance the tax base by encouraging compatible industrial, commercial, office and retail facilities to locate or expand in Union County."* The Draft Master Plan puts forth objectives to achieve this goal, one of which is *"…to assist in the development of industrial parks and other infrastructure."* The construction of the TPCR would open the 400-acre tract to new light industry warehousing facilities, thus providing new employment opportunities near existing infrastructure.

The transportation and circulation goal is *"…the development of an improved and balanced multi-modal transportation system."* By constructing the TPCR, traffic related to the proposed redevelopment of Tremley Point would be directed to a smooth connection from Interchange 12 of the Turnpike without any disruption to existing neighborhoods and businesses.

The goal of development activities is to direct *"…new growth to environmentally suitable areas which can be provided with essential infrastructure and support facilities."* The 400-acre Brownfield site would be remediated through the development of warehousing facilities, thus providing a public health benefit.

4.2.3 Port Authority of New York and New Jersey Portfields Initiative

The Port Authority of New York and New Jersey (PANY/NJ) and the New Jersey Economic Development Authority (EDA) have outlined the Portfields Initiative to

promote the use of underutilized and Brownfield sites back into productive use to support Port commerce operations. Sites were chosen on the following criteria:

- Located within the Port District;
- Accessible to major highways;
- Contamination issues that are resolvable within the immediate future and not cost prohibitive;
- Targeted but not absolute goal of 25+ contiguous acres;
- Proximate to essential utilities;
- Appropriate industrial zoning or redevelopment designation;
- Close proximity to navigable waters, marine and/or airport terminals and/or other key transportation hubs and infrastructure;
- Limited ownership interest;
- Local government support; and,
- Developable for port commerce activities, especially those which bring significant jobs, investment and economic activity to the Port District.

The PANY/NJ and the EDA has previously identified the Tremley Point area, specifically the former ISP and DuPont sites, and significant areas on the south side of the Rahway River (i.e., Titan PDC's now existing warehouse distribution center) as potential Portfield sites. These areas designated by the PANY/NJ and the EDA and the area proposed for warehousing on Tremley Point are consistent with the above criteria, with the exception of access to a major highway. The proposed TPCR would satisfy the one criteria not currently present (i.e., access to a major highway) and is the necessary infrastructure improvement that could allow for the suitable redevelopment of the Tremley Point area. Not only would the TPCR provide a smooth connection to and from the New Jersey Turnpike via Interchange 12, a major north-south roadway, without significant impact to existing local roadways, but Tremley Point is proximate to existing port facilities (and has the capability to reestablish port facilities at Tremley Point itself) and other transportation hubs in the metropolitan region. As mentioned throughout this section, the redevelopment of Tremley Point would benefit the local economy by creating jobs and improving the general public health through the remediation of an extensive Brownfield site.

4.2.4 Smart Growth

As presented in the NJDEP's website on Smart Growth, New Jersey has a wealth of precious natural resources and unique landscapes. It is also the nation's most densely populated state, and the most developed. Yet, new development claims approximately 50 acres every day, and 40 percent of this growth is occurring in critical natural resource areas and other environmental sensitive lands that are better for the public to be preserved and protected. Ill-conceived land use and poorly designed development threatens New Jersey's vital drinking-water supplies, devours open space, adversely impacts upon the existing landscape and

creates traffic congestion that pollutes the air. Further, rampant sprawl imperils continued economic growth, jobs, housing and investment in New Jersey's future.

Before all of the remaining land is gone, the NJDEP has been taking actions to balance New Jersey's future growth needs with the fundamental needs of its citizens so that everyone can enjoy clean drinking water, clean air, a vibrant economy, good schools and recreational opportunities outdoors.

The NJDEP and all other agencies of state government focus on three central objectives:

- Make developed areas healthier, more appealing places with cleaner air, cleaner water, and more parks and open space;
- Reduce the rate, at which forests, open space, farmland and other undeveloped areas are being lost to development; and,
- Promote and accelerate development in urban and suburban areas or other growth areas identified through sound planning.

In conformance with the State Master Plan, the Brownfields Act and the PANY/NJ Portfields Initiative, the proposed TPCR would provide just such a mechanism to redevelop 400 acres of Brownfield areas on Tremley Point by providing a direct road access from Tremley Point to Interchange 12. The remediation and redevelopment of existing Brownfields at Tremley Point would restrict any impacts to undeveloped areas of the state and provide for a cleaner environment for the citizens of Linden in particular and the citizens of New Jersey in general.

Today, investments in New Jersey's urban centers and older suburbs, such as preserving open space and Brownfields revitalization (such as the proposed TPCR project presented herein), are empowering communities to chart a course for redevelopment that ensures public health and environmental protection. With the redevelopment of 400 acres of Brownfields on Tremley Point, various components of Smart Growth issues would be met, primarily:

- Redevelopment of Brownfield sites rather than green sites;
- Remediation and clean-up of contaminated sites within the City of Linden;
- Improvement of transportation network that would provide traffic relief to residents on South Wood Avenue by encouraging traffic onto the TPCR;
- Revitalization of Tremley Point to provide new employment opportunities and a new tax base for the citizens of Linden; and
- Protection of the character of the existing community.

4.3 Man-Made Resources

4.3.1 Project Site Land Use

Portions of the project area have been heavily developed with industrial uses (generally roadways, landfills, bulk chemical, petroleum storage and trucking facilities, and a sewerage treatment plant) to take advantage of the proximity to the New Jersey Turnpike and the Arthur Kill. However, the majority of the lands through which the various TPCR alignments traverse are identified as saline marshes, tidal rivers, industrial sites, transportation and utility corridors, and herbaceous wetlands. Many of these areas are in need of remediation due to existing contamination from past industrial activities. The land at the project area has been significantly modified through past filling activities and modification of the Rahway River. Other surface features include altered lands, tidal marshes and emergent freshwater wetlands.

Across Tremley Point Road from the proposed intersection with the various TPCR alignments is an extensive petroleum storage facility managed by Tosco and the Linden/Roselle Sewerage Authority's wastewater treatment facility. Natural land uses along the route includes open water associated with the Rahway River, tidal marshes and emergent freshwater wetlands.

All of these areas are undeveloped and/or underutilized. The Brownfields on Tremley Point that are proposed for redevelopment have been identified by the State Development and Redevelopment Plan as well as the PANY/NJ Portfields Initiative as a location that could be redeveloped for beneficial uses. Not only would redevelopment of Tremley Point remediate and clean up the contamination at this location, it locates industrial and warehousing uses at an appropriate location proximate to a major transportation corridor, airports and waterways, as well as bringing needed employment opportunities and economic benefits to the region.

4.3.2 Adjacent Land Uses

4.3.2.1 Borough of Carteret

The southern terminus of the TPCR lies in the Borough of Carteret. Adjacent land uses in Carteret include Interchange 12, altered lands, industrial properties, the Titan PDC warehouse distribution facility and bulk storage chemical and refined petroleum tank farms. The Turnpike bisects the Borough. Carteret is a five square mile municipality in Middlesex County. Adjacent municipalities are the City of Linden to the north across the Rahway River and Woodbridge Township to the south and west. The Arthur Kill separates Carteret from Staten Island, New York.

There are two distinct residential areas within Carteret, one to the west of the

Turnpike (West Carteret) and the main body of the Borough east of the Turnpike. Carteret's residential land uses are concentrated in these two areas. The remainder of the Borough consists of significant heavy industrial uses, along the Rahway River and Arthur Kill, east of the Turnpike. An additional industrial area is located east of the Turnpike and south of the West Carteret residential area. Interchange 12 is located at the periphery of Carteret's residential land uses, separating the two residential communities, and also separating these residential land uses from the heavy industry, primarily bulk chemical and refined petroleum storage facilities.

The land uses in the immediate vicinity of the proposed TPCR consist of heavy industry bulk petroleum storage uses and commercial highway uses; further to the south are a motel and retail stores. The residential use closest to the proposed TPCR is the Carteret Garden Apartments that are located on Roosevelt Avenue approximately ½ mile south of and opposite the Holiday Inn that is adjacent to the Interchange 12 toll plaza. These land uses are shown on Figure No. 3.

4.3.2.2 City of Linden

In Linden, adjacent land uses include tidal and freshwater wetlands, bulk petroleum tank farms, the Linden-Roselle Sewerage Authority's wastewater treatment facility, a trailer storage facility and a Sea Scout Base along Tremley Point Road. To the north of these existing facilities are the 400 acres of existing Brownfields whose redevelopment is the primary purpose and need for the TPCR. The northern terminus of the proposed TPCR lies in the City of Linden, a municipality in Union County with an area of approximately 11 square miles. Municipalities adjacent to Linden are the Borough of Roselle and the City of Elizabeth to the north, Staten Island, New York to the east, the Borough of Carteret, City of Rahway, and the Township of Clark to the south, and the Townships of Westfield and Cranford to the west.

East of the Turnpike, land uses in Linden are industrial, including petroleum tank farms, a PSE&G power plant, and the Linden-Roselle Sewerage Authority's wastewater treatment facility. Between the Turnpike and Edgar Road (Routes 1 & 9), which is parallel to and west of the Turnpike, land uses include Linden Airport, Rose Hill and Mount Calvary cemeteries, South Reservoir, a small neighborhood south of South Wood Avenue (consisting of residences, Tremley Park and a school) that is surrounded on the north, west and south by petroleum tank farms, and a larger residential neighborhood to the west on either side of South Wood Avenue. West of Edgar Road, land uses in Linden are primarily residential and commercial.

4.3.3 Zoning

4.3.3.1 Borough of Carteret

There are two zoning designations along the proposed TPCR alignment in the Borough of Carteret (see Figure No. 21). The area adjacent to the Turnpike and Interchange 12 is zoned Highway Commercial/Business (HB). Along the remainder of the alignments the land is predominantly zoned Heavy Industry (HI-A).

The Highway Commercial Zone was established to: encourage clustered retail development to promote public convenience; protect against establishment of uses that would introduce hazards, offensive noises, vibrations, smoke, dust, odors, heat, glare or other objectionable influences into residential areas; protect commercial development against congestion; and provide space for transactions of all types of commercial and miscellaneous service activities in a beneficial relationship to one another.

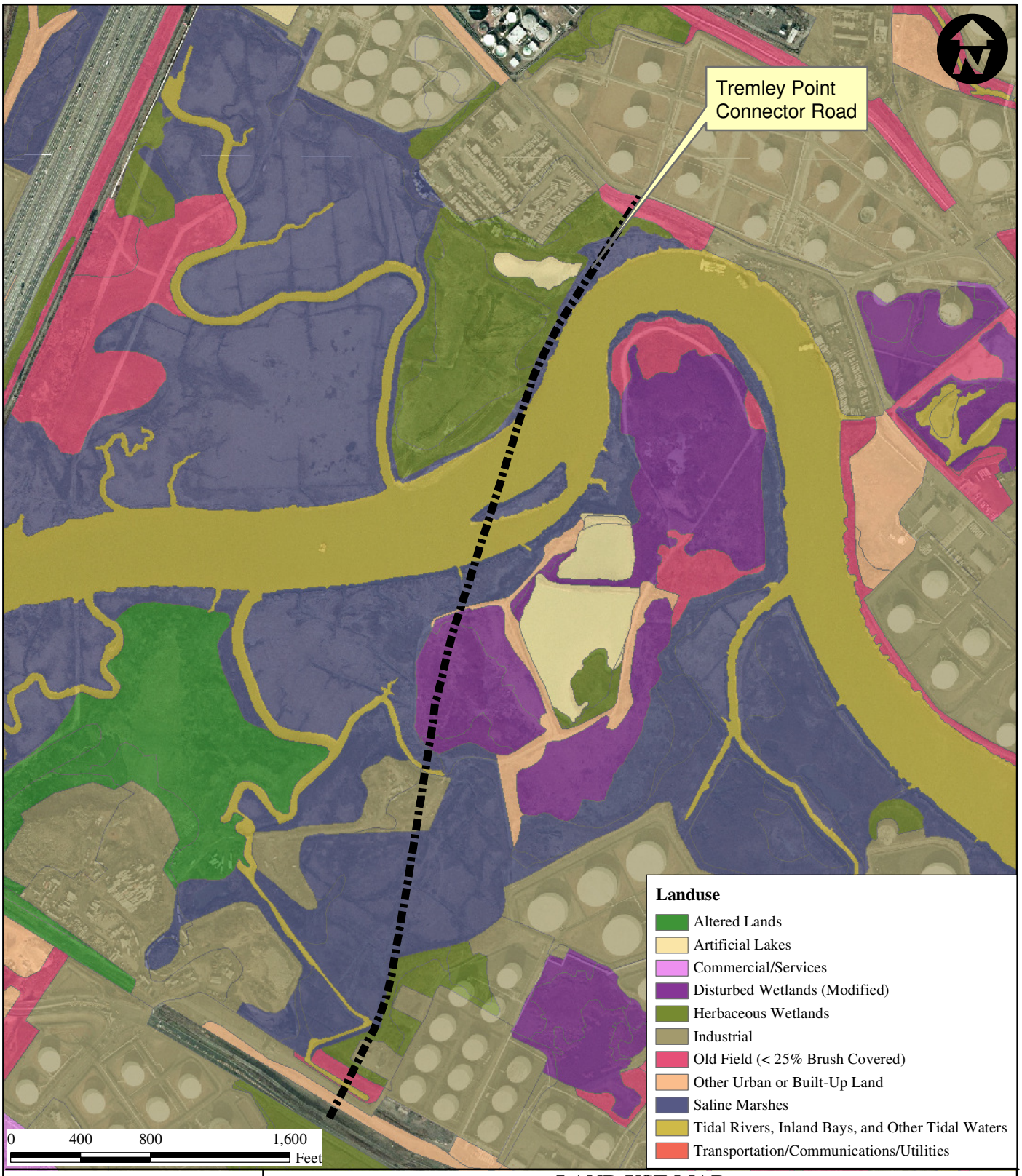
Uses permitted under the HB zone include: retail shopping centers consisting of integrated uses, such as retail stores and shops, personal service establishments, department stores, professional and business offices, banks, post offices, restaurants, theaters and auditoriums housed in an enclosed building or buildings; and utilizing such common facilities as customer parking areas, pedestrian walks, truck loading and unloading space, utilities and sanitary facilities and other necessary and appropriate uses.

The purpose of designating an area as heavy industrial includes the protection of residential and commercial areas and the labor force in other establishments engaged in less offensive types of manufacturing, and other related activities by restricting those individual activities that create offensive noise, vibrations, smoke, dust, odors, heat, glare and other objectionable influences on the surrounding community.

Permitted uses in the HI-A zone include: open storage; industrial and manufacturing facilities; warehousing and storage of goods and products; underground and above-ground storage of oil; and other petroleum products except for liquefied natural gas.

4.3.3.2 City of Linden

In the City of Linden, there is one zoning designation that affects the proposed alignments. The area is designated as Heavy Industry (H-I) (see Figure No. 21). The *City of Linden Zoning Ordinance* establishes a precise and detailed plan for the use of land in the City based on the master plan for the City. The Ordinance is intended to: regulate the use of land within zoning districts; promote orderly development; regulate intensity of use and the location of buildings; establish



Legend

Tremley Point Connector Road

LAND USE MAP

NEW JERSEY TURNPIKE AUTHORITY
TREMLEY POINT CONNECTOR ROAD
BOROUGH OF CARTERET, MIDDLESEX COUNTY
AND CITY OF LINDEN, UNION COUNTY, NEW JERSEY

PS&S
integrating design & engineering

Drawn By: ML	Scale: 1" = 800'	Project No. 02595.003.004
Chk'd By: IPD	Date: 8/15/08	Figure No. 21

SOURCE:
Aerials Express, 2006
NJDEP Landuse Landcover 2002

Map Document: (P:\02595\003\Y\N\Maps\Fig21_Landuse_043007_02.mxd)
8/14/2008 -- 4:02:03 PM

standards of development; prohibit incompatible uses; regulate the alteration of existing buildings; limit congestion in the street; protect against hazards; and conserve the taxable value of land.

Permitted uses in the H-I zone include: open storage; industrial and manufacturing facilities; warehousing and storage of goods and products; underground and above-ground storage of oil; and other petroleum products except for liquefied natural gas.

4.3.4 Population Density

4.3.4.1 Existing Conditions

Data describing population density for the period 1950 to 2000 (data for 2005 is estimated by the New Jersey Department of Labor) for Union and Middlesex Counties, and for the Borough of Carteret and the City of Linden, which the proposed alignment traverses are presented in Table 4-9. The data show that in the most recent decade, the population density of Linden has increased by 7.3 percent, with a 1.5 percent increase since 2000, while the density of Carteret has increased by 8.8 percent in the most recent decade, with a 4.4 percent increase in the last five years. Population density for Middlesex County as a whole increased during the period 1990 to 2005 by 15.4 percent and the density of Union County increased by 7.4 percent.

Table 4-9
Tremley Point Connector Road Project
Population Density

Jurisdiction	Persons per Square Mile						
	1950	1960	1970	1980	1990	2000	2005*
Linden	2,837.4	3,697.3	3,834.2	3,503.3	3,398.2	3,647.6	3,701.8
Union County	3,868.0	4,899.0	5,276.6	4,897.4	4,782.3	5,060.9	5,138.6
Carteret	3,030.2	4,767.9	5,306.7	4,724.3	4,363.5	4,749.8	4,960.9
Middlesex County	952	1400.8	1,885.0	1,924.0	2,169.0	2,422.1	2,504.0

Source: U.S. Census Bureau, Census 2000 , New Jersey Population Trends 1970 to 2000 and New Jersey Municipal Data Book 2005 (*Estimated by New Jersey Department of Labor)

4.3.5 Demographics

Characteristics of the population in the vicinity of the project area are described in Tables 4-10 through 4-16. The information presented is based upon information from the U.S. Census Bureau and the 2000 census. More recent data is available from the New Jersey Department of Labor; however, the results are all estimates. Therefore, the following information and discussion is based upon the federal 2000 census data. Ethnic background of the population within the project area and within Middlesex and Union Counties are listed in Table 4-10. Table 4-11 presents 2000 annual average labor force estimates, and indicates that there is a

large labor force with a moderate unemployment rate in the project vicinity. Table 4-12 describes the occupations of the labor force. Median household income is presented in Table 4-13, describing a population with income slightly below the State mean. Housing units in the project area are listed in Table 4-14 while Table 4-15 presents data on the level of educational attainment, indicating that the workforce in the project vicinity is relatively well educated. Table 4-16 presents data describing the means of transportation to work, showing that over three quarters of the workforce in the project vicinity drives alone to work. Average travel time to work is also shown in Table 4-16, indicating that the majority of the workforce in the project vicinity travels approximately 30 minutes from residence to place of employment.

Table 4-10
Tremley Point Connector Road Project
Ethnic Background of Population

Race	Middlesex County	Carteret	Union County	Linden
White	68.4%	68.8%	65.5%	66.1%
Black or African American	9.1%	9.5%	20.8%	22.8%
American Indian or Native Alaskan	0.2%	0.2%	0.2%	0.1%
Asian	13.9%	8.3%	3.8%	2.3%
Native Hawaiian or other Pacific Islander	>0.01%	>0.01%	0%	>0.01%
Hispanic or Latino	13.6%	23.3%	19.7%	14.4%
Other race	5.7%	9.3%	6.4%	4.9%

Source: U.S. Census Bureau, Census 2000

Carteret is a borough within Middlesex County. Both Carteret and Middlesex County are growth areas. Generally, Carteret mirrors the demographic patterns of the county as a whole, however, certain differences can be identified from the most recent 2000 federal census data (see Table 4-10). For example, Carteret has a larger Hispanic population share and a smaller Asian population share than Middlesex County as a whole. Carteret's unemployment rate in 2000 was almost twice that of Middlesex County (see Table 4-11). The Carteret labor force has a greater share of production workers (21.2% for Carteret vs. 12.8% for Middlesex County) and a lesser proportion of managers (21.6% for Carteret vs. 40.6% for Middlesex County, see Table 4-12). Medium household income in Carteret is 86% of the state median, while that of Middlesex County is 111% of the state median (see Table 4-13). A large majority of the workforce in Carteret and Middlesex County as a whole travels alone to work in personal vehicles (see Table 4-16).

Linden is a city within Union County. The census data indicate that Linden has a slightly higher African American population share, a slightly lower Asian population share and a much lower Hispanic population share than Union County

as a whole (see Table 4-10). Linden and Union County had identical unemployment rates in 2000 at 5.6% of the population (see Table 4-11). The Linden labor force has a lower share of management workers than Union County (22.9% vs. 35.4 %), slightly higher shares of service (14.9% vs. 13.3%), sales and office (32.3% vs. 28.4%), and construction (9.2% vs. 7.6%) workers, and a higher share of production and transportation workers (20.7% vs. 15.3%) than Union County as a whole (see Table 4-12). Median household income in Linden is 84% of the State median vs. 100% for Union County (see Table 4-13). A somewhat larger majority of the workforce in Linden drives alone to work than for Union County as a whole (75.9% vs. 70.9%, see Table 4-16).

Table 4-11
Tremley Point Connector Road Project
2000 Annual Average Labor Force Estimates

Jurisdiction	Labor Force	Employment	Unemployment	Unemployment Rate (%)
Linden	19,892	18,772	1,120	5.6
Union County	258,566	244,197	14,369	5.6
Carteret	9,972	9,036	936	9.4
Middlesex County	391,067	370,817	20,250	5.2

Source: U.S. Census Bureau, Census 2000

Table 4-12
Tremley Point Connector Road Project
Occupations of the Project Area Population

Occupation	Middlesex County	Carteret	Union County	Linden
Management & Professional	40.6%	21.6%	35.4%	22.9%
Service	11.1%	14.9%	13.3%	14.9%
Sales & Office work	28.4%	33.4%	28.4%	32.3%
Farming, fishing & forestry	>0.01%	>0.01%	>0.01%	>0.01%
Construction, extraction & maintenance	7.1%	8.9%	7.6%	9.2%
Production, transportation & material moving	12.8	21.2%	15.3	20.7%

Source: U.S. Census Bureau, Census 2000

Table 4-13 Tremley Point Connector Road Project Median Household Income		
Jurisdiction	**Median Household Income – 2000**	**Percent of State Median**
State of New Jersey	55,146	100%
Linden	46,345	84%
Union County	55,339	100%
Carteret	47,148	86%
Middlesex County	61,446	111%
Source: U.S. Census Bureau, Census 2000		

Table 4-14 Tremley Point Connector Road Project Housing Profile				
Units in Structure	**Middlesex County (265,815 units)**	**Carteret (7,039 units)**	**Union County (186,124 units)**	**Linden (15,052 units)**
% Own	66.7%	68.3%	61.6%	58.7%
% Rent	33.3%	31.7%	38.4%	41.3%
Source: U.S. Census Bureau, Census 2000				

Table 4-15
Tremley Point Connector Road Project
Level of Educational Attainment
Percentage of Population 25 Years and Older

Jurisdiction	Total #	Less than 9th Grade		9th to 12th grade - no Diploma		High School Graduate, (includes equivalency)		College and Some College, No Degree		Associate Degree		Bachelors Degree		Graduate or Professional Degree	
Linden	27,238	2,363	8.7%	3,577	13.1%	11,153	40.9%	4,905	18.0%	1,398	5.1%	2,627	9.6%	1,215	4.4%
Union County	351,903	30,835	8.8%	42,064	12.0%	104,431	29.7%	57,534	16.3%	16,815	4.8%	61,760	17.6%	38,464	10.9%
Carteret	13,745	1,284	9.3%	2,160	15.7%	5,648	41.1%	2,222	16.7%	670	4.9%	1,259	9.2%	502	3.6%
Middlesex County	501,552	31,015	6.3%	47,449	9.5%	145,657	29.0%	84,865	16.9%	27,033	5.4%	102,750	20.5%	62,783	12.5%
Source: U.S. Census Bureau, Census 2000															

Table 4-16
Tremley Point Connector Road Project
Means of Transportation to Work & Average Travel Time (Minutes)
Percentage of Labor Force 16 Years and Older

Jurisdiction	Total	Drove Alone	Car-pooled	Public Transportation	Walked	Other Means	Worked at Home	Mean Travel Time (minutes)
Linden	18,381	75.9%	11.7%	7.1%	3.5%	0.9%	0.9%	25.8
Union County	238,606	70.9%	11.6%	10.6%	3.2%	1.2%	2.5%	28.7
Carteret	8,826	73.3%	15.1%	6.3%	3.0%	1.0%	1.3%	27.8
Middlesex County	363,176	74.4%	11.1%	8.7%	2.8%	0.9%	2.1%	31.5
Source: U.S. Census Bureau, Census 2000								

4.3.6 Cultural Features

The TPCR impact area is primarily vacant land (predominantly sludge lagoons, former landfills and wetlands) surrounded by industrial land uses. Primary industrial uses in the vicinity of the proposed TPCR are bulk chemical and refined petroleum tank farms.

The region surrounding the proposed TPCR includes residential development with small commercial areas south of the project. The City of Elizabeth, north of the proposed TPCR, contains major shopping and commercial activities.

4.3.7 Parks and Recreational Facilities

The nearest park to the proposed TPCR is Carteret Park. This park lies along the Rahway River approximately 3,000 feet northwest of the proposed TPCR. In Linden, located approximately 2.5 miles west of the project area on South Wood Avenue, there is a small park known as Tremley Park, which is adjacent to Memorial Park. Approximately one mile to the east and across the Arthur Kill in the Chelsea section of Staten Island is the William T. Davis Wildlife Refuge.

Adjacent to where the TPCR will intersect the shoreline of the Rahway River in Linden is a Sea Scout Station. Public and private boat ramps to the Arthur Kill are available approximately three miles south in Sewaren.

4.3.8 Aesthetic Features

The project area where many of the proposed roadway alternatives are located is typical of a highly industrialized urban area and exhibits many of the same features of other urban areas along New Jersey's waterfront. The area at the confluence of the Rahway River and the Arthur Kill within both Linden and Carteret have a long history of chemical and petroleum bulk storage facilities and landfills. As such, much of the land has been filled and significantly disturbed due to the construction of above-ground storage tanks and under-ground pipelines.

The project area contains both high and low scenic value. The primary aesthetic features in the area are the Rahway River, tidally influenced marsh habitat and open water creeks that are sometimes called the Carteret Arch. Within Linden, this wetland complex occupies the area from Tremley Point Road south to the Rahway River. Within Carteret, this wetland complex is located between the Titan PDC warehouse distribution facility and the Kinder Morgan complex and bisected by numerous man-made mosquito ditches. The marsh habitat features flat terrain with the upper marsh areas dominated by common reed and the intertidal marsh dominated by salt marsh cordgrass.

The most dominant feature of the project area is the New Jersey Turnpike, which is also the main travel corridor through the area. Other significant features of the area are the chemical and petroleum bulk storage facilities, a warehouse distribution facility, freight railroad sidings and spurs, and landfills. These man-made features have dramatically changed the scenic value of the area. The Conrail Chemical Coast Line tracks are located adjacent to the east side of the New Jersey Turnpike and cross the Rahway River over a drawbridge. At one time, there was a railroad bridge crossing the Rahway River where it meets the Arthur Kill, however, it has subsequently collapsed, and has not been rebuilt.

The project area is primarily an area of low scenic value due to its disturbed nature and filled land. The wetland complex, an area of scenic quality, has been avoided to the extent practicable by several of the alternative alignments in order to limit wetlands impacts. However, the major travel corridor of the New Jersey Turnpike and the abundance of chemical and petroleum bulk storage tanks have diminished the scenic quality of the entire Tremley Point area.

4.3.9 Historic and Archeological Resources

4.3.9.1 Area History

The TPCR area is within Carteret, Middlesex County and Linden, Union County. Union County was formed from Essex County in 1857. Linden Township was formed from Elizabeth Borough in 1861. Prior to 1925, Linden City and Township were separate, and the area was within the Township. Middlesex County was formed in East Jersey in 1683. The Borough of Carteret was known as Roosevelt Borough between 1906 and 1922. Prior to 1906, the project area was a settlement called Carteret, within Woodbridge Township.

At the time of European Contact, the Lenni-Lenape natives were using the lands and waters of Linden and Carteret for hunting and fishing. St. George Avenue, Lower Road and Tremley Point Road were originally Native trails. The Rahway River was previously called “Rahwac” or “Rahwiack”, a Lenape word that applied to the River, surrounding land, and the local Native bands. Native peoples continued to live in the vicinity long after they became a minority. Long after the great Delaware tribe migrations to the north and west, other Natives remained in Woodbridge Township. Without much in the way of population or manufacturing, but with no shortage of mosquitoes, most of the project area remained an unpopulated, isolated salt marsh during the colonial period.

The Linden area remained very rural for the first 150 years following Euro-American settlement. Farms prospered on the rich flat lands of the area now known as Tremley Point in Linden. The name comes from Jean Traubles, a French Huguenot who changed his name to John Trembley. His farm was in the southern part of Linden.

The period from 1889 to 1896 saw a proliferation of industries and a matching increase in rail service to those industries. In order to service industries far from the Central Railroad of New Jersey's (CNJ) Perth Amboy Branch, the CNJ built short branches over the marshes to the new industries. These extensions included: the Bayway Branch (1889); the Carteret Extension Railroad (1889) built from East Rahway (now West Carteret) 1.6 miles to the waterfront at Carteret; the Carteret and Sewaren Railroad (1891) extending the Carteret Extension Railroad another 1.25 miles south almost to Port Reading; and the Grasselli Spur or Third Branch (c1891) north of Carteret. These branches were then extended along the waterfront to reach further industries, and in 1895-1896 the six-mile CNJ Sound Shore Branch was completed, connecting and incorporating the branch lines. The Sound Shore Branch had local passenger service from its origins to accommodate industrial plant workers, as well as some commuters. In 1902, the CNJ built another connecting spur between its Perth Amboy and Sound Shore branches, the New Jersey Terminal Railroad or Reformatory Branch.

By the 1870s, local businessmen and the federal government realized that the increase in rail facilities would lead to a similar increase in marine traffic along the Arthur Kill. By 1873, there were a staggering 55,000 vessels of all descriptions using the facilities at Elizabethport. The natural channel had been deepened by private efforts from 10-12 feet to 13-14 feet between1858-1873. The USACE was involved in improving the waters around Staten Island as early as 1874. However, it was not until early in the 20th century that the USACE made improvements to navigation on the Arthur Kill.

Two factors made the project area prime real estate for industrial expansion: the rapid increase in rail facilities along the Arthur Kill in the 1870s; and the start of federal navigation improvements between Staten Island and New Brunswick. By the 1880s, large sites with both good rail links and deepwater connections were becoming increasingly rare in the Port of New York. Even though the marshes of places like Port Newark, Port Elizabeth and the area were harder to develop, they proved to be well worth the effort.

With excellent water and rail connections, this area soon became a national force in the copper and rare metals refining industry. Copper refining came to the Arthur Kill in Union County around the turn of the century. The De Lamar Refining Works were built in the Chrome section of Carteret in 1902. Located south of the project area, it later became the U.S. Metal Refining Company. The iron industry was represented on Tremley Point by the American McKenna Process Company, which re-rolled steel rails at the turn of the Twentieth Century.

The oil refining and distribution industry came to Bayonne in 1875, and as the industry grew, so did its impact on the area. At the time, fertilizer and bone processing companies were already present along the shore. The fertilizer factories quickly converted from using organic sources to acid and phosphate rock to produce super phosphate fertilizers. In response to demands from the booming

oil business, acid factories were built in the area. Among the early acid factories in Linden were the S.S. Fales & Company Chemical Works and the Russel Coe Bone and Acid Factory. In 1884, the Marsh & Harwood Company of Cleveland built a large sulfuric acid factory in the marshland at Tremley Point. The plant was taken over by the Grasselli Chemical Company of Cleveland in 1889. Taking advantage of outstanding water and rail links, the acid industry boomed in response to seemingly unlimited local demands. By 1910, New Jersey was a leader in the industry. Grasselli also fostered the residential development of the area by building many workers' houses in Tremley Point around 1918.

The massive Grasselli property was later divided and sold. General Aniline & Film Co. (GAF) purchased the western plant in 1915, while DuPont bought the waterfront plant in 1928. DuPont was the major chemical maker in New Jersey. At the Grasselli plant, they made heavy agricultural and industrial chemicals, including sulfuric acid. GAF became one of the biggest dyestuff producers in the country. At the time, it was the only high-pressure acetylene works in the country.

Other major companies began buying up land on the Linden waterfront. American Cyanamid Company (originally Ammo-Phos Corp.) began making superphosphate fertilizer in their waterfront Linden plant in 1916. They produced acids, reagents, insecticides, alum, resins and many other chemicals. Standard Oil of New Jersey (later called Esso, then Exxon) quickly expanded their facilities in Bayonne and Jersey City to their limits, and looked to the marshy farmlands of Linden near Morse's Creek. In 1907, they started construction on the massive Bayway Refinery. The Warner-Quinlan Company started a small refinery in Linden in 1912. It was bought by Cities Service Oil Company (now Citgo) in 1937.

World War II sent the demand for oil products soaring. In response, the U.S. Government sponsored an unprecedented rush effort to build the "Big Inch" and "Little Big Inch" pipelines. Known as the War Emergency Pipeline, or WEP, it was a joint effort by 11 companies that pooled their resources to build and operate the pipelines. The stockholding companies were the: City Service Oil Company; Standard Oil Company of New Jersey; Texas Pipeline Company; Socony-Vacuum Company; Atlantic Refining Company; Gulf Oil Company; Consolidated Oil Company; Shell Oil Company; Tide Water Associated Oil Company; Sun Oil Company; and Pan American Petroleum Company. The 1,363-mile "Big Inch" was a 24-inch pipeline that ran from Longview, Texas to Linden, and was completed in August, 1943. The "Little Big Inch" was a 20-inch pipeline that ran 1,475 miles from Beaumont, Texas to Linden, and was finished in 1944. Both were converted to transport natural gas after World War II.

Introduction of catalytic refining, or "cracking", was a major development in the oil industry after the war. In 1954, Esso's Bayway plant was the largest in New Jersey, with a daily capacity of 150,000 barrels. Esso's laboratories led to many developments in new uses for petrochemicals. In 1981, the Exxon Bayway plant

was the largest in the Northeast. There were more than 600 people working in their chemical plant alone that was largely supplied by the refinery. Other oil companies with tank farms in the area include Cities Service Oil (now Citgo), Sinclair (now BP), Mexican Petroleum Company (now BP/Amoco) and Mobil (now Exxon/Mobil).

4.3.9.2 Geology and Prehistoric Considerations

Reviews of the site files of the New Jersey State Museum - Bureau of Archaeology noted that there are no known archaeological sites within the proposed TPCR area. However, there is one known site in the general vicinity. The Carteret site was reported by Alanson Skinner in 1913. Skinner was an archaeologist associated with the American Museum of Natural History who explored numerous sites in the metropolitan area early in the Twentieth Century. Skinner owned a grooved ax from Carteret, and other objects have been reported from there but the exact location of the find is unknown. Grooved axes typically date to the Late Archaic into the Woodland era.

In nearby Rahway, a grooved ax, grinding stone and 4 projectile points have been found. The projectile points include a triangular point, likely from the Late Woodland, and three stemmed points. The stemmed points appear to be Brewerton side-notched and Lackawaxen points. Brewerton points date to the Late Archaic, while Lackawaxen may be later. Local historians have noted that there are a few collections of "Indian relics" from unspecified locations in Linden.

4.3.10 Navigation

For each of the design alternatives that results in a crossing of the Rahway River, it was determined that the bridge has to be at least 36 feet above the Rahway River due to USCG height requirements for bridges that cross over the Rahway River (i.e., for the purpose of maintaining existing and future navigation on the river). The USCG required bridge height presents a design constraint as the TPCR has to intersect properly with the termini (i.e., Tremley Point Road and Industrial Highway) for vehicle safety.

Currently, the Turnpike bridge that traverses the Rahway River approximately 3,000 feet upstream of the project area is at a fixed height of 36 feet above mean low water (31.4 feet at mean high water). Immediately adjacent and east of the Turnpike bridge is a moveable bascule bridge owned by Conrail that is at a height of 6 feet above mean low water. Approximately 2.5 miles upstream of this location is the Lawrence Street Bridge, which has a vertical clearance of 15 feet.