Hudson-Raritan Estuary Ecosystem Restoration Feasibility Study

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Appendix G
Hazardous, Toxic and Radioactive Waste

Final Integrated Feasibility Report &
Environmental Assessment
April 2020

Prepared by the New York District
U.S. Army Corps of Engineers

THE PORT AUTHORITY OF NY & NJ

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1. Introduction

The United States Army Corps of Engineers (USACE), New York District (District) has been conducting six (6) parallel restoration feasibility studies for ecosystem restoration within the Hudson Raritan Estuary (HRE) Study Area. This Final Integrated Feasibility Report and Environmental Assessment (FR/EA) recommends 20 sites for construction authority located within the Jamaica Bay, Harlem River, East River and Western Long Island Sound, Newark Bay, Hackensack River, and Passaic River, Upper Bay, and Lower Bay Planning Regions as shown in Table G-1.

Table G-1. Restoration Sites Recommended for Construction.

Location	Recommended Restoration	Site
Jamaica Bay Planning Region		
Jamaica Bay	Estuarine Habitat Restoration	• Dead Horse Bay (Tier 2)[1] • Fresh Creek
	Jamaica Bay Marsh Island Restoration	• Duck Point • Stony Creek • Pumpkin Patch West • Pumpkin Patch East • Elders Center
	Small-Scale Oyster Restoration	• Head of Jamaica Bay
Harlem River, East River and Western Long Island Sound Planning Region		
Flushing Creek	Estuarine Habitat Restoration	• Flushing Creek
Bronx River	Freshwater Riverine Habitat Restoration	• Bronx Zoo and Dam • Stone Mill Dam • Shoelace Park • Bronxville Lake • Garth Woods/Harney Road
Newark Bay, Hackensack River and Passaic River Planning Region		
Hackensack River	Estuarine Habitat Restoration	• Metromedia Tract • Meadowlark Marsh
Lower Passaic River	Estuarine Habitat Restoration	• Oak Island Yards (Tier 2)[1]
	Freshwater Riverine Habitat Restoration	• Essex County Branch Brook Park
Upper Bay Planning Region		
Upper New York Bay	Small-Scale Oyster Restoration	• Bush Terminal
Lower Bay Planning Region		
Sandy Hook Bay	Small-Scale Oyster Restoration	• Naval Weapons Station Earle

[1] Tier 2: Site requires remedial activities to take place prior to or in coordination with restoration.

The HRE study area (Figure G-1) is within the boundaries of the Port District of New York and New Jersey, and is defined by a 25 mile (40-kilometer) radius from the Statue of Liberty. The study area includes all tidally influenced portions of rivers flowing into New York and New Jersey Harbor, including the Hudson, Raritan, Hackensack, Passaic, Shrewsbury, and Navesink Rivers and the East River from the Battery to Hell Gate (USFWS, 1997). Located within the most densely populated area of the country and including the largest port on the East Coast, the HRE has tremendous ecological, historical, cultural, and recreational significance.

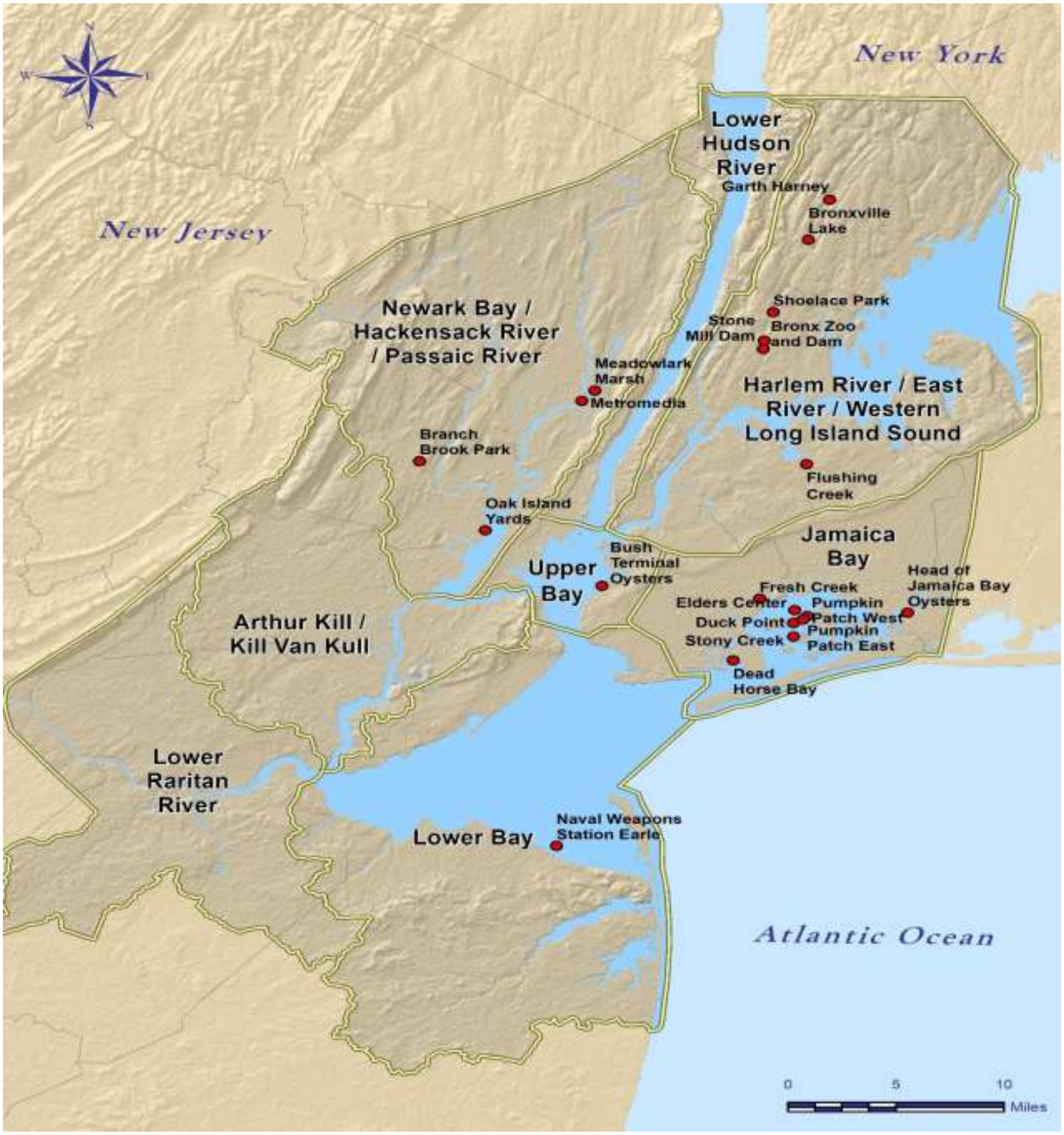

Figure G-1. Location map of the HRE restoration sites corresponding HRE Planning Regions.

1.1 Purpose

In accordance with ER1105-2-100 and ER 1165-2-132, USACE defines HTRW as “any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq (CERCLA).” In addition, paragraph G-5(2)(p) of ER 1105-2-100 states the USACE will not participate in clean-up of materials regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or by the Resource Conservation and Recovery Act (RCRA).

The purpose of this appendix is to summarize the hazardous, toxic and radioactive waste (HTRW) investigation for the HRE Integrated Feasibility Report/Environmental Assessment (FR/EA). This report presents a summary of existing available contaminant data within each planning region and associated with each restoration site.

This report identifies sites that are expected to have HTRW concerns and identifies potential actions that would be required prior to restoration actions. The literature used in performing the review is described throughout the narrative text and summarized in the References section. Conclusions and recommendations regarding potential site-specific issues that will influence planning of a site, including potential construction impacts due to HTRW issues associated with the project sites, are provided.

Available site specific information (Phase 1s, literature searches, identification of known contaminated sites, and data collected on site) are included in this HTRW Appendix. Coordination has occurred with New Jersey Department of Environmental Protection (NJDEP), New York State Department of Environmental Conservation (NYSDEC), United States Environmental Protection Agency (USEPA) and United States Fish and Wildlife Service (USFWS) relating to levels of contamination throughout the HRE and the proposal for restoration. USFWS prepared a Fish and Wildlife Coordination Act Report (FWCAR) (Appendix F), which described the complex challenges posed by contaminants within urban ecosystems like the HRE Study Area. The FWCAR also made recommendations for future designs and implementation.

The FWCAR HTRW-Related Planning Recommendations included:

- Baseline conditions, defined by historical characteristics or best available data, should be determined before initiating restoration activities.
- USACE should work with the HRE stakeholders to develop the appropriate monitoring matrices to ensure success of each project selected.
- Develop a matrix that would evaluate contaminant/re-contaminant risk of each of the project sites, relative to established Effects Range Median (ER-M) concentrations for PCBs, mercury, and dioxin and furans.
- The Service recommends giving priority to projects that do not adjoin contaminated waterways to avoid the risk of recontamination. Should the USACE select a restoration project in close proximity to a known pollution source, it should optimize the design of the project based on benefits to the environment, contaminant risk, and cost effectiveness.

The selection of a high marsh construction alternative, where possible, is an alternative that could meet the rigors of cost-benefit analysis and minimize contaminant risk to biota.

Regulatory agencies are expected to review and comment on the HTRW investigation that will be carried out during the PED phase. If the HTRW investigation indicates a need for additional environmental remediation before construction can begin on the HRE ecosystem restoration project, the non-federal sponsor must pay 100 percent of those environmental remediation costs. HTRW response actions must be acceptable to USEPA and applicable state regulatory agencies. No contaminated soils will be placed onto clean soils during recontouring, and restoration plans will include the placement of a clean growing media following soil/sediment regrading on each site.

1.2 Methods

To achieve the objectives of the USACE, the following activities were performed:

- Reviewed existing, readily available contaminant data within each Planning Region and associated with each restoration site.
- Utilized the HTRW Appendix of the Programmatic Environmental Document to identify contaminated areas/sites that are co-located with restoration sites to be evaluated in each Planning Region.
- Utilized the data from the Remedial Investigation/Feasibility Study (RI/FS) as well as upland soil sampling from post-flood events, the Lower Passaic River Remedial Investigation and contaminant characterization to review available data within the main stem river and mudflats and tributaries (Saddle River, Third River, Second River) to extrapolate potential upland contamination issues at adjacent restoration sites.
- Reviewed contamination analysis and risk assessment on the Hackensack River at Meadowlark and Metromedia sites.
- Utilized the Environmental Data Resources (EDR) Radius Map Report to identify any HTRW concerns located on or within 1 mile of each restoration site.
- Review of historic imagery provided by EDR.

2. Planning Region Description

The HRE Study Area is located within one of the largest estuaries on the east coast of the United States, comprising over 1,600 square miles and almost 1,000 linear miles of shoreline. The HRE Study Area is broadly defined by a 25-mile (40-kilometer) radius from the Statue of Liberty. The HRE Study Area was divided into eight planning regions to facilitate stakeholders' identification of restoration needs and opportunities specific to each region. The FR/EA recommends for construction a total of 20 restoration sites in the following planning regions: (1) Jamaica Bay, (2) Lower Bay, (3) Newark Bay, Hackensack River, and Passaic River, (4) Harlem River, East River, and Western Long Island Sound, and (5) Upper Bay.

The NY/NJ Harbor Estuary is located within a major metropolitan area of the United States, which includes two major cities: New York City, New York and Newark, New Jersey. Since the

American industrial revolution, this area has experienced significant urbanization and industrial development, which impacted the surrounding ecosystems and waterways. Accidental and intentional discharges of industrial waste and municipal sewage have degraded sediment and water quality throughout the estuary. The HRE Study Area is the most densely populated estuary in the United States, with more than 20 million residents. In addition to residential land use, a large amount of the HRE Study Area is used for industry and commerce. Many industries are closely linked to the ports of the HRE Study Area. Therefore, shipping channels are maintained in most waterways and surface waters are used primarily for commercial boat traffic. There are also many power plants and other industrial facilities that withdraw water from the HRE Study Area, and at least 27 major wastewater treatment plants that discharge treated and untreated effluent into the estuary through combined sewer overflows (CSOs).

Surface Waters

Within the New York City boroughs, the majority of streams and creeks have either been eliminated by filling, redirected through storm sewers, or have been altered by stormwater runoff or channelization. These modifications have nearly eliminated the natural salinity gradient that should occur within tidal streams. Wastewater treatment plants and CSOs increase freshwater inputs to localized areas. Many power plants, municipal water supplies, and other industrial facilities also withdraw water from the HRE Study Area (NYCDEP 2003). Stormwater runoff into the estuary also brings debris and sediment that can change nearshore areas by filling or scouring, depending on the magnitude of flow. Bridges, piers and roadways have constricted or restricted flow in many locations (USACE 2004a).

Bathymetric changes in support of navigation have also influenced water circulation and flow patterns. The subsequent increase in ship traffic by more and larger vessels produces waves and wakes as well as scour areas that can result from movement of deep draft vessels through shallow side channels.

Human impacts adversely affect water and sediment quality in the HRE Study Area. Untreated discharges of human and industrial wastes and debris have entered the estuary and its sediments from the time of European settlement to the establishment of environmental regulations in the 1970s. Although the establishment of water quality regulations such as the Clean Water Act (CWA) has led to gradual improvements to water quality, the surface waters are impaired in areas where bathymetry and/or shoreline alterations have affected natural hydrodynamics and residence time. In addition, during large rain events, untreated wastewater enters the estuary through the hundreds of CSOs remaining in the HRE. The wastewater contains floatable debris, pharmaceutical agents, bacterial and viral pathogens and nutrients. The nutrients released from the CSOs exacerbate eutrophication, resulting in low dissolved oxygen concentrations, decreased fish production, loss of aquatic vegetation, and production of noxious odors (Steinberg et al. 2004).

Urbanization also causes less conspicuous impairments to water quality. For example, excess sediment and contaminants in runoff caused by an increase in paved surfaces can reduce water clarity and quality and impact sensitive habitats, including shellfish beds/reefs and submerged aquatic vegetation (Steinberg et al. 2004). Reduced water clarity can also affect fish and aquatic invertebrates, such as zooplankton, by interfering with their ability to feed or by changing the composition of prey species and phytoplankton. In some bays and confined waterways with reduced or limited flushing, high organic loads increase biological oxygen demand and can cause periodic hypoxia or anoxia (Yozzo et al. 2004). Sediment and surface water contamination have resulted in impacts on fisheries resources. Although the HRE Study Area has historically supported significant commercial as well as recreational fisheries resources, much of these benefits are currently unclaimed due to fish consumption advisories relating to high concentrations of mercury, PCB, Dioxin, and DDT levels in fish and shellfish (Steinberg et al. 2004). Much of the HRE is closed to commercial fishing, and it is suggested that recreational fishing be primarily practiced as catch-and-release techniques. Contamination issues have limited the economic benefits that could be achieved through a viable fishery that includes both commercial and recreational party boat fishing industries. Consumption advisories are in effect for any fish caught in the Harbor, including Upper New York Bay. Advisories vary based on species and can differ for the general public and "high risk individuals" such as infants, children, pregnant women, nursing mothers, and women of childbearing age. Consumption advisories are issued by the New York State Department of Health (NYSDOH) and NJDEP and are subject to change (NYSDOH 2008, NJDEP 2008).

Groundwater

Groundwater within much of the HRE Study Area has not been extensively studied. However, by reviewing the geology of the surrounding landmasses, it is possible to infer the type of groundwater present. Groundwater in the New Jersey portions of the HRE Study Area occurs in bedrock, in unconsolidated Cretaceous deposits, and in Pleistocene and Recent deposits. In unconsolidated deposits, groundwater is produced from pore spaces between grains of gravel, sand, and silt. Groundwater provides approximately 50% of all of New Jersey's potable water, with 39% coming from public-supply wells and 11% from domestic-supply wells. In addition, groundwater provides base flow to streams and is closely related to the ecology of the state's wetland systems. Groundwater reservoirs are found in the unconsolidated deposits and bedrock of Staten Island. The largest yields of groundwater are obtainable from sand and gravel beds and lenses in the upper Pleistocene deposits, principally from glacial outwash. Small to moderate supplies of groundwater are available from sand beds in the Cretaceous Raritan Formation and older bedrock (USACE 2000).

Groundwater in bedrock in the HRE Study Area is generally stored and transmitted along fractures and joint openings that decrease in size and number with depth. Groundwater from these deposits is generally of acceptable quality, except where saltwater intrusion associated with over-pumping of the Coastal Plain aquifers has produced excessive chloride concentrations (USACE 1999). Significant improvement in salt-water intrusion has occurred owing to years of aquifer recovery after most commercial withdrawal has ceased. The aquifers are beginning to recover since the connection of the outer boroughs to the New York City Water Supply System has raised groundwater levels, to the point that flooding is occurring in certain New York City subway systems and residential basements, notably in Queens and Brooklyn (USACE 2000).

Until the 1980s, the underlying Pleistocene-age aquifer systems were a major source of municipal water supply for Brooklyn and Queens, causing aquifer drawdown which resulted in the virtual cessation of groundwater base flow in many areas of these two boroughs. However, due to a major change in municipal water supply for Queens and Brooklyn over the last 30 years, groundwater has now been largely replaced by surface water supplied by the New York City aqueduct system from reservoirs located in the Hudson Valley and Catskill region. As a result, hydraulic head in the local aquifers has been rebounding (Buxton and Shernoff, 1999). This rebounding groundwater system covers an area of approximately 5.5 square miles (8.9 square kilometers). It is comprised of 69 wells (e4sciences, 2016) documentation, ranging in depth from 67 to 618 feet (20 to 188 meters) and drawing from the Glacial, Post Jameco, Magothy, Cretaceous, and Lloyd aquifers. The groundwater system provides drinking water to fewer than 100,000 people.

Manhattan is underlain primarily by till and bedrock, which typically yields only small to moderate amounts of water. Continuous flow systems occur in unconsolidated Coastal Plain sediments that make up the Magothy and Lloyd aquifers. These thick and productive aquifers underlie the upper glacial aquifer on Long Island (USACE 2000).

A variety of contaminants have been identified in shallow groundwater resources within the HRE Study Area. This contamination has been attributed to historic urban fill materials and long-term industrial activities.

2.1 Jamaica Bay Planning Region

Jamaica Bay is a highly urbanized estuary in southern Brooklyn and Queens that contains the Jamaica Bay Wildlife Refuge, established as part of the Gateway National Recreation Area (GNRA). GNRA was the country’s first national urban park and remains a dominant feature of this planning region. Predominant land uses on the northern shore of Jamaica Bay are developed commercial, industrial, and residential. The shorelines of Jamaica Bay are flanked by heavily developed lands, including the Belt Parkway, John F. Kennedy International Airport, and several landfills. Along the waterfront, land and water uses include marinas, marine parks, parkland, vacant disturbed land (wetlands and uplands), tidal wetlands, and residential land.

2.1.1 Regional Geology

The Jamaica Bay Planning Region lies within the Southern Long Island watershed, contained within the Coastal Plain Physiographic region. Surficial deposits of Long Island are glacial in origin with morainal deposits to the north and outwash deposits to the south. The surficial deposits form the unconfined aquifer and local water-bearing deposits of lesser extent, including the Jameco aquifer. These systems are underlain by the Magothy and Lloyd aquifers, which are generally confined.

Top of crystalline bedrock beneath Jamaica bay is over 600 feet deep. Above bedrock lies Cretaceous-aged semi-consolidated Coastal Plain Sediments. This sequence is overlain by Pleistocene sediments. The upper 100 feet consist of Wisconsin-aged Pleistocene glacial outwash sands and silts. These are overlain and reworked by Holocene sands and silts and local estuarine marsh deposits.

The shallow subsurface in the area is recorded by a series of borings drilled approximately 4 miles west of the site, just west of Bergen Basin in Queens. Borings 20980, 21001, 21002, 21003, and 21004 were drilled from July 1988 to February 1990 (e4sciences, 2016). The general stratigraphy of the site is also informed by a subsurface and geophysical investigative USACE-NAN report on Plumb Beach in Jamaica Bay, conducted in 2011 by e4sciences.

2.1.2 Regional Soils

Portions of Jamaica Bay may contain contaminated upland soils, tidal marsh sediments, and marine sediments because of past industrial and landfill activities. CSOs, storm drain outlets, and non-point sources continue to affect water quality within the Jamaica Bay watershed by releasing excess nutrients, floatable debris, and fecal coliform into the Bay. These discharges can also result in low dissolved oxygen concentrations and increased turbidity (USACE 2004a).

Jamaica Bay is threatened by poor sediment quality derived from a combination of sewage inputs, landfill leaching, industrial activity, and runoff from roads and developed areas (USFWS 1997). Jamaica Bay sediments are often characterized by high amounts of trace metals such as cadmium, chromium, and mercury along with chlorinated hydrocarbon contaminants (Levinton and Waldman 2006).

2.1.3 Water Quality

Surface water quality data

The Jamaica Bay oyster site is part of the estuarine and marine deepwater wetland. Table G-2 lists 2010 National Park Service Water Resources Division water measurements at station GATE_NPS_JB-12A, (Jo Co Marsh South), which is approximately 2,380 feet (0.45 miles) west of the Head of Bay site. Complete surface water quality reports are in e4sciences, 2016 documentation.

Table G-2. Water quality data acquired in Head of Bay, Jamaica Bay

Month	Jun	Jul	Aug	Sept	Marine average
Acidity (pH)	7.83	7.71	7.22	7.42	7.4 to 8.4
Dissolved oxygen concentration (mg/mL)	6.87	6.09	6.62	8.79	
Salinity (ppt)	29.30	28.85	29.43	28.20	
Surface water temperature (°F)	76.64	81.23	76.69	80.06	
Turbidity (FTU)	7.50	31.00	14.67	9.00	

Data acquired by the National Park Service Water Resources Division in June-September 2010. Measurements were made 1 to 4 times each month during the survey period and are averaged by month.

Groundwater quality data

No information was available on groundwater quality near the proposed Jamaica Bay Oyster site.

A study performed by the Department of Geology and Geophysics of Yale University in the early 1980s measured the amount of heavy metals in Jamaica Bay sediments that likely came from liquid sewage effluent and stormwater runoff (e4sciences, 2016, Seidemann, 1991). The sample site closest to the Head of Bay oyster site was located approximately 7,000 feet to the southwest.

2.1.4 HTRW

2.1.4.1 Jamaica Bay Shoreline/Perimeter Sites

Soil sampling (surface and sub-surface coring) was conducted in 2004 as part of the "source" study in order to identify the presence of HTRW contamination at each of the six perimeter/shoreline restoration sites (Attachment A). The chemical concentrations measured in surface soil samples represented current existing exposure to receptors, while the composite samples represented possible future exposure following restoration actions that may include excavation, re-grading and movement of the sub-surface soil to restore topography more suitable to target habitat including wetland complexes, upland maritime forest and grassland habitat. Chemical concentrations were compared to toxicological benchmarks including the NYSDEC Soil Cleanup Objectives (SCOs) (NYSDEC, 2012) and NOAA Effects Range-Low (ER-L) and Effects Range- Median (ER-M) sediment guidance benchmarks (Long et al., 1995).

Chemicals of Potential Concern (COPCs) were identified by calculating Hazard Quotients (HQs):

HQ = "Screening Value" (95% UCL or Maximum Chemical Concentration)
NYSDEC SCOs, ER-Ls, ER-Ms

Hazard Quotients for appropriate screening values exceeding one, may be an indication of a potential unacceptable impact from the COPC. The NYSDEC SCOs included thresholds for Unrestricted Use, Residential Use, Restricted Residential Use, Commercial Use, Industrial Use, Protection of Ecological Resources and Protection of Groundwater. Given the primary exposure pathways following restoration actions are to ecological receptors, and the sites intended use as natural areas, with little to no human presence, the most appropriate benchmark to evaluate the six sites is the Protection of Ecological Resources, as well as the Effects Range-Median values for benthic invertebrates.

COPCs were identified for surface soil (representing existing contaminant exposure) and subsurface exposure (potentially excavated and exposed during construction). All COPCs identified in soils on-site would be covered by the growing medium (clean cover) in both upland areas and restored wetland habitat. The restoration plan includes 1-ft of growing media in the excavated areas where wetlands will be restored and 18-in of growing media in the upland areas where excavated soils/sediments will be placed.

The USACE has had ongoing discussions with NYSDEC about restoration at these sites and adjacent restoration within Jamaica Bay (e.g., Spring Creek North and South). A more detailed HTRW evaluation may be needed during the Preconstruction Engineering Design (PED) Phase to determine the need for this clean growing media. Overall, the placement of clean growing media as part of the restoration design and the positive effect the proposed restoration will have in Jamaica Bay will increase the value of the restored and existing wetlands and improve the overall health of the environment. A summary of this screening and identification of COPCs at each site is provided in Attachment A. NYSDEC Memorandum dated 11 April 2013, included in Attachment A, further confirms this approach.

In 2019, NPS conducted response actions under the authority of the CERCLA and determined that a removal action to evaluate appropriate options to minimize human exposure to and migration of hazardous substances from the landfill that are potentially being released from the banks along the southern shoreline of the Site into Jamaica Bay (Dead Horse Bay South). NPS further determined that a site-wide Remedial Investigation/Feasibility Study (RI/FS) to fully characterize site contamination and evaluate the need for remedial action is also required. If determined no actions are needed at Dead Horse Bay North, the restoration would still be timed in coordination with the NPS removal action on South given clean excavated soil from the restoration project is planned as clean cap material for the NPS remedial action. All remedial actions and engineering controls would be identified during the NPS Investigation. Any additional costs associated with addressing unacceptable contamination would be paid for 100% by the non-federal sponsor (or Potential Responsible Party in coordination with NPS).

2.1.4.2 Jamaica Bay Marsh Island Sites

For the Jamaica Bay marsh island sites, it is assumed that they would be restored with material removed in conjunction with an operation and maintenance dredging contract. Bottom sediment cores were previously taken from the Rockaway Inlet and the Ambrose Channel, which are included among likely sources of material for future marsh island restoration projects. These materials were found to meet the criteria for ocean placement without additional testing, as per 40 CFR 227.13 (b) 1, Ocean Dumping Regulations. Island-specific HTRW samples will be collected during the PED phase.

2.1.4.3 Jamaica Bay - Head of Bay Oyster Restoration Site

Environmental Data Resources, Inc. (EDR) carried out a federal and state database search, in accordance with American Society of Testing and Materials (ASTM) Standard E1527-13, for each Oyster Bed Restoration Site in April, 2016. In addition to the EDR database search, Historic Aerial Imagery, and available Sanborn Fire Insurance Rate maps were obtained and reviewed to assist in review of each restoration site's history and to identify environmental conditions with potential to impact the restoration site. Full copies of these documents can be found in Appendix B.

The results of the search identified 14 records that are of potential concern within 1 mile of the Jamaica Bay – Head of Bay Oyster Bed Restoration Site. These include 3 State-equivalent CERCLIS record, two Solid Waste Facilities/Landfill Sites records, 7 NYS LTANKS records (all are currently closed), and two Major Oil Storage Facilities (MOSF) records, both of which include aboveground (AST) and underground (UST) designations. It is also important to note that the Head of Bay site is located adjacent to the John F. Kennedy International Airport, which presents the potential for myriad environmental issues, though one orphan record (NYS LTANK) was returned, the name of this site is listed as JFK TTF, which is likely related to the airport. The site of most concern is listed below, while the full report and list can be found in Appendix B:

Quick and Clean Cleaners is a now vacant property to the east of the Head of Bay site, and was housed in a large building with two parking lots on the property. The site has historically been used as a dry cleaning facility. Sampling on the property has revealed contamination from dry cleaning fluids and solvents, such as tetrachloroethene (PCE), trichloroethylene (TCE), dichloroethene (DCE), and vinyl chloride (VC) in groundwater on and off the site. The site is considered an environmental threat due to the continued release of contaminants from source areas into groundwater.

2.2 Harlem River, East River, and Western Long Island Sound Planning Region

The Harlem River, East River, and Western Long Island Sound planning region is the most densely populated of the eight HRE planning regions. Shorelines along the Harlem and East rivers are lined with urban residential, commercial, and industrial development. Commercial ferry terminals, marinas, and parkland are also found along the shorelines of this planning region. The waterways are used for commercial navigation as well as recreation boating, fishing, and water/jet skiing. Public and private beaches, found in the Upper East River and Western Long Island Sound, are open for bathing except when total coliform concentrations exceed water quality criteria. This planning region receives treated effluent from six sewage treatment plants, and water is withdrawn from the East River by four power plants as well as industrial/commercial interests (USACE 2004).

The Flushing Bay and Creek watershed is highly urbanized with a dense mixture of residential, transportation, commercial, industrial and institutional development. 14 combined sewer overflows (CSOs) discharge a combination of raw sewage and storm water during periods of heavy rainfall into the bay and creek. NYCDEP has made a significant investment to reduce CSOs via the Flushing Creek Long Term Control. In 2007, DEP completed a $363M CSO storage facility, and the agency will invest another $56M in seasonal disinfection technology by 2025.

The Bronx River Basin is located in southeastern New York. The basin lies within the metropolitan area of Greater New York and occupies 56.4 square miles in central and lower Westchester County and central Bronx County. The basin is oriented in a north-northeast – south-southwest direction. Its headwaters are at Davis Brook, northeast of the Kensico Dam and Reservoir. The Kensico Reservoir has only a minor ornamental outlet (via a fountain) into the Bronx River Basin. The Bronx River Basin’s greatest width is found miles in the east-west direction from the Village of Ardsley in the west to the City of White Plains in the east. The basin is 24.3 miles in length, from its mouth at the East River, in the Soundview and Hunts Point sections of Bronx, northeast to its northern most point in the town of New Castle.

2.2.1 Regional Geology

The Harlem River, East River, and Western Long Island Sound Planning Region lies with the Atlantic Coastal Plain physiographic province. Sediments vary depending upon location as a result of the complex flow patterns existing in the Long Island Sound, and overall HRE. Surficial sediments include both glacial and postglacial deposits, with the most recent glaciation period ending about 21,000 years ago. Surficial glacial deposits include till and stratified drift. Postglacial deposits consist of sand, marsh deposits, and estuarine silt.

The course of the Bronx River, like most rivers in the Manhattan Prong, follows a narrow band of weak Inwood marble. The river follows the southwesterly trend of the marble and then turns southward to empty into the East River at the apex of the Long Island Sound. Many believe that prior to the Pleistocene Period, the Bronx River was a pre-glacial stream that would its way from its source in present-day upstate New York to the present Long Island Sound. When a glacier came through the Bronx, approximately 240,000 years ago, it blocked part of the original path of the Bronx River and subsequently reshaped and modified the path of the River (Van Driver, Roadside Geology of New York, 1985).

2.2.2 Regional Soils

The majority of the Harlem River/East River/Western Long Island Sound planning region is highly urbanized. Historic inputs of toxic substances have degraded water quality and contaminated bottom sediments of freshwater tributaries. The primary contaminants of concern in the planning region are heavy metals, polychlorinated biphenyls (PCBs), and oil by-products. In addition, sewage and storm water discharges have degraded water quality to the extent that portions of the Western Long Island Sound become hypoxic or anoxic at certain times of the year. Anoxic and hypoxic events in the planning region are believed to occur from sewage effluent that, when discharged into the waters, causes algal blooms and subsequent oxygen depletion due to bacterial decomposition. Leachate, containing toxic substances, particularly ammonia, from the Pelham Bay landfill has also contributed to historic water quality degradation in the planning region (USACE 2004a).

The sediment contamination problems that occur in the study area are due in large part because of historical discharges of toxic contaminants. No single source category appears to be the primary determinant of conditions in the Sound. The largest sources of heavy metals are the major rivers that flow into the Sound; these dominate the load because of the large volume of discharge. Some of the load originates from natural sources and ambient conditions as most pollutants do not exceed state criteria for surface waters. Sewage treatment plants in New York and Connecticut are the second largest source of toxic substances and are dominated by the New York City sewerage treatment plants. Urban runoff, CSOs, and stormwater discharges are the third most significant source of toxic substances. They are potentially, significant sources of lead, PCBs, and polycyclic aromatic hydrocarbons (PAHs). Atmospheric deposits may also contribute substantial amounts of some metals, such as copper, lead and zinc, as well as organic compounds. Relatively minor sources of toxic substances may include industrial discharges, power plants, old landfills, chemical and oil spills and marine operations (Adams and Benyi, 2003).

2.2.3 Water Quality

2.2.3.1 Flushing Creek

Surface water quality
Mean tide ranges within Flushing Creek at the Northern Boulevard Bridge are reported to be 6.8 feet at mean tide and 8.0 feet a spring tide. The system receives freshwater (non-saline) flow from CSO discharges, direct rainfall runoff, and discharge through the tide gate from Meadow and Willow Lakes. The creek is a Class I waters per the NYSDEC.

Water quality throughout Flushing Creek typically exhibits low levels of dissolved oxygen and anoxia, and high levels of bio-chemical oxygen demand. Sediments are organics-rich with a low level of benthic community diversity. Exposed intertidal mudflats generate hydrogen sulfide gas.

High inputs of point source pollutants have led to an increase in coliform bacteria and a decrease in levels of dissolved oxygen. The southern region of the bay has experience intensive increases in chlorophyll ‘a’ concentrations (greater than 20µg/L) due to a high nitrogen input (Table G-3). The conditions of this area have been classified as eutrophic, which is directly correlated with an increase in biological oxygen demand (BOD) (NYCDEP, 2000).

Table G-3. Water quality parameters and hydrological data for Flushing Bay, NY.

	Average	Maximum	Minimum
Temperature (°C)	20.9	26.7	14.5
Salinity (ppt)	22.3	26.5	0.0
Dissolved Oxygen (µg/L)	4.5	14.7	<1.0
Chlorophyll ‘a’ (µg/L)	>20	n/a*	n/a*
Fecal coliform (cells/mL)	<100	n/a*	n/a*
Tidal range (feet)	6.5-6.8	+14.4 mlw	-4.0 mlw

*n/a = no available data; **mlw = mean low water

2.2.3.2 Bronx River

The Bronx River begins near the Kensico Dam in Valhalla, NY and flows south for 23 miles through Westchester and Bronx Counties before emptying into the East River. As the river flows through the Westchester County it starts in a suburban setting. Along the eight-mile stretch, which includes several city parks, the New York Botanical Gardens and the Bronx Zoo, have mostly naturalized banks and a fairly well vegetated, though often low quality, buffer area. Industrial and commercial uses dominate much of the lower three miles of the corridor, as evidence by its armored shoreline and lack of riparian vegetation.

Impervious surfaces (rooftops, parking lots, roads) cover more than 60 percent of the river’s upland areas and inhibit the watershed’s natural hydrological function (McDonnel and Larsen, 2004). In the Bronx River watershed, impervious surfaces produce storm water runoff that is conveyed quickly to the river through sewers and drains. This causes disturbed flow patterns within the river channel that cause flash floods, erosion, low habitat value, high water temperatures, low base flow and excessive sedimentation. Drainage systems and surface runoff from the surrounding watershed also discharge untreated wastewater directly into the river at several locations. The resulting degraded water quality is exacerbated by the River's low base flow and lack of wide buffer of native vegetation.

In the Unified Watershed Assessment for 1999 and 2000, the NYSDEC rated the Bronx River as a category 1 watershed – the lowest of three ratings. Category 1 watersheds do not meet, or face imminent threat of not meeting, clean water and other natural resources goals and are in need of restoration. All sections of the Bronx River are listed on NYSDEC's Section 303(d) List of priority water bodies. These are priority waters in New York State identified for total maximum daily loads (TMDL) development and do not support appropriate uses. In this listing, the problem parameters cited for the Bronx River are DO and fecal coliform.

In New York City, the topographical watershed of the Bronx River is 5,110 acres. However, sewer system construction, urban development and other alterations to the watershed and runoff pathways have altered the watershed such that only 4,163 acres now drain the Bronx River. Combined sewers serve 2,657 acres of this area and discharge to the river at five CSOs in the saline reach. The Hunts Point Wastewater Treatment Plant (WWTP) services this area. There are over 100 storm water and other discharges to the river along the entire length from Westchester to the East River. (Hydroqual, 2001).

2.2.4 HTRW

2.2.4.1 Flushing Creek Restoration Site

Sediment samples were collected during April 2013 from a total of 20 boring locations within Flushing Creek (NYCDEP 2014). The location of sampling extended from the Porpoise Bridge to the south to the area north of the Van Wyck Expressway and Roosevelt Avenue Bridges and encompassed the maximum area that was originally anticipated could be part of any proposed environmental restoration effort for the creek.

Samples were analyzed for NYSDEC Technical and Operational Guidance Series (TOGS) 5.1.9 parameters benzene, total BTEX (benzene, toluene, ethylbenzene and xylene), polycyclic aromatic hydrocarbons (PAHs), total PCBs, pesticides (DDT+DDD+DDE, chlordane, mirex and dieldrin), metals (arsenic, cadmium, copper, lead and mercury), and total organic carbon (TOC). Grain size analyses were also conducted on the material in the project area.

In addition, samples were analyzed for USEPA Priority Pollutants. Total Characteristic Leaching Procedure (TCLP) analyses were also conducted on 15% of the project depth samples (three samples). In addition to sediment samples, a limited number of surface water samples were also collected in locations that would be representative of the proposed study area. Surface water sampling efforts were limited to routine water quality parameters (salinity, dissolved oxygen, temperature) and were measured in the field. All analyses were performed following EPA or American Society for Testing and Materials (ASTM) procedures.

The objective of collecting and analyzing these sediment samples was to compare the analytical data to the TOGS 5.1.9 criteria that are used to characterize potential sediment contamination and determine if special management measures may be required. Among the objectives of TOGS 5.1.9 is the identification of sediment quality thresholds for selecting best management practices for dredging. Sediments are classified as either A, B, or C based upon the level of potential contamination present and this is used for purposes of assessing appropriate management strategies. The three classifications are defined as follows:

- Class A - No appreciable contamination or toxicity to aquatic life.
- Class B - Moderate contamination and chronic toxicity to aquatic life.
- Class C - High contamination and acutely toxic to aquatic life.

Based on the fall 2013 wetland delineation and habitat assessment surveys, the existing upland soils consist mostly of "fill material", including a predominantly silty sand with very little organic matter. Scattered through this soil is a variety of material including cobbles, small pieces of concrete, brick, asphalt, glass, plastic, fabric, and pieces of metal. Larger slabs of concrete and other debris material are apparent on the surface of the soil. These upland soils are very droughty and appear to shed water rapidly and dry out. The plan to prepare the soil for planting has been developed to reduce costs. It minimizes grading and maintains the existing elevation in most cases. The larger slabs of concrete and surface debris including bottles, cans and other materials would be removed to the extent practicable. Some selected areas would be amended with excess soils from suitable soil being removed from other areas of the project. The major earthwork in the upland areas would be for over-excavation for the root balls and the use of select or imported topsoil for the proposed tree plantings.

Surface water samples were collected to provide information on existing surface water quality within Flushing Creek and to provide a baseline understanding of existing water quality in conjunction with previous sampling of surface waters.

<u>Sediment Chemistry Analytical Results</u>

TOGS 5.1.9 Data
Sediment sampling results indicated that dominant sediment classifications within the proposed project dredge depth and post-dredge sediments were largely the same for the individual parameters evaluated. Sediment classifications for TOGS parameters are summarized in Table G-4 for both the materials to be dredged and the material to be exposed after dredging.

The sum of DDD+DDT+DDE concentrations was classified as Class A in the material to be dredged and Class B in the material to be exposed. However, the Class B concentrations in the material to be exposed were on the low end of concentration range for Class B, with the average concentration just over the Class B threshold. Total PAH concentrations were classified as Class A in the material to be dredged. Newly exposed sediments would also generally be Class A with 84% of the samples from the materials to be exposed demonstrating Class A concentrations. Only one sample collected at Station FCS-19 located in a small portion of the creek, south of the LIRR Bridge, was Class C at a concentration high enough to skew the average in the materials to be exposed. This station however is no longer within the currently proposed project area that is being considered for restoration and/or dredging. Excluding station FCS-19, the total PAH concentrations in the material to be exposed would be classified as Class A. TOC concentrations were generally within the same range for both the materials to be dredged and those exposed after dredging.

Based on these analytical results, the proposed dredging would therefore not be expected to result in the exposure of more highly contaminated sediments based upon sediment classification, but instead would expose sediments that are largely comparable in their level of contamination to the existing sediments that would be removed during dredging.

Table G-4. Summary of TOGS Classification for Material to be Dredged and Material to be Exposed

Item	TOGS Classification	Study Area Analytes
Material to be Dredged	Class A	Total PCBs
		Dieldrin
		Mirex
		Benzene
		Total BTEX
		Total PAHs
	Class B	Arsenic
		Cadmium
		Chlordane
		DDD+DDT+DDE
	Class C	Copper
		Lead
		Mercury
Material to be Exposed	Class A	Total PCBs
		Dieldrin
		Mirex
		Benzene
		Total BTEX
		Total PAHs (1)
	Class B	Arsenic
		Cadmium
		Chlordane
		DDD+DDT+DDE
	Class C	Copper
		Lead
		Mercury

Note: (1) Total PAH does not include data from Station FCS-19

Phase I environmental assessments have been completed for sites that were considered in this analysis. Table G-5 presents a synopsis of the Phase I results. There have been no concerns identified that would preclude continued development of restoration alternatives at any of these sites.

Table G-5. Phase I Environmental Assessment Results

Site Name	Level of Concern	Issues of Concern
Willow Lake	Low	None identified
Meadow Lake	Low	None identified
Flushing Creek – Corona Park	Moderate	Pre 1930's ash disposal and coal handling facilities
Flushing Creek – Porpoise Bridge Area	Low	None identified
Flushing Creek – Northern Blvd	Moderate	History of unidentified commercial structures pre-1960's
Flushing Bay – Inner Bay	Low	None identified
Flushing Bay, East River – College Point North	Moderate	Property adjacent to potential restoration site is listed in the NYDEC Voluntary Cleanup Program. Contaminants include metals and PAHs
Flushing Bay, Powell's Cove – Tallman Island	Low	None identified

As part of the cooperative agreement between the USACE and the City of New York Department of Environmental Protection (NYCDEP), the NYCDEP collected sediment samples from the upper section of Flushing Creek and adjacent shoreline. The areas sampled are that part of the creek adjacent to the area of environmental restoration. Samples were collected from the top one foot and at three to four foot depths of sediment.

Shallow sediment is composed of fine grain sand to silt. Deep sediments are composed entirely of silt. Augers from shallow and deep sample depths produced oil sheens of varying intensities and size. Soil samples were heterogeneous, with miscellaneous size bits of gravel. Soil moisture was minimal, slightly damp and color was light brown.

Laboratory analysis showed metals to be the main concerns. Considering the long time presence of industrial activities along its stream banks elevated levels of metals were present. Contributing further to the high levels are the histories of combined sewers dumping their flows into the creek during heavy rain events. Metals were found to be of the highest concentration in slack water areas. Metals were of lesser concentration in the main channel areas.

The higher level of concern are assigned to Arsenic and Mercury. Because of these high levels disposal and or treatment will be a major cost issue to manage effectively. The high Mercury levels in sample FC2 will be an equally difficult contaminant to effectively manage. With a guideline of 0.1 PPM and numbers of 10.6 PPM in the deep and 2.98 PPM in the shallow samples it could be potentially very expensive to dispose and treat this sediment.

Of the ten metals detected, nine of them have a "Site Background" guideline in addition to a numerical value. Mercury has a numerical guideline, but no site background guideline.

Managing Mercury contamination is one focus of restoration efforts. For the other nine metals, managing the excavation, transport, treatment and disposal of the sediments by their assigned numerical values is a project goal.

The high level of metals contamination was expected considering the location of the creek and its surrounding areas. In some samples, the low levels of SVOC contaminants were also found elevated. The other contaminants of concern, VOAs, ABNs, pesticides, PCBs and TPHC were not as prevalent as previously expected and should not prevent the restoration of the upper portion of the creek.

2.2.4.2 Bronx River Restoration Sites

Hazardous materials and wastes from both industrial and commercial sources may be present within the Bronx River Basin. As a first step in identifying these areas, a Preliminary Corridor Assessment (PCA) was conducted by the New York District in cooperation with the Westchester County Department of Planning and the NYCDEP, the results of which were published in the Draft Bronx River Watershed Preliminary Corridor Assessment Report (PCAR) (USACE 2007).

Historic inputs of toxic substances have degraded water quality and contaminated bottom sediments of freshwater tributaries. The primary contaminants of concern in the planning region are heavy metals, polychlorinated biphenyls (PCBs), and oil by-products. In addition, sewage and storm water discharges have degraded water quality to the extent that portions of the Western Long Island Sound become hypoxic or anoxic at certain times of the year. Anoxic and hypoxic events in the planning region are believed to occur from sewage effluent that, when discharged into the waters, causes algal blooms and subsequent oxygen depletion due to bacterial decomposition. Leachate, containing toxic substances, particularly ammonia, from the Pelham Bay landfill has also contributed to historic water quality degradation in the planning region (USACE 2004a).

The sediment contamination problems that occur in the study area are due in large part because of historical discharges of toxic contaminants. No single source category appears to be the primary determinant of conditions in the Sound. The largest sources of heavy metals are the major rivers that flow into the Sound; these dominate the load because of the large volume of discharge. Some of the load originates from natural sources and ambient conditions as most pollutants do not exceed state criteria for surface waters. Sewage treatment plants in New York and Connecticut are the second largest source of toxic substances and are dominated by the New York City sewerage treatment plants. Urban runoff, CSOs, and stormwater discharges are the third most significant source of toxic substances. They are potentially, significant sources of lead, PCBs, and polycyclic aromatic hydrocarbons (PAHs). Atmospheric deposits may also contribute substantial amounts of some metals, such as copper, lead and zinc, as well as organic compounds. Relatively minor sources of toxic substances may include industrial discharges, power plants, old landfills, chemical and oil spills and marine operations (Adams and Benyi, 2003).

Locations of HTRW sites within the Bronx River Basin are shown on Figure G-2. The contaminant levels of the HTRW sites and their proximity to restoration sites played a role in prioritization of the sites evaluated.

The NYSDEC site remediation files identify four sites in the State Superfund Program, 6 sites in the Brownfield Cleanup Program, twenty-three sites in the Voluntary Cleanup Program, two Toxic Release Inventory sites and one Environmental Restoration Program Site within the Study Area (USACE 2007). Additional sites were identified through the geographic information system (GIS) database on Environmental Site Remediation and Spill Incidents maintained by the NYSDEC. Of the sites documented in the PCAR, the following six were identified as areas of concern (AOC) for the Bronx River Ecological Restoration Study:

- Red Devils Plant (Bronx River Middle Subwatershed) – Polyurethane and toluene are the two principal contaminants at this former paint manufacturing site which is approximately 125 feet from the Bronx River. Product seepage from the site to the river has been documented. Cleanup at the site was initiated in 1999; however, the initial efforts were not fully effective. The responsible party filed for bankruptcy in 2002. A third party took on cleanup responsibilities in 2005. A work plan which proposed interim remedial measures, including source removal and tank removal was approved by NYSDEC in November 2006.
- CE - White Plains MGP (Bronx River Upper Subwatershed) – This former Manufactured Gas Plant (MGP) is located approximately 340 feet from the Bronx River. MGPs, which were common from the early 1800s to the mid-1900s, converted coal, oil, and water into gas for lighting city streets and heating homes. Byproducts such as coal tar, ash, cinders, and oils are typical contaminants associated with former MGP sites. Contamination issues associated with former operations at the CE White Plains MGP include dense non-aqueous phase liquids DNAPL MGP tar at the site as well as off-site to the south. The off-site migration of tar was addressed during the 2004 IRM by installing a down-gradient NAPL cut-off wall. Additional remediation is necessary at the site, but the status of any additional remedial actions is unknown.
- *The Kensington* (Bronx River Middle Subwatershed) – This site is currently a municipal parking lot approximately 400 feet from the Bronx River. Spills and/or materials associated with past uses, which included a Light & Power Plant, auto repair, gas station & garage, have resulted in the identification of this site as an AOC. A Remedial Investigation Workplan (RIWP) has been completed for the site. Based on its proximity the Bronx River this site is a potential AOC until the spill cases are closed.
- *Hunts Point Food Distribution Area* (several sites in the NYSDEC site remediation database) – These sites are located approximately 1000 to 1700 feet from the mouth of the Bronx River, just outside the boundary of the Estuary Subwatershed, and are associated with MGPs and coal gasification facilities that operated in from the mid-1920’s to 1960. By-products of the coal gasification process including polycyclic aromatic hydrocarbons (PAHs), light aromatic hydrocarbons, phenolic compounds, and various inorganic compounds such as iron, lead, copper, zinc, sulfides, cyanides and nitrates are suspected contaminants of concern at these sites. Known areas of soil and groundwater contaminated with purifier waste and coal tar exist at some sites. At other sites investigations have not been conducted to date.

- *Dexter Chemical Corporation* (Estuary Subwatershed) – This active chemical manufacturing facility is located approximately 500 feet from the Bronx River in the industrial/ commercial district of Hunts Point, Bronx. The site has been a chemical manufacturing plant for over 40 years, producing products used in textiles, paint coatings and other industrial applications. Dexter has been a conditionally exempt Small Quantity RCRA Waste Generator, and the main waste product is wastewater which is neutralized onsite. Prior to Dexter, the site was utilized for paint manufacturing. Petroleum and non-petroleum wastes and some metals are present in onsite soils and groundwater. A Soil Vapor Extraction and Air Sparging system was selected as the remedy for the site in September 2005, and a limited pump and treat system has also been proposed.
- *CE - E. 173rd St. - Bronx Works* (Estuary Subwatershed) – This former MGP site is located adjacent to the Bronx River. It is bounded by the Sheridan Expressway to the west and by the Bronx River to the south and east. The site currently presents a significant environmental threat due to the ongoing releases of contaminants from source areas into the groundwater. Groundwater level measurements collected during the Site Investigations indicate that the groundwater flow toward, and discharges to, the Bronx River.

In addition to the sites identified above, there are numerous industrial properties within the Bronx River Watershed which have been identified as AOCs, or are potential AOCs. Active and former industrial sites include gas stations, parking lots, chemical manufacturing plants, inactive hazardous waste sites, former manufactured gas plants, state superfund sites, etc. Several of the AOC's have active sources of contaminants with direct pathways to the Bronx River and many more are impacting the River through transport of contaminants via stormwater run-off, groundwater migration and sedimentation. Approximately 60% of the watershed is impervious cover and significant runoff is generated and discharged to the Bronx River primarily by street drains and storm sewer outfalls to the River and its tributaries, with little or no retention. Westchester and Bronx County rely on aging infrastructure and conveyance systems for stormwater and wastewater which were built at the turn of the century. This infrastructure is undersized, fraught with leaks, breaks, illicit connections, direct discharges, and combined sewer overflows. The Bronx River Watershed Coalition prepared the Bronx River Watershed Management Plan for the County to address the urban stormwater runoff to improve water quality.

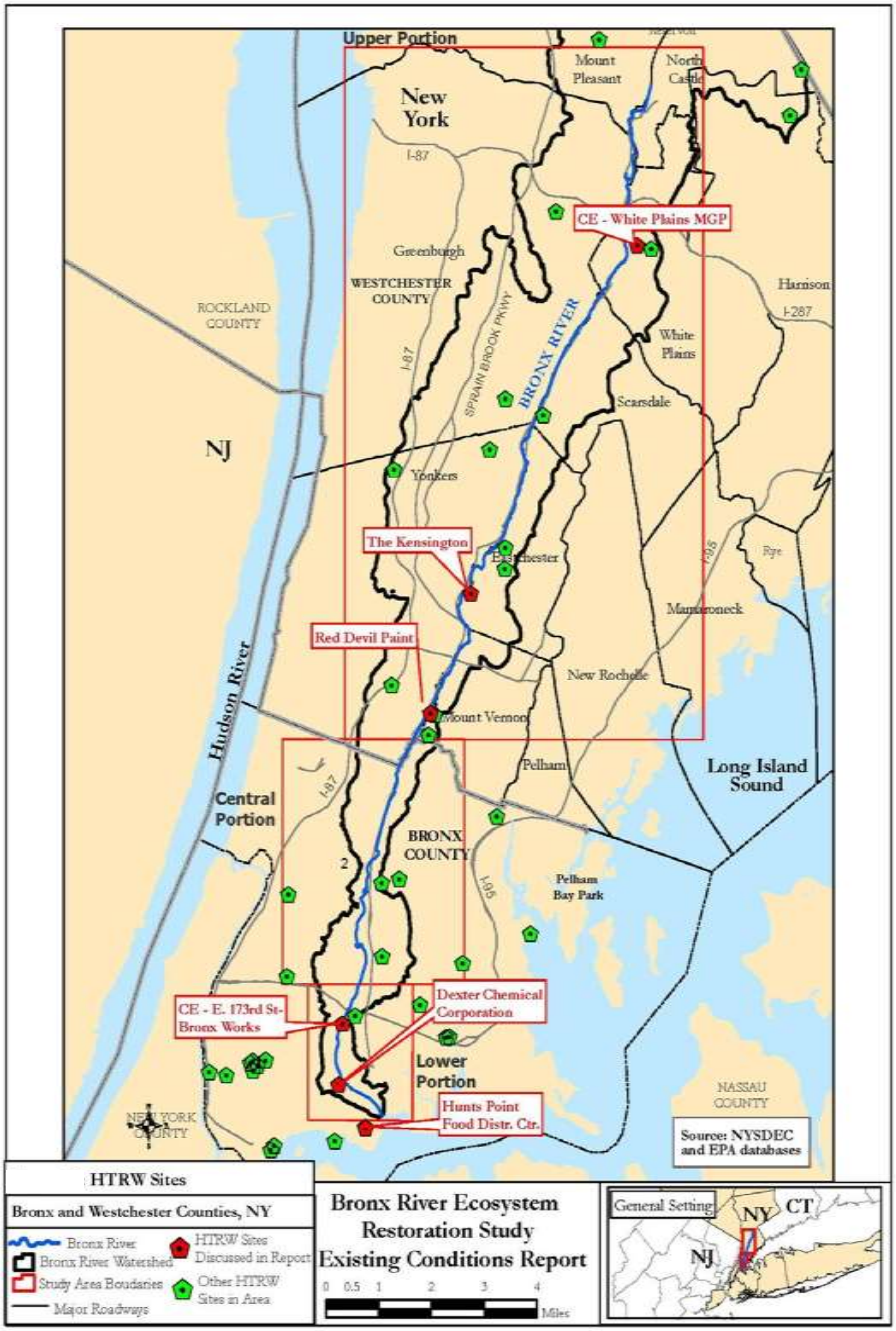

Figure G-2. Location of HTRW Sites within the Bronx River Watershed

2.2.4.2.1 *USEPA Toxics Release Inventory (TRI) Program*

The Toxics Release Inventory (TRI) is a publicly available EPA database that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990.

For Bronx River, the database search identified three facilities for the 2004 dataset: Medi-Ray, Inc., Jenna Concrete Corp, and Dexter Chemical LLC. Facility records are provided in the Bronx River HTRW Corridor Assessment.

Cycle: 2004 **State:** NY **List ID:** NY-1702-0006
Waterbody Name: BRONX RIVER, LOWER
State Basin Name: ATLANTIC-LONG ISLAND SOUND
Listed Water Map Link: MAP 303(d)

State List IDs:

Cycle	State List ID
2002	1702-0006
2004	1702-0006

State Impairments:

State Impairment	Parent Impairment	Priority	Rank	Targeted Flag	Anticipated TMDL Submittal
OXYGEN DEMAND	OXYGEN DEPLETION				
PATHOGENS	PATHOGENS	HIGH			

Potential Sources of Impairment:
There were no potential sources reported to EPA by the state.

Total Maximum Daily Load (TMDL) Information:
There were no TMDLs reported to EPA by the state.

Watershed Information:

Watershed Name	Watershed States
BRONX	NEW YORK
NORTHERN LONG ISLAND	NEW YORK

This water body was also listed in the following years: 2002, 1998, 1996
http://iaspub.epa.gov/tmdl/enviro.control?p_list_id=NY-1702-0006

2.2.4.2.2 *USEPA Watershed Database*

The Bronx River Watershed is listed as an impaired watershed and is part of the New York Harbor Watershed designated as priority for TMDL development over the next two years. Oxygen depletion and pathogens are the listed impairment.

2.2.4.2.3 *Miscellaneous Records*

Focused Remedial Investigation East 183rd Street Works, Bronx, NY, April 2003, Con Edison GEI Consultants prepared for Con Ed

In sediment samples collected from the Bronx River, no VOCs were detected at concentrations above analytical detection limits. No PAHs were detected in sediment samples at concentrations above freshwater sediment screening criteria (ORNL, 1997). Cyanide was not detected in the sediment samples above the EPA generic soil screening level of 1,600 mg/kg. Metal compounds were detected in sediment samples that exceed sediment-screening criteria. The report states the concentrations of individual metals in each of the samples were similar (within the same order of magnitude). These data suggest that sediment of the Bronx River contains background concentrations of metals that exceed screening criteria, and sediment is not impacted by former MGP operations. Groundwater level measurements collected during the FRI indicate that the groundwater flow direction is to the south, towards the Bronx River, and groundwater discharges to the river.

Groundwater samples collected from monitoring wells located along the hydraulically down gradient site boundary exhibited acenaphthene and/or benzene concentrations that exceed AWQSs. It is unlikely that these compounds in groundwater are present in surface water at concentrations that could potentially affect surface water quality. However, the surface water quality of the Bronx River should be evaluated to determine if surface water quality standards are being achieved. The evaluation of surface water would be performed using a mass balance analysis or surface water sampling and analysis. A mass balance analysis could be used to calculate the concentrations of regulated compounds in river surface water. The mass balance analysis would require additional hydraulic characterization data to determine saturated hydraulic conductivities, groundwater flow velocities, and river flow rates. Surface water sampling would include the collection and analysis of surface water from selected reaches of the Bronx River (i.e., upriver, adjacent to the park property, and downriver).

Additional sediment samples should also be collected upriver and downriver from the site to determine background chemical concentrations that are representative of natural or existing background concentrations not in the area of the former MGP.

The above referenced report states that Con Edison is committed to the development of a remedy to address the contamination identified at Starlight Park from the former manufactured gas plant. The intent of the remediation will be to satisfy the requirements of the NYSDEC and NYSDOH so that an unrestricted use determination is granted to Con Edison and the property owner. Based on the findings of the focused remedial investigation, the following components are being evaluated as part of the site remediation:

- Excavation and removal of soils impacted by visible tar.
- Removal of tar-impacted subsurface structures.
- Transportation of impacted soils to a commercial thermal facility for treatment and disposal.
- Placement of clean backfill into the excavations that will be compatible with the future use of the site.
- On-site odor and fugitive air emission control throughout the remedial activities.
- Installation of new storm drain lines and appurtenances during the excavation backfilling activity.
- Determination of all required permits early in the development of the remediation plan.
- Grading and surface preparation suitable to allow the park to be developed by the city.
- Groundwater monitoring.

Associated Press Article "Hazmat Crews Work on Major White Plains Gas Spill", White Palins, NY, Wednesday, 24 January 2007

Based on the news article, a large gasoline spill at a service station occurred in White Plains, NY. Hazardous materials crews were dispatched to prevent the spread of gasoline into the Bronx River. More than 1,000 gallons spilled onto the pavement and a roof of a nearby one-story building.

Fire and hazardous waste crews placed booms in the Bronx River to contain the gasoline, but it was not immediately known how much got into the water. The roof and surrounding pavement were foamed, and a strong odor of gasoline could be smelled as far away as the White Plain train station, about half a mile away.

Heavy Metals Survey of Bronx River Watershed

From a study on comparing urban soils to rural soils (Pouyant and MacDonnel, 1991, 1995), researchers found that urban soils in the Bronx had higher concentrations of lead, copper and nickel than rural soils. In the Bronx, lead was detected at levels four times higher than soils in Westchester and Litchfield Counties. Nickel and copper were also detected in Bronx soils at levels higher than Westchester and Litchfield Counties.

Soil samples were collected by USDA/NRCS at Soundview Park, Bronx River Avenue, Bronx Botanical Gardens and the Bronx Park Museum and analyzed for lead, copper and nickel. The soil sampling results showed elevated levels for these metals. The concentrations of metals detected are indicative of being from anthropogenic sources not natural sources (Cadavid, 2003).

2.3 Newark Bay, Hackensack River, and Passaic River Planning Region

The Lower Passaic River and Hackensack River connect to the New York-New Jersey (NY-NJ) Harbor Estuary and the Hackensack River through Newark Bay. Newark Bay (approximately 6 miles long and 1 mile wide) extends southward from the confluence of the Passaic and Hackensack Rivers and is connected to Upper New York Bay by the Kill Van Kull and to Raritan

Bay by the Arthur Kill. Newark Bay is enclosed on the west by the New Jersey cities of Newark and Elizabeth and on the east by Jersey City and Bayonne. It is bordered on the south by Staten Island, New York. The northern and western banks of Newark Bay are home to numerous active and abandoned commercial and industrial properties. These banks are extensively developed and consist of miles of hardened shoreline. The eastern and southern banks have more of a mix of commercial, residential and recreational uses. Although originally a shallow tidal estuary, deep navigational channels are maintained in Newark Bay to provide ocean-going container ship access to the Port Newark-Elizabeth Marine Terminal along the bay's western side. These navigational channels originally extended northward from Newark Bay into the Lower Passaic River and the Hackensack River, but the channels in the rivers have not been maintained for decades.

2.3.1.1 Lower Passaic River

The Lower Passaic River is located in northeastern New Jersey (NJ), from the river's confluence with Newark Bay at River Mile (RM) 0 to RM8.3 near the border between the City of Newark and Belleville Township. The Lower Passaic River is part of the 80-mile long Passaic River. The Passaic River has a total watershed of 935 square miles that empties into Newark Bay in the NYNJ Harbor. The watershed is divided into three distinct topographic regions: the Highland Area, the Central Basin, and the Lower Valley. The Highland Area is the 500 square mile northwesterly portion of the Passaic River watershed, and is located in mountainous and wooded areas of the Appalachian province. The Central Basin consists of 262 square miles in a low-lying floodplain area that includes meadows, swamps, and bogs. The Passaic River meanders through the low-lying areas of the Central Basin (which are highly susceptible to flooding during and following heavy storms) until it passes through a gorge at Little Falls and enters the Lower Valley. Because of the large storage area represented by the Central Basin, significant storms can produce a vast reservoir of water that may take many days to dissipate, supplying relatively high flows to the Lower River for extended periods. The Lower Valley represents a drainage area comprised of 173 square-miles and is also drained by tributaries (discussed below) that enter the Passaic River below the Dundee Dam. While these watershed areas are based on hydrologic divides, for the purpose of the HRE Study Area, boundaries are defined at locations where flows or contaminants enter the main area of interest, and where these flows and fluxes can be readily measured, such as at a dam or discharge point.

Dundee Dam, originally built in 1845, divides the Upper Passaic River from the Lower Passaic River. The Upper Passaic River meanders across several geologic settings, draining urban, suburban, and rural portions of northern New Jersey. The Upper Passaic River watershed is 805 square miles (defined at the dam for the purpose of the HRE Study Area) and includes approximately 1,200 Known Contaminated Sites, 3 Chromate Waste Sites, 15 NPL Sites and 200 Toxic Release Inventory Facilities as defined by USEPA and NJDEP. However, very few of these contaminated sites discharge directly into the Passaic River. The cumulative effect of these and other natural and anthropogenic watershed contaminant sources form a background contaminant discharge over Dundee Dam into the Lower Passaic River. Since Dundee Dam forms a barrier for the upstream transport of contaminates released from the Lower Passaic River, such as from the Diamond Alkali Superfund Site, the Upper Passaic River just above

Dundee Dam is used in the risk characterization as the background location for the HTRW Literature Review Report (USEPA, 1991).

The Lower Passaic River watershed consists of highly developed urban areas located in portions of Bergen, Essex, Hudson, and Passaic counties in northeastern New Jersey. Major tributaries that discharge to the Lower Passaic River include the Saddle River (RM15.6), Third River (RM11.3) and Second River (RM8.1). Land use in the watershed is a mix of residential, commercial, and industrial uses. Intensive commercial and industrial uses occur near the mouth of the Lower Passaic River and around portions of Newark Bay, in part to take advantage of the multi-modal transportation infrastructure that includes roadway, railway, air, and marine transportation services. Near RM4, the Lower Passaic River continues to include commercial uses, but also starts to include more recreational and residential uses.

2.3.1.2 Hackensack River

The Hackensack River is approximately 45 miles long, originating at Lake Lucille in New City Rockland County, New York, and empties into Newark Bay, New Jersey. From its headwaters, the Upper Hackensack River flows into several man-made reservoirs including Lake DeForest (in Clarkson, New York); Lake Tappan (spanning across the New York/New Jersey border from Rockland County, New York to Bergen County, New Jersey); then into the Oradell Reservoir (primarily in the borough of Oradell, Bergen County, New Jersey). The New Jersey portion of the Hackensack River is 32 miles from the state line to Newark Bay. Below the Oradell Dam, the river is tidally influenced and brackish. Almost 70% of the river's watershed is in New Jersey, of which 58% is in Bergen County and 10% is in Hudson County (Tiner and Bergquist 2007).

The portion of the Lower Hackensack River in this report is located between RM 12.5 and RM 10.5 near Bellmans Creek. Oradell Dam is approximately 17 miles north/northeast of the mouth of the river and includes approximately 23 RMs. This section of the river spans across Bergen and Hudson counties, New Jersey, and includes the Hackensack Meadowlands and several tributaries. The Hackensack Meadowlands District (HMD) is a 5,445-acre estuarine emergent wetland (half of the total wetland/pond acreage along the Hackensack River) located just a few miles north of Newark Bay (Tiner et al. 2005). There are over 17 tributaries to the Hackensack below the Oradell Dam. The primary tributaries include:

- Hirshfeld Brook and an associated unnamed branch;
- French Brook;
- Van Saun Mill Brook and associated tributaries (Herring Brook, Coles Brook, and Behnke Brook);
- Overpeck Creek and its associated tributaries (Mill Creek, Teaneck Creek, Flatrock Brook, Metzler Brook, and an unnamed branch near the north end);
- Losen Slofe Creek;
- Doctor Creek;
- Bellmans Creek;
- Cromakill Creek;
- Mill Creek;
- Wolf Creek;

- Moonachie Creek;
- Bashes Creek;
- Berry's Creek Canal;
- Berry's Creek and its tributaries (Fish Creek);
- Mary Ann Creek;
- Kingsland Creek; and
- Penhorn Creek.

The list above includes most of the tributaries; however, there are several other smaller tributaries that empty directly into the Hackensack River or into one of the tributaries listed above.

The total RMs including the Hackensack River and all of its primary and secondary tributaries below the Oradell Dam are approximately 72 miles.

2.3.2 Regional Geology

The Lower Passaic River is situated within the Newark Basin portion of the Piedmont physiographic province, located between the Atlantic Coastal Plain Province and the Appalachian Plateau (Fenneman, 1938). The Newark Basin geology is comprised primarily of mid-Triassic to early Jurassic sedimentary rocks (sandstone, shale, and calcareous shale) and conglomerates, and to a lesser extent, of igneous rocks (basalt and diabase). Bedrock underlying the Lower Passaic River is called the Passaic Formation (Nichols, 1968 and Olsen, et al., 1984) and consists of interbedded red-brown sandstone and shale. Almost the entire Passaic River watershed, including the Lower Passaic River, was subjected to glacial erosion and deposition as a result of the Wisconsinan glaciation. A glacial sand and gravel aquifer and more recent alluvium exist beneath portions of the Lower Passaic River; elsewhere the river flows over less permeable sediments from a Wisconsinan glacial lake.

The Hackensack Meadowlands is located within the Piedmont physiographic province, which encompasses the northern part of New Jersey. The topographic relief of the Piedmont is generally characterized by wide valleys and gently rounded hills lying at elevations that vary from 100 to 400 feet above sea level. The underlying bedrock geology in the Meadowlands consists mainly of sedimentary deposits, such as sandstone and shale. These deposits, collectively known as the Newark Group, are of the Triassic age and form low ridges and valleys that trend northeast to southwest, essentially parallel to the Palisades Ridge and the First Watchung Mountain.

The Newark group is divided into lower, middle and upper formations: the Stockton, the Lockatong, and the Passaic (formerly known as the Brunswick), respectively, all of the Newark Group. The Passaic formation is the predominant layer in the Meadowlands, forming most of the bedrock of the Hackensack River basin. It is composed of sandstone, mudstone, siltstone, and conglomerate containing gypsum and glauberite. The Stockton formation occurs in a narrow belt extending from the town of West New York, New Jersey, northward to Rockland County, New York. It is composed of shale, red sandstone, light colored sandstone, and mainly quartz and feldspar. The Lockatong formation interweaves both the Stockton and Passaic formations, but generally lies between the two. It is composed of mudstone of chemical and detrital origin and contains sodium feldspar, calcite, chlorite, dolomite, albite, and analcime. The depth of the bedrock valleys ranges from 55 feet below sea level at the Sparkill Gap to more than 250 feet below sea level around Newark. The Piedmont has been widely affected by Pleistocene glaciation, which formed the Passaic and Hackensack River drainages.

The Meadowlands formed as a result of the last major glacial advance, the Wisconsin, which built the massive Harbor Hill terminal moraine that extended from Long Island west across Staten Island to Perth Amboy. Between 15,000 and 12,000 years ago, this terminal moraine served as a dam for glacial meltwaters, and formed the southern boundary for Glacial Lake Hackensack. Sedimentation resulting from the advance and retreats of Pleistocene ice fronts resulted in the deposition of massive beds of lacustrine clays and glacial till which now fill the bedrock valleys and mantle the sandstone ridges. Following the drainage of Glacial Lake Hackensack (approximately 10,000 years ago), the lake bottom went through a complex succession of hydrologic and vegetation regimes before achieving its modern condition. With the gradual post-Pleistocene sea level rise, the initial freshwater marsh was gradually invaded by increasing amounts of seawater and consequent tidal influence. Much of the Meadowlands District is at or just above sea level.

2.3.3 Regional Soils

Till, glacial deltaic deposits, and glacial outwash terrace deposits are located upland from the Lower Passaic River. The surface soils near the river are often disturbed by human activities, such as placement of fill material. The Riverhead-Dunellen soil series (which consists of a sandy loam) dominates the riverbanks of the Lower Passaic River above RM5. The Wetherfield Urban land-Boonton soil series (which consists of deep, moderately-well and well drained soils that form in till on uplands) dominates the riverbanks below RM5.

2.3.4 Water Quality

2.3.4.1 Lower Passaic River

The Lower Passaic River is an estuary bounded by the Dundee Dam (RM17.4) upstream and by Newark Bay (RM0) downstream. River depth ranges from less than 3 feet MLW in the upper portion to almost 26 feet MLW20 in the lower portion. Flow over the Dundee Dam is the primary source of freshwater to the Lower Passaic River, with a long-term average flow of approximately 1,100 cfs. The mouth of the river at Newark Bay experiences a semidiurnal (i.e. twice daily) tidal fluctuation in surface elevation, with a range of approximately 5 feet. This tidal elevation influence may propagate upstream as far as the physical barrier at Dundee Dam under low freshwater (Upper Passaic River) flow conditions.

Salinity in Newark Bay, especially near the bottom of the water column, is high relative to the freshwater inflow to the Lower Passaic River at Dundee Dam, but it varies in response to freshwater flow and wind (Chant and Wilson, 2004; Chant, 2005). During low flow periods, the salinity in Newark Bay is over 20 parts per thousand (ppt), whereas the salinities at the mouth of the Lower Passaic River are typically 5 ppt lower than Newark Bay. The salinity drops significantly as the freshwater river flow increases, i.e. during periods of higher flow.

Within the Lower Passaic River, the density contrast between the freshwater river flow and more saline water in Newark Bay interacts with the tidal input to form a partially stratified estuary. Denser saline water from Newark Bay extends upstream underneath the less dense freshwater surface layer. The tidally-averaged velocity profile near RM5 showed a clear residual upstream velocity near the bottom and a strong downstream velocity near the top, which is characteristic of estuarine circulation. Relatively strong tidal currents generate vertical turbulent mixing that partially mixes the water column along the interface between the two layers. The upstream edge of the interface is called the salt front.

The position of the salt front within the Lower Passaic River is controlled by the force balance among riverine discharge, tidal flow, the magnitude of the salinity difference between Upper Passaic River water and Newark Bay water, turbulent mixing of the opposing momentum in the surface and bottom density layers, and frictional effects of the riverbed. For example, under low-flow conditions of approximately 35 cfs, measured salinity and turbidity data place the salt front between RM10 and RM12. Under high-flow conditions of approximately 11,654 cfs, measured data found the salt front pushed well downstream into Newark Bay. Under typical flow conditions, the salt front is usually located between RM2 and RM10, and moves back and forth about 4 miles each tidal cycle (twice a day).

Since the magnitude of estuarine circulation in the Lower Passaic River is controlled, in part, by the salinity contrast between freshwater inflow at Dundee Dam and salinity at the head of Newark Bay, a complete understanding of the hydrodynamics requires knowledge of the physical processes and morphological features controlling salinity in Newark Bay. Thus, the spatial scale of the hydrodynamic characterization must encompass the Lower Passaic River, the Hackensack River, and Newark Bay. This combination forms one of the most complex estuarine systems in the United States. The confluence of the Passaic River and Hackensack River is located at the northern end of Newark Bay. Newark Bay is connected at its southern end to Upper New York Bay and Raritan Bay through two narrow tidal straits, the Kill van Kull and Arthur Kill, respectively. Relatively deep (35 to 50 feet) shipping channels run along the centerlines of both Kills and extend northward along the western side of Newark Bay, supporting shipping at Port Elizabeth and Port Newark. These shipping channels play an important role in transporting saline water from the coastal ocean into the Passaic River-Hackensack River-Newark Bay system.

The estuarine circulation pattern described above affects the resuspension, deposition and transport of solids in the Lower Passaic River. The stratification and the tidal currents work together to move sediment and associated contaminants both upstream and downstream within the estuary, transporting contaminants multiple miles downstream and upstream of their original discharge points while tending to smooth out contaminant concentration gradients along the Lower Passaic River. While the net transport of sediment at any given time is highly dependent on the balance of fresh water and tidal flows, over the long-term, there is a net transport of sediment from the Lower Passaic River to Newark Bay.

Oak Island Yards

Surface Water Quality Data

In 2013, the New Jersey Harbor Dischargers Group (NJHDG) took a variety of field measurements in rivers, bays, and harbors in New Jersey and New York according to sub-watershed classification as part of the Ambient Water Quality Monitoring Program. These water measurements included acidity, DO concentration, salinity, temperature of the surface water, turbidity, and amount of fecal coliform. The measurements were made multiples times throughout each month and are averaged by month in Table G-6. Turbidity was measured in terms of the concentration of total suspended solids, and enterococcus values were measured in terms of number of colony forming units found in 100mL.

Table G-6. Summary of water quality parameters measured from January to December 2013 in the sub-watershed of the Newark Bay/Kill Van Kull (74°7'30").

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Acidity (pH)	6.04	7.67	7.73	7.87	7.50	7.48	7.60	7.61	7.52	7.52	7.74	7.58
DO Concentration (mg/L)	11.57	12.18	11.45	11.28	7.14	6.43	5.48	5.77	6.07	6.67	9.56	9.13
Salinity (ppt)	21.86	20.74	19.38	19.30	21.34	15.79	21.72	23.91	25.05	25.91	27.85	25.44
Temperature (°F)	43.97	37.26	40.57	43.05	58.64	66.63	74.61	73.26	69.21	66.67	50.16	45.00
Turbidity (mg/L)	48.22	-	29.00	47.22	30.67	50.11	50.54	49.67	47.52	49.50	49.11	59.25
Enterrococcus (cfu/100mL)	15.78	11.60	-	-	91.60	15.00	12.50	11.14	-	-	-	-

Groundwater Quality Data

There are no Known Contaminated Sites (KCS) within the Oak Island Yards site. Figure G-3 shows the locations of known contamination sites near the Oak Island Yards site. Less than 1,000ft northwest of the site there is a KCS with groundwater contamination associated with the Newark Energy Center constructed between 2012 and 2014. The address of the site is 921 1111 Delancy St, in the city of Newark, New Jersey. The PI name is ARCO Petroleum Products – Hess. The known contaminants include are listed in Table G-7. The contamination values were the greatest measured at the site described above at the time of Groundwater CEA establishment on 8/22/2012.The KCS encompasses 22.8 acres.

Figure G-3. Wetland areas and NJDEP Known Contaminated Sites in the area of the Oak Island Yards site.

Orthophoto obtained from NJGIN Clearinghouse Web Map Services, 2015. Wetland information obtained from U.S. Fish and Wildlife Service, National Wetlands Inventory, 2010

Table G-7. Known Contaminants at Delancy Street Site near Oak Island Yards

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Aluminum	6,740	200
Arsenic	74.1	3
Benzo(a)anthracene	72.5	0.1
Benzo(a)pyrene	66.7	0.1
Benzo(b)fluoranthene	92	0.2
Benzo(k)pyrene	42.4	0.5
Bis (2-ethylhexyl) phthalate	1,290	3
Cadmium	116	4
Chromium	80.9	70
Chrysene	88.4	5
Dibenzo(a,h)anthracene	19.9	0.3
Indeno(1,2,3-cd)pyrene	50.9	0.2
Iron, pentacarbonyl	896,000	300
Lead	2,480	5
Manganese	7,650	50
Mercury	5.9	2
Methylnaphthalene (2-)	10,000	30
Sodium	320,000	50,000
Synthetic Organic Chemicals - Carcinogen [Total]	22,150	100
Synthetic Organic Chemicals - Non Carcinogen [Total]	9,030	500
Tert-butyl alcohol	1,320	100
Zinc	2,020	2,000

[1]The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and Standards and establishes classes of groundwater according to hydrogeologic characteristics of the groundwater resource and designated uses of the classification area.

Essex County Branch Brook Park

Surface Water Quality Data

The Essex County Branch Brook Park site contains freshwater ponds and freshwater forested/shrub wetland areas. Between 2003 and 2006, the NJHDG conducted the Ambient Water Quality Monitoring Program, which involved taking a variety of field measurements in rivers, bays, and harbors in New Jersey and New York according to sub-watershed classification. These water measurements included acidity, DO concentration, and salinity, temperature of the surface water, turbidity, and amount of fecal coliform. Turbidity was measured in terms of the concentration of total suspended solids, and fecal coliform values were measured in terms of the number of colony forming units (cfu) found in 100mL.

The measurements were made multiples times throughout each month and are averaged by month in Table G-8.

Table G-8. Summary of water quality parameters measured in January – December 2004 in the sub-watershed of the Passaic River Lower (4th Street to Second River).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Acidity (pH)	6.31	6.44	6.86	6.58	6.97	7.24	7.61	7.12	6.65	-	8.01	7.59
DO Concentration (mg/L)	14.22	13.96	11.76	8.62	6.81	6.95	5.66	5.40	7.91	9.67	10.82	11.83
Salinity (ppt)	0.20	0.80	0.45	0.20	0.85	-	0.50	1.67	0.37	0.23	0.16	0.15
Temperature (°F)	35.96	34.43	42.17	53.60	65.75	71.00	74.54	73.66	65.48	57.28	49.32	43.61
Turbidity (mg/L)	4.00	11.00	8.00	14.50	17.50	37.80	28.33	20.25	19.00	8.50	19.33	16.00
Fecal coliform (cfu/100mL)	100.00	50.00	480.00	530.00	257.50	206.00	2066.67	678.00	923.33	120.00	280.00	2000.00

Groundwater Quality Data
Figure G-4 shows the locations of known contamination sites in or near the Essex County Branch Brook Park site.

Figure G-4. Wetlands and NJDEP recognized Known Contamination Sites in the area of the Essex County Branch Brook Park site.

Base map images are March-May 2015 orthorectified images (NJGIN, 2015).Wetland information

On the eastern edge of Essex County Branch Brook Park, adjacent to Bloomfield Ave, there is a Known Contaminated Site (KCS) with groundwater contamination associated with the Lake St. Bus Garage. The address of the site is 228 Bloomfield Ave, in the city of Newark, New Jersey. The PI name is NJ Transit. The known contaminants are listed in Table G-9. The contamination values were the greatest measured at the site described above at the time of Groundwater CEA establishment on 9/10/2007.The site encompasses 4.0 acres.

Table G-9. Known Contaminants at 228 Bloomfield Avenue Site near Essex County Branch Brook Park

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Benzene	30.3	1.0
Cyclohexane	1,000	100
Diesel Fuel	10,000	0
Lead	708	5
Methylcyclohexane	665	100
Synthetic Organic Chemicals – Carcinogen [Total]	15,490	500
Synthetic Organic Chemicals – Non Carcinogen [Individual]	2,300	100
Toluene	1,600	600
Xylenes (total)	2,660	1,000

[1]The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and Standards and establishes classes of groundwater according to hydrogeologic characteristics of the groundwater resource and designated uses of the classification area.

On the eastern edge of Essex County Branch Brook Park, adjacent to Bloomfield Ave, there is another KCS with groundwater contamination associated with the former Exxon service station. The address of the site is 241 Bloomfield Ave, in the city of Newark, New Jersey. The PI name is Meineke Mufflers. The known contaminants are shown in Table G-10. These contamination values were the greatest measured at the site described above at the time of Groundwater CEA establishment on 9/10/2007. The site encompasses 0.9 acres.

Table G-10. Known Contaminants at 241 Bloomfield Avenue Site near Essex County Branch Brook Park

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Benzene	850	1.0
Ethylbenzene	959	700
Synthetic Organic Chemicals – Non Carcinogen [Total]	5,810	500
Toluene	2,700	500
Xylenes (total)	3,710	1,000

[1]The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and

Standards and establishes classes of groundwater according to hydrogeologic characteristics of the groundwater resource and designated uses of the classification area.

On the northern edge of Essex County Branch Brook Park, there is another KCS with groundwater contamination associated with the Branch Brook Maintenance Garage. The address of the site is 30 Heller Pkwy, in the city of Newark, New Jersey. The PI name is Branch Brook Maintenance Garage. The known contaminants are listed in Table G-11. The contamination values were the greatest measured at the site described above at the time of Groundwater CEA establishment on 5/8/2002. The site encompasses 2.5 acres.

Table G-11. Known Contaminants at 30 Heller Parkway Site near Essex County Branch Brook Park

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Aluminum	7,220	200
Arsenic	9.6	3.0
Benzene	1,530	1.0
Benzo(a)anthracene	0.48	0.1
Benzo(a)pyrene	0.22	0.1
Bis (2-ethylhexyl)phthalate	86	3
Cadmium	26.3	4.0
Ethylbenzene	2,070	700
Hexachlorobenzene	64	0.02
Iron	173,000	300
Lead	2,110	10
Manganese	36,200	50
Methyl tert-butyl ether	442	70
Naphthalene	350	300
Nitrate	13,3000	10,000
Sodium	4,600	50,000
Synthetic Organic Chemicals – Non Carcinogen [Total]	11,307	500
Toluene	3,700	1,000
Xylenes (total)	5,500	1,000

[1]The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and Standards and establishes classes of groundwater according to hydrogeologic characteristics of the groundwater resource and designated uses of the classification area.

On the western edge of Essex County Branch Brook Park, adjacent to Bloomfield Ave, there is another KCS with groundwater contamination associated with the Getty Service Station. The address of the site is 315 Bloomfield Ave, in the city of Newark, New Jersey. The PI name is Getty Service Station #95337. The known contaminants are listed in Table G-12. The contamination values were the greatest measured at the site described above at the time of Groundwater CEA establishment on 1/30/2001. The site encompasses 1.0 acres.

Table G-12. Known Contaminants at 315 Bloomfield Avenue Site near Essex County Branch Brook Park

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Benzene	290	1.0
Ethylbenzene	3,380	700
Lead	1,440	100
Synthetic Organic Chemicals – Non Carcinogen [Individual]	1,250	100
Synthetic Organic Chemicals – Non Carcinogen [Total]	3,455	500
Toluene	18,500	1,000
Xylenes (total)	22,300	1,000

[1]The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and Standards and establishes classes of groundwater according to hydrogeologic characteristics of the groundwater resource and designated uses of the classification area.

2.3.4.2 Hackensack River

Water quality within the Hackensack Meadowlands District (HMD) has been significantly degraded in the last century. Industrial waste discharges and increased stormwater runoff from developed areas within the HMD, as well as the greater New York Harbor area, have contributed significantly to the degradation of water quality within the estuary (USEPA, 1995). Continued urbanization of the Hackensack River watershed and the resulting untreated stormwater runoff have contributed to declines in water quality as well. In a natural, unaltered estuary, freshwater flowing into the system sustains an over-all seaward movement of the water mass, along with any pollutant loads that may exist. The estuarine system of the lower Hackensack River, however, does not maintain normal water flow due to the many manmade modifications (NJSEA, 2004). Therefore, pollutants discharged into the Hackensack River system tend to diffuse more slowly than they would in a typical estuary. Salinity decreases moving upriver, with an average salinity around 5 ppt at the northern end of the Meadowlands District being measured in both studies.

There are many existing point and non-point sources of pollution that affect the water quality of the Meadowlands. Point source pollution tends to come from sources such as Sewage Treatment Plants (STPs), Combined Sewer Outfalls (CSOs), and industrial discharges. The initial discharging sources of NPS pollution cannot be pinpointed and include storm sewers, landfill leachate, and surface storm water runoff.

The level of DO is particularly critical, as it is necessary to support the maintenance, migration, and propagation of the natural and established biota. Concentrations have varied between seasons and from year to year. For example, the restriction of freshwater input during a drought worsens conditions. For example, DO readings taken by NJMC/MERI were above the criteria minimum (standard) for 95 percent of readings in 2002 and 67 percent of readings in 2001. Counts of fecal coliform bacteria, indicators of untreated sanitary wastes, were highly variable over time and from station to station. Bacterial counts have not exceeded the criteria maximum since fall 1998, although they are still high in some areas. Counts did show an overall reduction in concentration. Heavy metals, which are by-products of industrial processes, power generation, and the transportation arteries that cross the HMD, are well below criteria limits. However, in recent years, drought conditions have led to increased metal concentrations (Meadowlands Comprehensive Restoration Implementation Plan, 2008).

Metromedia Tract

Surface Water Quality Data

The Metromedia Tract site is part of the estuarine and marine wetland, as shown in Figure G-5.

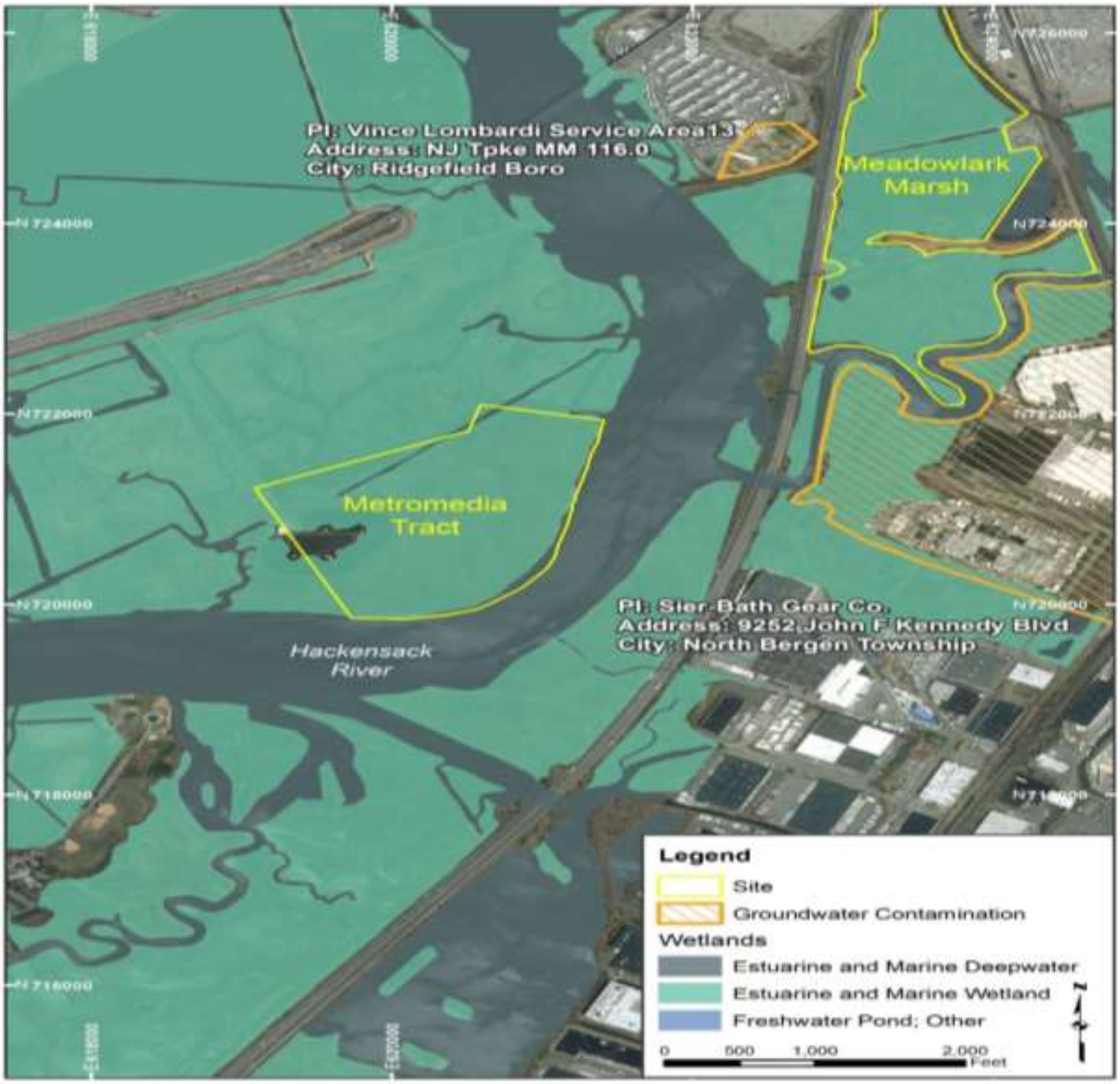

Figure G-5. Wetland areas and NJDEP recognized Known Contaminated Sites in the area of the Metromedia Tract site.

Base map images are March-May 2015 orthorectified images (NJGIN, 2015). Wetland data is from U.S. Fish and Wildlife Service, National Wetlands Inventory, 2010.

Groundwater Quality Data
Figure G-5 shows the locations of known contamination sites in or near the Metromedia Tract site. The movement and storage of groundwater in the Meadowlands District occurs primarily in the interconnected network of openings that form along joints, fractures, and other channels in the Passaic Formation. The estimate of thickness of the groundwater-producing zone in the bedrock is between 200 and 600ft (NJMC Master Plan, 2004).

Due to limited freshwater inflow and the lack of a direct connection with the open ocean, the lower Hackensack River area is susceptible to pollutants introduced to the watershed. Sources of pollution tend to be sewage treatment plants, industrial discharges, landfills, and surface runoff (NJMC Master Plan, 2004).

There are no NJDEP recognized Known Contaminated Sites (KCS) within 1,000ft of the Metromedia Tract site. The KCS (with groundwater contamination) that is south and east of Meadowlark Marsh is 1,400ft from the edge of Metromedia Tract. The address of the site is 9252 John F Kennedy Blvd in the city of North Bergen, New Jersey. The Program Interest (PI) name is Sier-Bath Gear Co. The known contaminants are listed in (Table G-13). These contamination values were the greatest contamination values measured at the KCS described above at the time of Groundwater Classification Exception Area (CEA) establishment on 8/25/1999. This KCS site encompasses 696 acres and the remediation status is unknown. The fact that this site borders Bellmans Creek, which is connected to the Hackensack River, could be a potential concern.

Table G-13. Known Contaminants at 9252 John F Kennedy Blvd Site near Metromedia Tract and Meadowlark Marsh

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Arsenic	13	8
Bis (2-ethylhexyl) phthalate	2300	30
Dichloroethylene (*cis*-1,2)	8000	2
Ethyldiene dichloride	120	70
Lead	17	10
Trichloroethane (1,1,1)	140	30
Trichloroethylene	440	1
Vinyl chloride	890	5
Vinyldiene chloride	33	2

[1] The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and Standards and establishes classes of groundwater according to hydrogeologic characteristics of the groundwater resource and designated uses of the classification area.

<u>*Meadowlark Marsh*</u>
Surface Water Quality Data
Bellmans Creek and the Hackensack River have a tidal range of 6.29ft. Due to limited freshwater inflow and the lack of a direct connection with the open ocean, the lower Hackensack River area

is susceptible to pollutants introduced to the watershed. Sources of pollution tend to be sewage treatment plants, industrial discharges, landfills, and surface runoff (NJMC Master Plan, 2004).

Groundwater Quality Data

The movement and storage of groundwater in the Meadowlands District occurs primarily in the interconnected network of openings that form along joints, fractures, and other channels in the Passaic Formation. The estimate of thickness of the groundwater-producing zone in the bedrock is between 200 to 600 feet (NJMC Master Plan, 2004).

The bedrock is separated from the surface by the relatively impermeable glacial lake clays and silt. The main groundwater aquifer in bedrock (NJMC Master Plan, 2004) is separated from the surface by over 70ft of impermeable Pleistocene glacial lake clay and silts. The main transport between the surface and the aquifer would be by wells or pilings that penetrated the Pleistocene.

Approximately 180ft east of the Meadowlark Marsh site, there is a KCS with ground water contamination. The address of the site is 9252 John F Kennedy Blvd in the city of North Bergen, New Jersey. The Program Interest (PI) name is Sier-Bath Gear Co. The known contaminants are listed in (Table G-14). These contamination values were the greatest contamination values measured at the KCS described above at the time of Groundwater Classification Exception Area (CEA) establishment on 8/25/1999. This KCS site encompasses 696 acres and the remediation status is unknown. This site is only separated from the Meadowlark Marsh restoration site by Bellmans Creek and therefore could be a potential concern.

Approximately 180ft west of the Meadowlark Marsh there is another KCS with groundwater contamination. The address of this site is NJ Turnpike MM 116.0, in the city of Ridgefield, New Jersey. The Program Interest (PI) name is Vince Lombardi Service Area 13. The known contaminants are listed in Table G-14. The contamination values were the greatest measured at the site described above at the time of Groundwater Classification Exception Area (CEA) establishment on 9/4/2013. The KCS site encompasses 4.9 acres. At the surface the NJ Turnpike I-95 physically separates this KCS from the Meadowlark Marsh restoration site.

Table G-14. Known Contaminants at NJ Turnpike MM 116.0 Site near Meadowlark Marsh

Contaminant	Concentration (µg/L)	GWQS[1] (µg/L)
Benzene	300	1
Tert-butyl alcohol	3,200	100

[1]The concentration of each contaminant found is compared to the Ground Water Quality Standard (GWQS), which was created by the NJDEP Division of Water Monitoring and Standards and establishes classes of groundwater according to hydrogeological characteristics of the groundwater resource and designated uses of the classification area.

2.3.5 HTRW

Lower Passaic River

The Passaic River was one of the major centers of the American industrial revolution starting two centuries ago. Early manufacturing, particularly cotton mills, developed in the area around Great Falls in the city of Paterson, which is eight miles upriver of the Dundee Dam. By the end of the 19th century, a multitude of industrial operations, such as manufactured gas plants, paper manufacturing and recycling facilities, petroleum refineries, shipping, tanneries, creosote wood preservers, metal recyclers and manufacturers of materials such as rubber, rope, textiles, paints and dyes, pharmaceuticals and chemicals, sprang up along the river's banks as the cities of Newark and Paterson grew. These industrial developments used the river for wastewater disposal. The Lower Passaic River was also used to convey municipal discharges.

As environmental laws came into effect starting in 1969 along with the changing economy, the once predominant manufacturing sector along the lower Passaic River went into a decline. By the late 1970's the majority of the factories and manufacturing operations had shut down. Two hundred years of industry and population growth has made a tremendous impact on the Passaic basin. The manufacturing legacy is represented by hundreds of contaminated sites located throughout the basin. The majority of the sites are concentrated in the lower portion, that area below the Great Falls in Paterson downstream to Newark Bay. These contaminated sites range from gasoline stations, machine shops, textile manufacturing, dye houses, heavy manufacturing/assembly, auto repair shops, dry cleaners and home-owners heating oil tanks leaking into the groundwater. The locations range from small lots to tens of acres in size. There are stretches along the lower Passaic where every lot is a known contaminated site. There are hundreds of locations along the river and within the basin with soil and/or groundwater contamination.

Many of these contaminated sites are included on the New Jersey Department of Environmental Protection (NJDEP)'s Known Contaminated Site List (KCS). There are a total of 132 active sites along the Passaic from the Two Rivers site in Wayne, Passaic County downstream to Newark Bay. In addition, there are 33 active sites along the main stem Passaic River upstream to the Boonton/Pequannock/Whippany Rivers and four active sites along the Pompton River down to the Two Bridges location.

As part of the Programmatic Environmental Document for the Hudson Raritan Estuary Ecosystem Restoration Feasibility Study (USACE, 2015), HTRW sites were identified within the Lower Passaic River/Hackensack River/Newark Bay Planning Region (only including the lower portion of the Passaic River Basin). A total of approximately 3,000 HTRW sites were identified in the Planning Region.

Of these 3,000 sites, only 905 were identified within a 0.5 mile buffer of potential restoration opportunities.

Together, these waste streams (industrial and municipal) have delivered a number of contaminants to the river, including, but not limited to polychlorinated dibenzodioxins and furans

(PCDD/F), polychlorinated biphenyl (PCB) mixtures, polycyclic aromatic hydrocarbon (PAH) compounds, DDT and other pesticides, mercury, lead and other metals.

In addition to various other accidental and intentional discharges on the Lower Passaic River, the river was significantly impacted by discharges from the manufacturing facility located at 80 Lister Avenue in Newark, New Jersey (located near RM3), which began producing DDT and other products in the 1940s. Between 1951 and 1969, the facility owned by Diamond Alkali Company (subsequently known as the Diamond Shamrock Chemical Company) was used for the production of the defoliant chemical known as “Agent Orange.” A by-product of the manufacturing was 2, 3, 7, 8-tetrachlorodibenzo-pdioxin (2, 3, 7, 8-TCDD), which was discharged into the river.

Between 1983 and 1985, the NJDEP and the USEPA collected samples from the Lower Passaic River and the 80 Lister Avenue upland property. These samples revealed extremely elevated concentrations of 2, 3, 7, 8-TCDD. Consequently, the site was included on the National Priority List (NPL) and designated a Superfund site by USEPA in 1984. USEPA issued a Record of Decision (ROD) for the property at 80-120 Lister Avenue in 1987 and an interim containment remedial action consisting of capping, subsurface slurry walls, and a groundwater treatment system was completed in 2001.

In 1994, Occidental Chemical Corporation (OCC), the property owner, agreed to investigate a six-mile stretch of the Lower Passaic River, under USEPA oversight. The sampling results from this investigation showed that sediments contaminated with hazardous substances move into and out of the six-mile stretch, leading USEPA, in 2002, to expand its investigation (working together with the USACE and partners on the Lower Passaic River “Source” Study) to include the entire 17-mile tidal stretch of the Passaic River, from Dundee Dam to Newark Bay

Significant amounts of data were collected as part of the Lower Passaic River Remedial Investigation and Feasibility Study (also known as the Lower Passaic River Restoration Project) (Appendix B- Prior Reports and Ongoing Restoration Efforts Appendix). During the study, thousands of sediment cores were collected between River Mile (RM) 0 and RM 17. High resolution sediment cores were collected between River Mile (RM) 0 and RM 15 (2005), above Dundee Dam (2005), and Upper Passaic (2007) and low resolution sediment cores throughout the Lower Passaic in 2006 through 2013. Water column sampling was conducted in 2005, 2009-2010 and 2010-2013 in the Passaic River and during 2011 through 2013 in the Passaic River, Newark Bay, Second River, Third River, Saddle River, Hackensack River, Arthur Kill and Kill Van Kull. Chemical concentrations were also measured in fish tissue in the 17 miles of the Passaic during 2009-2010 and upstream of Dundee Dam in 2012. These data are presented and evaluated in USEPA’s Remedial Investigation Report for the Focused Feasibility Study for the Lower eight (8) miles of the Lower Passaic (USEPA, 2014). Specific data reports are also available on www.ourpassaic.org.

USEPA’s Remedial Investigation (RI) Report (USEPA, 2014a), Feasibility Study Report (USEPA, 2014b, Record of Decision (ROD) (USEPA, 2014c) and Proposed Plan (USACE, 2016a) for the Focused Feasibility Study (FFS) were completed for the lower 8.3 miles of the Lower Passaic River. The remedial action consists of the removal of 3.5 million cubic yards of toxic sediments followed by capping the entire stretch of river bottom bank-to-bank. The lower 8.3 miles of the Passaic contains ninety percent of the volume of contaminated sediments in the river. The cleanup plan requires the permanent removal from the river of approximately 24,000 pounds of mercury, 6,600 pounds of PCBs, 1,300 pounds of DDT, a pesticide, and 13 pounds of highly toxic dioxin. Following dredging, the cap will isolate the remaining contaminated sediment, effectively eliminating the movement of major source of contamination to the rest of the river and Newark Bay. In October 2016, USEPA reached a legal agreement with Occidental Chemical Corporation, one of more than 100 parties identified as potentially responsible for contamination in the lower Passaic River, to perform engineering and design work needed to begin cleanup (USEPA, 2016b).

The USEPA cleanup of the lower 8.3 miles builds upon dredging that has already occurred in two areas of the lower 17 mile stretch with high concentrations of sediment. In 2012, the USEPA oversaw dredging in the Passaic River near the former Diamond Alkali facility in Newark. About 40,000 cubic yards of the most highly dioxin contaminated sediment were removed, treated and then transported by rail out of state. In 2013, the USEPA oversaw dredging of approximately 16,000 cubic yards of highly contaminated sediment from a half-acre stretch of the Passaic River that runs by Riverside County Park North in Lyndhurst, NJ located about 11 miles north of the confluence with Newark Bay (USEPA, 2016b).

USEPA has also determined that no remedial actions are necessary in the tributaries based on the investigation of the extent of contamination within the mainstem of the Passaic River. At this time, the 17 mile Remedial Investigation/Feasibility Study (RI/FS) Report has not been finalized and additional remedial decisions in the upper nine (9) miles of the Passaic River have not been made.

These remedial decisions have been coordinated with the restoration planning throughout the investigation and has directly influenced the timing/sequencing and ability for the USACE to recommend restoration sites within the Passaic River Study Area. To date, the focus of abiotic contaminant sampling has been “in river” and not in upland areas associated with specific restoration sites recommended in this FR/EA.

Based on this information, Essex County Branch Brook Park has been identified as a “Tier 1” Site that can move forward for near-term construction. Restoration of Oak Islands Yards, designated “Tier 2” or “deferred” sites, would be advanced following the remediation of the lower 8.3 miles.

<u>*Oak Island Yards*</u>

The Oak Island Yards restoration site is 39 acres in size and belongs to the Newark Bay watershed. The Oak Island Yards site is located on top of a mix of fill, salt-marsh, sand, and gravel deposits. The water quality around Oak Island Yards is mostly suitable for aquatic life, however the turbidity has been measured high at times. Northwest of the site is the Newark Energy Center, where many contaminants have been measured in the soil/groundwater. It is unknown if these contaminants affect Oak Island Yards site. Sediment sampling conducted during the Lower Passaic River RI/FS indicated contamination at an unacceptable risk and a

Record of Decision (ROD) was executed for the cleanup of the lower 8.3 miles. Oak Island Yards would be restored following EPA's Remedial Action.

Essex County Branch Brook Park
The Essex County Branch Brook Park restoration site consists of 360 acres and is between the Garden State Parkway and Route 21 in Newark, NJ. The site belongs to the Passaic River Lower (4^{th} Street to Second River) sub-watershed.

The site is underlain by shale (Passaic formation), which is underneath layers of Pleistocene till and Holocene swamp deposits. The surface of the Essex County Branch Brook Park site is made up of four different types of soil units: Boonton Red Sandstone Lowland, Udorthents Boonton Red Sandstone Lowland Substratum, Udorthents loamy fill substratum, and Urban land Boonton red sandstone lowland substratum.

NJDEP recognizes four known contaminated sites adjacent to the Essex County Branch Brook Park site. These sites contain concentrations of certain compounds that exceed their respective GWQS. How this affects the overall health of the site cannot be determined definitively. Soil samples were not available directly on-site; however, contaminant levels were assumed to be acceptable for this FR/EA. Additional site-specific HTRW data would be collected during the PED Phase.

Hackensack River

The Meadowlands have been subjected to numerous sources of contamination, which contribute to impaired soil, sediment and water quality and adversely impact fish and wildlife resources. Contamination originates from point sources, such as industrial discharges, as well as non-point sources, in the form of storm-water runoff, landfill leachate, and air deposition.

The history of industry and waste disposal in the Hackensack Meadowlands District (HMD) has resulted in unacceptable concentrations of organic and inorganic pollutants in the soils, sediments, and waters. Contaminants of concern in the HMD include mercury, cadmium, chromium, dioxin, PCBs, PAHs and other metals and organic chemicals. Further detail concerning sources, effects and interactions of these contaminants can be found in the Meadowlands Comprehensive Restoration Implementation Plan (MCRIP) (USACE, 2005); and an in-depth account on the effect of restoration on contaminant bioavailability can be found in the 2005 USFWS Planning Aid Report.

Tides play an important role in increasing contaminant bioavailability and distribution. The tides in the Hackensack River allow contaminants, such as mercury, to become distributed widely (Ramalhosa *et al*., 2001; Pecchioli *et a*l., 2003; USFWS, 2005). This tidal influence, coupled with the low-lying terrain of the Meadowlands, allows for extensive horizontal mixing (BCUA, 1990; Konsevick *et al*., 1994).

An estimated 70 percent of the total pollutant load entering the lower Hackensack River comes from Newark Bay and its associated waterbodies (BCUA, 1990). Newark Bay is at the center of the largest manufacturing and industrial center in the northeast and has been impacted extensively by industrial and municipal activities, causing elevated levels of numerous contaminants in the sediment and water column (Crawford *et al*., 1995). Newark Bay also has been impacted by petroleum spills (Gunster *et al*., 1993a; 1993b). Tides allow contaminants to migrate into Newark Bay from the Raritan Bay and Upper New York Bay (Crawford *et al*., 1995). This pollutant load is exacerbated by the fact that the Hackensack River has limited flushing because of restricted freshwater flow and an indirect connection to the ocean (USFWS, 2005).

The USACE and New Jersey Meadowlands Commission (NJMC) have collected data to identify and characterize HTRW at potential restoration tracts in the HMD including Anderson Creek Marsh, Lyndhurst Riverside Marsh, Meadowlark Marsh, and the Metromedia Tract. The USACE and NJMC also completed HTRW and geotechnical investigations at seven other tracts in the HMD including: the proposed Bellemeade Mitigation Tract, Eastern Brackish Marsh Tract, Kearny Brackish Marsh Tract, Richard P. Kane Natural Area, Saw Mill Creek Wildlife Management Area, Teterboro Woods Tract, and Western Brackish Marsh (USACE 2008). The purpose of the geotechnical and HTRW investigations was to support the future tract-specific designs as part of the feasibility studies.

HTRW analysis included Target Compound List (TCL) Volatile Organic Compounds (VOC+10), Semi-Volatile Organic Compounds (SVOCs), Pesticides/PCBs: Target Analyte List (TAL) Metals, Methyl-Mercury, Total Organic Carbon (TOC) and percent solids. Select samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, SVOCs, Pesticides, Herbicides, Metals, and RCRA Characteristics including Ignitability, Corrosively, and Reactivity. Results varied from tract to tract, ranging from no HTRW detected in some samples to exceedances of ecological protection criteria in other samples. The analysis indicated that there was no discernable contamination pattern.

As would be expected in the Meadowlands District, some levels above regulatory soil and sediment guidelines were detected. At Anderson Creek, HTRW results showed that surficial sediments have higher concentrations of metals than deeper sediments at the site. When compared to NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC), elevated levels occurred in samples mainly for metals, with elevated PCB, semi-volatile organic compounds (SVOC), and pesticide levels also detected in some samples. Specifically, Hg and Me-Hg were detected at concentrations above the RDCSCC regulatory criteria (USACE-NYD, 2006 [2]).

At Meadowlark Marsh and Metromedia Tract, some sediment-test results exceeded NJDEP Soil Cleanup Criteria (SCC) and TCLP Maximum Contaminant Concentrations, and NJDEP Site Remediation Program (SRP) Guidance for Sediment Quality Evaluations (effects range low [ER-L] and effects range median [ER-M] levels). Specifically for Meadowlark Marsh, some samples exceeded NJDEP SCC for Benzo(a)pyrene, arsenic (As), antimony (Sb), and Hg; exceeded TCLP for Pb; and other various metals, total BNA compounds, PCBs, and pesticide compounds exceeded ER-L levels. Specifically for Metromedia Tract, total tentatively identified volatile organic compounds (VOCs), As, and Pb exceeded the NJDEP SCC levels; no samples exceeded TCLP; and ER-L levels were exceeded for Benzo(g,h,i) perylene, metals, PCBs, and pesticide compounds (USACE-NYD, 2006 [1]).

In addition to the investigations described above, a selection of site-specific ecological/sediment data is also available on the MERI website (http://meri.njmeadowlands.gov/ecorisk). As part of a Screening Level Ecological Risk Assessment (ENSR, 2004), both chemical contamination and biotic inventory data were assimilated to develop a geographic database for previously assessed wetlands in the Meadowlands District in an effort to help guide decision-making for restoration strategies.

Metromedia Tract

The Metromedia Tract restoration site is 74 acres in size and is in the Hackensack-River-Route-3-to-Bellmans-Creek sub-watershed. This site is managed by the Meadowlands District. The site is underlain by siltstone, shale, and coarse-grained sandstone (Passaic formation), which is underneath layers of estuarine and salt-marsh deposits and fill. The surface of the Metromedia Tract site is made up of the Westbrook, Ipswich, and Sandyhook soil complexes, which are all flooded very frequently, as is characteristic of marshes. The closest NJDEP recognized Known Contaminated Site is 1,400ft east of the Metromedia Tract site. An HTRW analysis was conducted at the Metromedia Tract by Louis Berger & Associates in September 2005.

Figure G-6 shows the locations of the HTRW samples, while Table G-15 shows a summary of the sampling results.

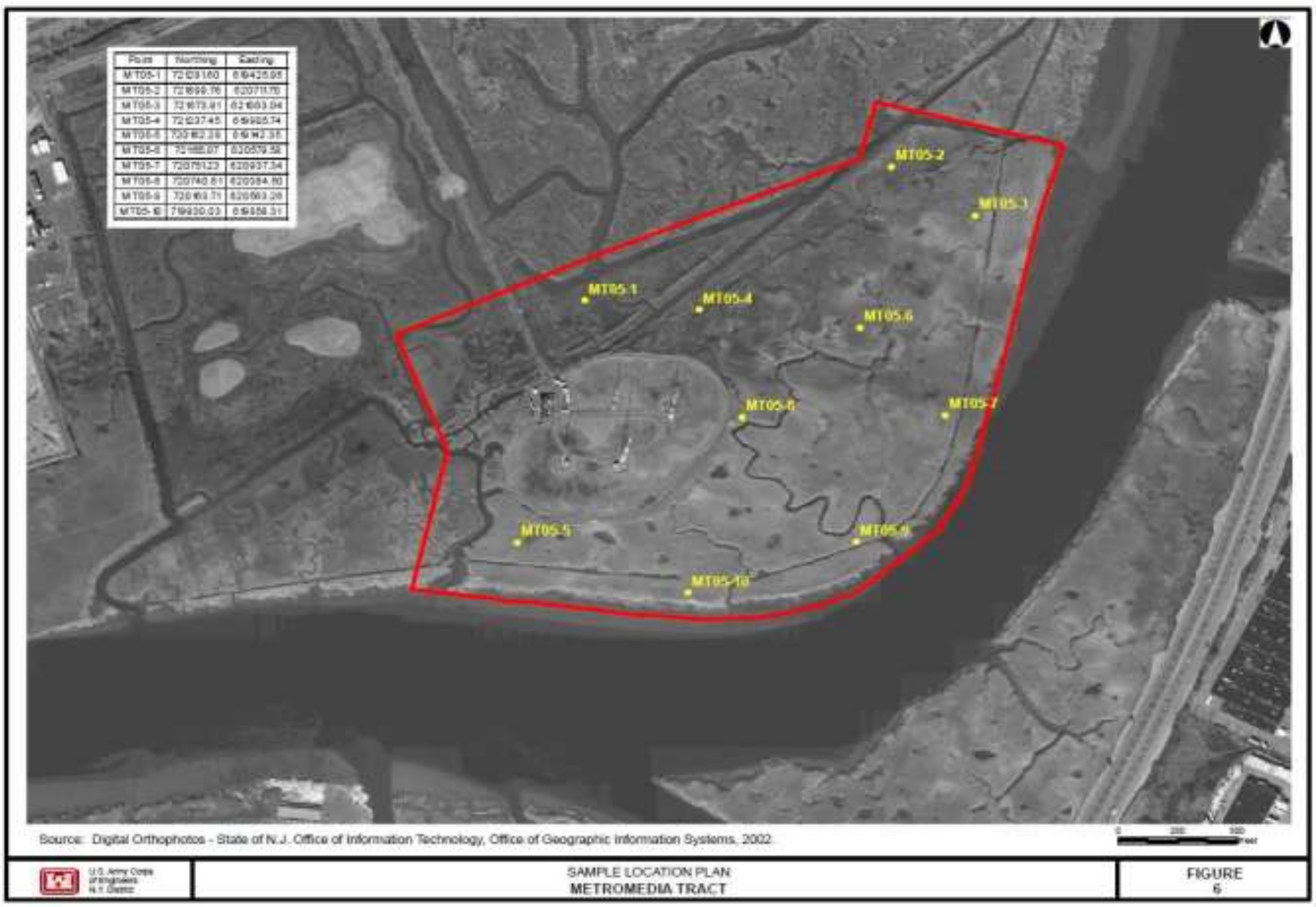

Figure G-6.HTRW Sampling Locations at Metromedia Tract

Table G-15. HTRW (TCLP) results for Metromedia Tract

	SAMPLE ID	MT051A		MT052A		MT053A		MT054A		MT055A		MT056A		MT057A		MT058A		MT059A		MT0510A		DUP03	
	LAB ID	J9519-3A		J9519-5A		J9519-1A		J9519-7A		J9809-3A		J10026-1A		J9809-5A		J10026-3		J9809-1A		J10026-5A		J10026-7A	
	SAMPLE INTERVAL (ft)	0-3		0-3		0-3		0-3		0-3		0-3		0-3		0-3		0-3		0-3		--	
	DATE COLLECTED	9/12/05		9/12/05		9/12/05		9/12/05		9/13/05		9/16/05		9/13/05		9/16/05		9/13/05		9/16/05		9/16/05	
ANALYTE	TCLP MAXIMUM CONTAMINANT CONCENTRATIONS																						
Volatile Organic Compounds +10																							
Benzene	0.5	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
2-Butanone (MEK)	200	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Carbon tetrachloride	0.5	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Chlorobenzene	100	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Chloroform	6	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
1,4-Dichlorobenzene	7.5	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
1,2-Dichloroethane	0.5	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
1,1-Dichloroethene	0.7	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Tetrachloroethene	0.7	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Trichloroethene	0.5	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Vinyl chloride	0.2	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U	0.025	U
Base Neutral Extractable Organic Compounds (BN+20)																							
2-Methylphenol	200	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
3&4-Methylphenol	200	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Pentachlorophenol	100	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2,4,5-Trichlorophenol	400	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
2,4,6-Trichlorophenol	2	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
1,4-Dichlorobenzene	7.5	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
2,4-Dinitrotoluene	0.13	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Hexachlorobenzene	0.13	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Hexachlorobutadiene	0.5	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Hexachloroethane	3	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Nitrobenzene	2	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Pyridine	5	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Pesticides/PCBs																							
2,4-D	10	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
2,4,5-TP (Silvex)	1	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U
gamma-BHC (Lindane)	0.4	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U
Chlordane	0.03	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Endrin	0.02	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U
Heptachlor	0.008	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U
Heptachlor epoxide	0.008	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U
Methoxychlor	10	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U
Toxaphene	0.5	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U
Target Analyte List Metals																							
Arsenic	5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Barium	100	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	1	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Chromium	5	0.01	U	0.012		0.01	U	0.01	U	0.01	U	0.01	U	**0.011**		0.01	U	0.01	U	**0.014**		**0.016**	
Lead	5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Mercury	0.2	0.0002	U	0.0002	U	0.0004	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.0002	U
Selenium	1	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Silver	5	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U

Notes:

- Results dry weight.
- All results reported in parts per billion (mg/l)
- RDCSCC = Residential Direct Contact Soil Cleanup Criteria (N.J.A.C. 7:26D, revised 5/12/99)
- NRDCSCC = Non-Residential Direct Contact Soil Cleanup Criteria (N.J.A.C. 7:26D, revised 5/12/99)
- IGWSCC = Impact to Groundwater Soil Cleanup Criteria (N.J.A.C. 7:26D, revised 5/12/99)
- U = Not detected above the quantitation limit
- J = Estimated concentration
- B = Analyte detected in an associated blank
- NC = No Criteria established
- NA = Not Analyzed

Meadowlark Marsh

The Meadowlark Marsh restoration site consists of 90 acres of marsh on the north shore of Bellmans Creek and is sandwiched between the NJ Turnpike to the west and the Conrail railroad to the east. These structures restrict surface waters from mainly draining into Bellmans Creek, which is adjacent to the site. The marsh is tidally influenced. The site is underlain by siltstone, shale, and coarse-grained sandstone (Passaic formation), which is underneath layers of Pleistocene glacial till and glacial lake deposits and Holocene fluvial and estuarine and salt-marsh deposits. The surface of the Meadowlark Marsh site is made up of the Westbrook, Ipswich, and Sandyhook soil complexes, which are all flooded very frequently, as is characteristic of marshes. There are two NJDEP recognized Known Contaminated Sites in the vicinity of the Meadowlark Marsh site. The shallow groundwater of these two sites contains concentrations of certain compounds that exceed their respective GWQS. Concern is warranted in that there is a KCS adjacent to the site separated only by Bellmans Creek. It is unknown if the contamination affects the health of Meadowlark Marsh. An HTRW analysis was conducted at the Metromedia Tract by Louis Berger & Associates in September 2005.

Figure G-7 shows the locations of the HTRW sample locations. Sample results can be found in Bronx River Basin, New York Ecosystem Restoration Study, Watershed Opportunities Report. Appendix G – HTRW Corridor Assessment (USACE, 2010).

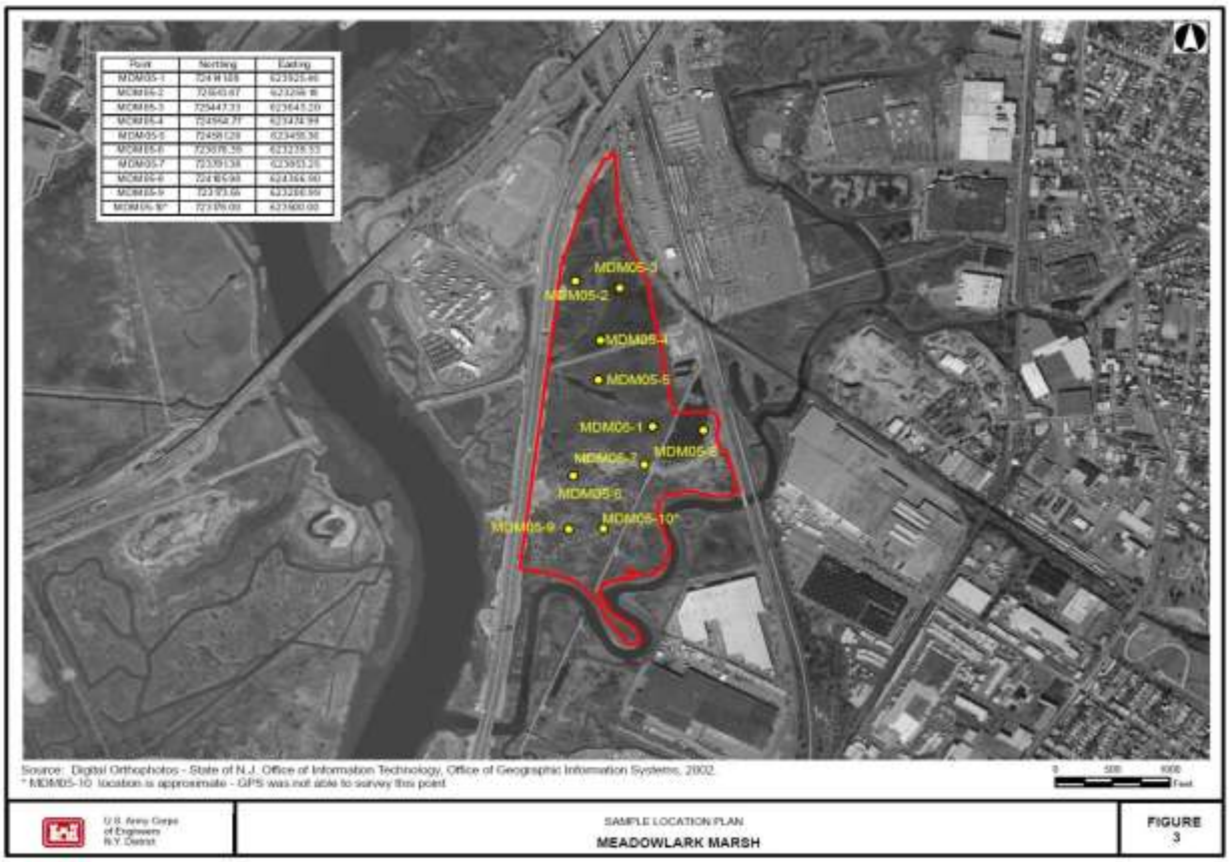

Figure G-7. HTRW Sampling Locations at Meadowlark Marsh

2.4 Upper Bay Planning Region

Land use along the shoreline of the Upper Bay planning region is primarily commercial and industrial, with few non-industrial uses. Industrial and CSO inputs in Upper Bay tributaries has severely degraded their water quality, such as in Gowanus Canal. This limits the waterways to primarily transportation-related uses. Two sewage treatment plants discharge effluent into the Upper Bay. Scattered among the shipping terminals and marinas are parklands or public promenades, some vacant disturbed land, and small residential areas.

The proposed Bush Terminal oyster habitat restoration site is located between Bay Ridge Channel and Bush Terminal Piers Park on the shore of the Sunset Park neighborhood in Brooklyn, NY. The USACE-NAN maintains the Bay Ridge channel, which is located just to the west of the Bush Terminal Site and is the closest maintained channel to the site, with periodic dredging of black silt and sand.

The proposed Governors Island oyster reef site extends from inside the “inverted-Y” pier to north along the shore. The site lies north of the southwest-northeast trending Buttermilk Channel. The proposed oyster restoration site lies just offshore of both the area of the original island, and the filled-in island. Much of the area is in waters shallower than 15 feet, although on the south side, the bottom slopes down to a channel 40 feet in depth. The water depth of present-day Buttermilk Channel appears to be no more than 5 feet deeper than in 1845. Another 1.59 feet should be added to that change to account for relative sea level change between 1845 and 2016 (based on the National Oceanographic and Atmospheric Administration (NOAA) average sea level rise of 2.84 mm per year, determined from continuous measurements just north of Governors Island at The Battery tidal station (8518750) from 1856 to the present). The USACE maintains the Buttermilk channel with periodic dredging.

2.4.1 Regional Geology

Beneath the Bush Terminal site, at a depth greater than 120 feet, lies bedrock of schist and gneiss of the Hartland Formation, overlain by a thick sequence of Pleistocene glacial deposits. Governors Island is underlain by bedrock of schist and gneiss of the Hartland Formation and is overlain by varying thicknesses of glacial lake clay and silts and interlayered glacial outwash sands and two glacial till layers. The Pleistocene deposits include a thick layer of glacial lake clay and silts and thinner layers of glacial outwash sands and glacial till. The Pleistocene is overlain by up to 20ft of Holocene deposits. The Holocene deposits consist of marine estuarine sands and silty sands that contain shells. Overlying the sands is black silt that locally includes hydrocarbons, as evidenced by petroleum odors, which indicates that this is an area of concern for the site. The Hartland Formation is considered to be dominantly gray-weathering, fine-to-coarse grained, well-layered muscovite-biotite-quartz-plagioclase-garnet schist, gneiss and granofels, and contains layers of greenish amphibolite and/or garnet (Merguerian and Baskerville, 1987).

2.4.2 Regional Soils

The industrial history of the Upper Bay planning region has led to widespread soil contamination of the waterfront areas. Heavy metals (e.g., arsenic, lead, zinc, and copper) and PAHs are found in nearly all of the fill sediments in the areas surrounding Liberty State Park in New Jersey. Additionally, fill materials also contain volatile organic compounds (VOCs), chromium, PCBs, and organochlorine pesticides (e.g., dieldrin, DDT). Previous studies have identified areas within the Upper Bay planning region as containing slightly elevated levels of chromium and nickel.

The Gowanus Canal is a prominent site within the Upper Bay planning region. Its watershed is a highly developed urban area located in the Borough of Brooklyn. There are approximately 60 acres (0.24 kilometers^2) of open water along the canal. The historic uses in and around the Gowanus Canal have caused a significant deposition of hazardous materials on the canal bottom. The canal is impacted by poor water quality, contaminated sediments, such as heavy metals, PCBs, and PAHs, deteriorating bulkheads, a poor benthic community structure, extensive filling, little or no buffers, and odors, all resulting from more than a century of heavy industrial use. In addition, changes to the natural water habitat have been drastic and detrimental. The Gowanus Canal was added to the USEPA's Superfund List in 2010, and issued its final cleanup plan for the Gowanus Canal Superfund site on September 27, 2013 (USEPA 2016).

2.4.3 Water Quality

2.4.3.1 Bush Terminal

Surface water quality data

The Bush Terminal oyster site is part of the estuarine Upper New York Bay. The NYCDEP has been collecting and publishing water quality data from 70 sampling stations all over New York Harbor every year since 2004 as part of the Harbor Water Quality Survey. One of these sites, G2, is located at the Gowanus Canal, which is approximately 1.2 miles up the Kings County coast from the proposed oyster restoration site at Bush Terminal Piers Park. This water data is presented in the e4sciences, 2016 documentation.

Groundwater quality data

Figure G-8 shows the locations of known contamination sites in or near the Bush Terminal site. Bush Terminal is listed as an Environmental Restoration Program site. The address of the restoration site is 47th to 52nd Street and 1st Ave to Gowanus Bay, Kings County New York. The site code is B00031. The site name is Bush Terminal Landfill Piers 1-4. This report did not identify the exact nature and extent of the contamination. Remediation activities are ongoing.

The same site is also listed as a State Superfund Program. The site code is 224011. The site name is Rear of Bush Terminal Building. The known contaminants include 2,4,-Dimethylphenol, Napthalene, Phenol, 4-Methylphenol, and heavy metals.

There is also a NYS Open Petroleum Spill Location noted at the Bush Terminal site. The spill name is Brooklyn West 07 DOS-DDC, the spill number is 9614638, and the spill address is 5100 1st Avenue. The spill occurred on 03/19/1997 and involved an unknown amount of gasoline and diesel fuel. The record was closed on 03/04/2014 after sufficient remediation activities had occurred.

Figure G-8.Wetland areas and the Known Contaminated Site at the Bush Terminal site.

Base map images are 2014 orthorectified aerial images (NYSDOP,.). Groundwater contamination data is from NYSDEC Environmental Site Database Search (Remediation Site Boundaries, 2013).

2.4.4 HTRW

Environmental Data Resources (EDR) carried out a federal and state database search, in accordance with American Society of Testing and Materials (ASTM) Standard E1527-13, for each Oyster Bed Restoration Site in April, 2016. In addition to the EDR database search, Historic Aerial Imagery, and available Sanborn Fire Insurance Rate maps were obtained and reviewed to assist in review of each restoration site’s history and to identify environmental conditions with potential to impact the restoration site.

2.4.4.1 Bush Terminal

The results of the EDR search identified 207 sites with 272 records (some sites may be listed on multiple lists) that are of potential concern within 1 mile of the Bush Terminal Oyster Bed Restoration Site. The vast majority of the records are isolated spill incidents, with one occurring within the waterway (subsequently cleaned up), as well as some parcels designated as possible sites with hazardous materials. The number of sites found in database of records of significance is listed in Table G-16 below, and those sites of most concern are outlined below.

Table G-16. List of Environmental Records within One Mile of Bush Terminal Oyster Bed Restoration Site

List	Number of Records
Federal CERCLIS NFRAP List	5
RCRA-LQG	5
RCRA-SQG List	1
RCRA-CESQG List	9
NY SHWS List	4
NY SWF/LF List	5
NY LTANKS	24
NY UST List	18
NY MOSF UST List	1
NY MOSF AST List	1
NY AST List	9
NY CBS List	3
NY CBS AST List	3
NY MOSF List	1
NY ENG CONTROLS List	1
NY INST CONTROL List	1
NY VCP List	1
NY BROWNFIELDS List	3
NY HIST UST List	12
NY Spills List	44
NY E DESIDNATION List	5
NY HSWDS List	2
EDR MGP List	1

Bush Terminal is a historic pier site with old eroding sunken piers, which was used for multiple commercial shipping uses, and is still adjacent to a major shipping lane. This allows for the constant risk of spill from passing commercial vessels as well as vehicles on the landward side of the Bush Terminal site. The dense confluence of both land based and aquatic traffic, as well as existing commercial and industrial uses surrounding the Bush Terminal site present the potential for environmental risk. Coupled with its close location to Gowanus Canal, there may be some level of contaminants in the sediments. Prior to 1974, the Bush Terminal site was an active port. As of 2006, the car floats and Bush Terminal Rail Yard are operated by New York New Jersey Rail, LLC, and used occasionally to deliver New York City Subway cars via the South Brooklyn Railway. Soil, groundwater, and sediment at and underneath the site became contaminated in the 1970s due to the unauthorized disposal of construction and demolition debris and liquid waste including oils, oil sledges, and wastewater (USACE, 2014). Bush Terminal Piers Park is both a State Superfund Program site and an Environmental Restoration Program site. It is also considered a NYS Open Petroleum Spill location.

Site investigations were conducted between 1999 and 2002, and site remediation was conducted between 2009 and 2014 (NYSDEC, 2017). The selected remedy for the ponded areas was described within the Environmental Restoration Record of Decision: “Excavation and covering of shallow pond area sediments, filling and covering of deeper pond area sediments, and shoreline stabilization to minimize potential ecological exposures to contaminated bv sediments.” (NYSDEC, ROD). The site is listed on the NYSDEC Superfund Program database under Hazardous Water (HW) Site Code 58024 and HW Code 224011 with a classification of ‘3’: “Contamination does not presently constitute a significant threat to public health or the environment”. The site has a classification code of C (Completed) and under the Environmental Restoration Program now operates with an Environmental Easement with a Highest Allowable Future Use of Restricted Residential. The site is currently being managed under a Site Management Plan (NYSDEC, 2014).

2.5 Lower Bay Planning Region

The Lower Bay planning region is predominantly developed with industrial, commercial, and residential land uses. Sandy Hook’s shoreline is interspersed with public and private marinas, sandy beaches, and riprap shorelines (USACE 1999). Private and public beaches are scattered throughout the region, located in Monmouth County, New Jersey, and on Coney Island and Staten Island, New York. The surface waters in this planning region are used for commercial shipping, recreational boating, and fishing/shell fishing. The proposed Naval Weapons Station (NWS) Earle oyster site is located inside the Leonardo Piers Complex, which protrudes approximately 2 miles from the coast of Belford, NJ.

2.5.1 Regional Geology

The New Jersey coast south of New York Bay is predominantly erosive. On land, the soils are of variable thicknesses and lie on the Coastal Plain Group deposits. Holocene stream deposits are relatively minor. Underwater, the Holocene is dominated by reworked sands of the Coastal Plain Group.

2.5.2 Regional Soils

As a result of industrial activities in and near the Lower Bay planning region, toxic contaminants such as heavy metals, hydrocarbons, PCBs, and PAHs, are present in the sediments. Shellfisheries in this area have been closed and fish consumption advisories have been issued because sediment contamination in the planning region is so high.

Sediment contamination in Raritan Bay is generally the result of the outflow from the Arthur Kill and the Raritan River. The highest toxicity levels are found in western Raritan Bay. Previous studies within the Lower Bay have identified areas with slightly elevated levels of arsenic, copper, and mercury and moderate to high levels of nickel, silver, zinc, and chromium. The Lower Bay also has localized “hotspots” of aldrin and hexachlorobenzene (USACE 2004a).

2.5.3 Water Quality

Surface water quality data
The NWS Earle oyster site is part of the estuarine and marine deepwater wetland, as shown in Figure G-9.

In June 2004, the Environmental Monitoring and Assessment Program of the Environmental Protection Agency (EPA) collected water quality measurements at station NJ04-0003-A, Sandy Hook Bay, which is approximately 1.25mi east of the proposed oyster site. These measurements included acidity, DO concentration, salinity, temperature of the surface water, and turbidity. These parameters were measured twice on June 30, 2004. Complete surface water quality reports are in e4sciences, 2016 documentation.

Groundwater quality data
No groundwater quality information was found for the proposed NWS Earle oyster site.
Figure G-9 shows the locations of wetland areas in or near the NWS Earle site. NWS Earle is a New Jersey Superfund site, due to toxic materials that have been buried in landfills as a result of military activities. The site name is Naval Weapons Station Earle (Site A). The site address is Tyler Lane and Texas Road in the city of Colts Neck, New Jersey. The site ID is NJ0170022172. The superfund site was established in 1984. The known contaminants include chromium, cobalt, lead, manganese, pentachlorophenol, titanium, zinc and others, but the scope and magnitude of the contamination is unknown. At least three areas are currently undergoing remediation under the Resource Conservation and Recovery Act (RCRA). The status of the cleanup operations is unknown.

2.5.1 HTRW

Environmental Data Resources, Inc (EDR) carried out a federal and state database search, in accordance with American Society of Testing and Materials (ASTM) Standard E1527-13, for each Oyster Bed Restoration Site in April, 2016. In addition to the EDR database search, Historic Aerial Imagery, and available Sanborn Fire Insurance Rate maps were obtained and reviewed to assist in review of each restoration site's history and to identify environmental conditions with potential to impact the restoration site.

Figure G-9. Wetland areas and NJDEP-recognized Known Contaminated Sites near the Naval Weapons Station Earle site.

Base map images are 2015 orthorectified aerial images (NJGIN, 2015), as well as images from USGS EROS (2014). Wetland data is from U.S. Fish and Wildlife Service, National Wetlands Inventory (2004). Groundwater contamination data is from NJDEP Digital Data Downloads (Known Contaminated Sites List, 2014).

2.5.1.1 Naval Weapons Station Earle

The results of the search identified 16 sites, some with multiple records that are of potential concern within 1 mile of the Naval Weapons Station Earle Oyster Bed Restoration Site. These include one NPL/SEMS record, one CERCLIS record, one RCRA CORRACTS record, one RCRA non-CORRACTS record, one US ENG CONTROLS record, one US INST CONTROLS record, one NJ VCP record, 12 NJ SHWS records (state equivalent CERCLIS), two NJ HWS RE-EVAL records (these are sites that have been removed from the Known Contaminated Sites List), and one ROD (superfund record of decision) record. Those sites of most concern are listed below.

According to the EDR database search, *Naval Weapons Station Earle* has operated since the 1940's as a base for renovation, storage, and maintenance of ammunition, including small arms, missile components, and explosives. Twenty-seven areas of concern have been identified at the station under the Superfund program, and 3 areas are permitted under the Resource Conservation and Recovery Act. Contamination was first detected in the 1980's, and has since come to include contaminants from paint and ammunition chips, PCBs, lead, VOCs, and hydrocarbon compounds. In addition a two-mile long naval service pier that includes fuel lines and transports munitions extends above the proposed restoration site.

Leonardo State Marina is a state run marina located to the east of the NWS Earle site, which features a boat launch and 176 berths. The marina has several records, including the removal and ongoing remediation of a fuel tank, and a sunken vessel, which resulted in release of fuel and other contaminants.

3. Findings and Conclusions

3.1 Jamaica Bay Planning Region (See Attachment A)

3.1.1 Fresh Creek

Concentrations in subsurface soils slightly exceeded the sediment ER-Ms for lead and mercury. Therefore, there is likely minimal risk and the restoration action results in improved conditions for aquatic receptors following the restoration of 21 acres of tidal marsh system and 45 acres of shallow water habitat. The capping of the upland soils with 12 inches of growing medium will further reduce exposure to receptors following the restoration of 11 acres of maritime forest and 4 acres of coastal shrub. Overall, the restoration action would decrease the concentrations of the COPCs at the surface and decrease the potential risk to receptors. In addition, the use of human health benchmarks would likely overestimate risk based on the future us of the site and the minimal exposure as a result of a trespasser scenario.

3.1.2 Dead Horse Bay

The restoration at Dead Horse Bay will be coordinated with the NPS CERCLA remedial actions and investigations. NPS investigations will provide needed data to be used in PED phase to inform any remedial actions or engineering controls needed. The optimized project at Dead Horse Bay is focused on the Northern portion of the site. The soil/sediment to be excavated at Dead Horse Bay North is assumed to be clean and will be placed on Dead Horse Bay South in coordination with NPS activities and following soil testing and acceptability determination. Any additional costs associated with addressing unacceptable contamination would be paid for 100% by the non-federal sponsor (or Potential Responsible Party in coordination with NPS).

3.1.3 Jamaica Bay Marsh Island Sites

For the Jamaica Bay marsh island sites, it is assumed that they would be restored with material removed in conjunction with an operation and maintenance dredging contract. Bottom sediment cores were previously taken from the Rockaway Inlet and the Ambrose Channel, which are included among likely sources of material for future marsh island restoration projects. These materials were found to meet the criteria for ocean placement without additional testing, as per 40 CFR 227.13 (b)1, Ocean Dumping Regulations. Island-specific HTRW samples will be collected during the PED phase.

3.1.4 Jamaica Bay – Head of Bay Oyster Restoration

Contamination has not been an issue associated with the current existing oyster restoration project that was implemented by NYCDEP. The USACE does not expect additional actions prior to restoration based on the available data in Jamaica Bay.

3.2 Harlem River, East River, and Western Long Island Sound Planning Region

After examining the available information provided by research and database searches, it has become clear that each proposed restoration site has reasonably been impacted in some way by the commercial, industrial, and in some cases residential and recreational uses on and adjacent to the site. In addition to some of the sites having groundwater contamination on or near them, the surrounding areas have documented incidents which range from small, isolated discharges, to decades of use as industrial or military centers resulting in major remediation efforts.

3.2.1 Flushing Creek

Excavation of sediment and soils to restore wetlands will be placed on site and covered with clean growing media in the upland habitat. Clean growing media will also be placed in the wetlands and on mudflats following re-grading. This cover will also result in a reduction in risk to any onsite contamination. If additional actions are needed based on further HTRW evaluation in PED, NYCDEP will pay 100% of such actions.

3.2.2 Bronx River Sites

As stated above, urban runoff pollution continues to be a serious problem for the river. In 2013, NYCDEP installed four pollution control devices along the Bronx River will help prevent trash and debris from entering the River. The litter control devices were installed at the following locations in the Bronx: West Farms Road; Bronx Park Avenue; Bronx Zoo; Sound View Park.

At this time, HTRW sampling has not taken place specifically on each restoration site. For the purpose of this assessment, it was assumed that the soil and sediment concentrations are acceptable and no remedial action will be required prior to the restoration actions. Additional sampling is expected to take place during the PED phase. If unacceptable levels of contamination are identified on site and additional measures are required, the non-federal sponsor is expected to pay 100% of the additional costs associated with the HTRW. All non-federal sponsors are aware of the USACE's policy.

3.3 Newark Bay, Hackensack River, and Passaic River Planning Region

3.3.1 Lower Passaic Planning Region

As outlined above, the unique governmental partnership with USEPA Superfund program provided significant amounts of in-river data associated with the extent, ongoing sources, transport and risks associated with contamination within legacy sediments, surface water and biota. One significant benefit of the partnership (from the USACE's perspective) was to determine if remedial actions were necessary to reduce human health and ecological risk if deemed unacceptable prior to restoring the habitat that has been lost in the region. If a remedial action was required, the polluter pays principle would be preserved through the Superfund program and the USACE and state (NJDEP) (as local sponsor) and federal trustees (NOAA and USFWS) would invest in restoration.

The Proposed Plan (USEPA, 2014) and April 2016 Record of Decision (ROD) (USEPA, 2016) was to implement the removal of 3.5 million CYD and capping within the lower 8.3 miles of the Passaic River.

The presence of HTRW and USEPA's remedial actions and decisions, in conjunction with the determination of areas that do not require cleanup (tributary and upstream segments of the Lower Passaic River mainstem), influenced the plan formulation strategy and sequencing plan as the 52 restoration opportunities (array of sites) were evaluated. The sites were grouped into Tier 1 [Near-term restoration opportunities that do not require remediation] or Tier 2 [remedial action needed prior to restoration] categories.

- Tier 1: Essex County Branch Brook Park is not located in the remedial action area of the lower 8.3 miles and would not be influenced by the action (i.e., negatively impacted by resuspension during dredging). Site specific upland HTRW data would need to be conducted in PED to determine impacts to restoration design. NJDEP, non-federal sponsor, understands that if HTRW is found at unacceptable levels, they are responsible for 100% of any additional costs.
- Tier 2: Oak Island Yards is within the focused feasibility remedial action area and would be subjected to dredging and capping up to the site's shoreline. Further evaluation of the restoration site would be required during PED. Thissite (and Kearny Point) were selected to illustrate the intended cooperative comprehensive solution for remediation and restoration indicative of the USEPA/USACE Urban Waters Federal Partnership Program. The USACE expects USEPA to provide documentation following their remedial action to indicate that the site could advance restoration within the Lower Passaic River. The non-federal sponsor understands that if additional environmental remediation is required, they are responsible for 100% of any additional costs.

3.3.2 Hackensack Planning Region

In concert with the geotechnical data collection undertaken at Meadowlark Marsh, and the Metromedia Tract, the USACE, and the NJMC have also collected soil and sediment in 2006 for HTRW analysis. These efforts are briefly summarized in the following paragraphs.

Soil borings were collected at each of the aforementioned sites to evaluate subsurface conditions. Boring locations were selected to provide distributed site coverage. From each boring, three separate HTRW soil samples were collected. One shallow (0- to 3-foot depth) sample and one deep sample (3- to 6-foot depth) were collected and analyzed for volatile and semi-volatile organic compounds, pesticides, PCBs, metals, total organic carbon (C), and percent solids. Methylmercury (Me-Hg) was also collected as some sites. A second shallow soil sample was utilized for Toxicity Characteristic Leaching Procedure (TCLP) testing.

As would be expected in the Meadowlands District, some levels above regulatory soil and sediment guidelines were detected. At Meadowlark Marsh and Metromedia Tract, some sediment-test results exceeded NJDEP Soil Cleanup Criteria (SCC) and TCLP Maximum Contaminant Concentrations, and NJDEP Site Remediation Program (SRP) Guidance for Sediment Quality Evaluations (effects range low [ER-L] and effects range median [ER-M] levels). Specifically for Meadowlark Marsh, some samples exceeded NJDEP SCC for Benzo(a)pyrene, arsenic (As), antimony (Sb), and Hg; exceeded TCLP for Pb; and other various metals, total BNA compounds, PCBs, and pesticide compounds exceeded ER-L levels. Specifically for Metromedia Tract, total tentatively identified volatile organic compounds (VOCs), As, and Pb exceeded the NJDEP SCC levels; no samples exceeded TCLP; and ER-L levels were exceeded for Benzo(g,h,i) perylene, metals, PCBs, and pesticide compounds (USACE-NYD, 2006 [1]).

In addition to the investigations described above, a selection of site-specific ecological/sediment data is also available on the MERI website (http://meri.njmeadowlands.gov/ecorisk). As part of a Screening Level Ecological Risk Assessment (ENSR, 2004), both chemical contamination and biotic inventory data were assimilated to develop a geographic database for previously assessed wetlands in the Meadowlands District in an effort to help guide decision-making for restoration strategies. In addition, benthic invertebrate community analyses were conducted at the assessment sites in an attempt to further test the validity of the ecological risk procedure, in an attempt to evaluate whether a decrease in benthic diversity is correlated with an increase in the amount of sediment contaminant concentrations at these wetlands. Data are available for the following sites: Kearny Marsh, Oritani Marsh, Secaucus High School, Skeetkill Creek Marsh, Riverbend Wetland Preserve, Mill Creek, Eight-Day Swamp, and Harrier Meadows. These data may prove useful for establishing baseline conditions for contamination in evaluating site-specific restoration plans or for Meadowlands-specific reference site information.

The ecological risk report illustrated that no clear or definitive relationships were found between sediment toxicity or sediment chemistry and benthic community parameters. The lack of obvious relationship may have been caused by a number of factors, including physical habitat, water chemistry and potential overestimation of risk from sediment chemistry, and differences in sensitivity to sediment contaminants between test organisms and indigenous populations. Likewise, it is possible that the sample sites selected reflect only a small segment along the continuum of sediment contaminant concentrations. The study points to the need for additional work to improve the predictive capacity of wildlife risk curves as well as screening for benthic/aquatic life risk.

3.4 Upper Bay Planning Region- Bush Terminal Oyster Restoration

Since the site has been remediated (capped), the 30 acres of oyster restoration at the site is expected to advance without additional actions and costs. The restoration will be closely coordinated with NYSDEC.

3.5 Lower Bay Planning Region - Naval Weapons Station Earle

The Naval Weapons Station Earle site is classified as a New Jersey Superfund site due to the toxic materials associated with military activities and wastes that have been buried in landfills. The restoration will be coordinated closely with NJDEP and there is no expectation of additional remedial actions needed prior to oyster restoration at the site (similar to the current oyster restoration implemented by the NY/NJ Baykeeper that will serve as the foundation for the HRE recommended plan of an additional 10 acres of oyster reef.

4. Recommendations

Based on the information gathered and on observations made during this investigation, recommendations are to perform more investigations of the specific project areas of concern in the HRE, and perform more detailed database searches.

For each selected ecosystem restoration site, if deemed necessary a Phase I ESA's should be prepared in accordance with the American Society of Testing and Materials (ASTM) Standard Practices for Environmental Site Assessments: Phase I ESA Process (ASTM Designation: E1527-2000).

Based on the results of the Preliminary Contaminant Assessment Report (CAR), subsequent Phase I ESA and future project plans, Phase II Environmental Assessments could be conducted in PED collecting soil and groundwater samples at proposed restoration sites to ascertain the level of impact from past activities. Results of these environmental studies will guide the planning of restoration so that areas with impacts are avoided and to determine if potential restoration sites have been impacted by past activities, so that areas with highest potential for success are selected and areas with environmental impact can be avoided until more suitable site conditions are achieved.

Based on NYSDEC correspondence, the NYSDEC has reviewed the summary of contaminant evaluation/risk analysis for the Jamaica Bay Ecosystem Restoration Feasibility Study for the six restoration sites outlined in the draft FR/EA. Based on the design information provided to date, the NYSDEC is in agreement that the project will lower the overall risk and exposure to contaminants for both ecological and human receptors.

All non-federal sponsors for the 20 restoration sites recommended in this FR/EA are aware that any additional requirements related to HTRW prior to restoration would be their responsibility at 100% non-federal cost.

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Appendix H: Hazardous Toxic Radioactive Waste (HTRW)
Attachment A

Hudson Raritan Estuary Ecosystem Restoration Feasibility
Jamaica Bay Ecosystem Restoration Feasibility “Source” Study
Hazardous Toxic Radioactive Waste (HTRW)
Contaminant Evaluation Summary and Conclusions
February 2013

Hazardous Toxic Radioactive Waste (HTRW) Contaminant Evaluation Summary and Conclusions

The U.S. Army Corps of Engineers - New York District had conducted an evaluation in February 2013 of current and future potential levels of contamination at the Jamaica Bay perimeter/shoreline restoration sites recommended in this HRE Draft Integrated Feasibility Report/Environmental Assessment (FR/EA). This evaluation was conducted in order to determine how the restoration actions proposed at each site could best be advanced and to identify any modifications to proposed actions, as well as additional costs that may result from these modifications. A summary of the conclusions of the screening assessment are presented herein for discussions with NY State Department of Environmental Conservation (NYSDEC) serving as the regulatory agency and future potential non-federal sponsor for implementation to advance restoration within Jamaica Bay.

The evaluation contained in this attachment was provided to NYSDEC in March 2013 to determine if proposed restoration designs would need to be modified or if additional actions were required due to the measured Hazardous Toxic Radioactive Waste (HTRW) concentrations at each site. NYSDEC provided a letter of support to advance these restoration projects included in Exhibit A.

Contaminant Evaluation Screening Process

Chemical concentrations were measured in surface (0-1 ft) and composite sub-surface (ranging from 1-16 ft) soil samples at six of the restoration sites within Jamaica Bay. The chemical concentrations measured in surface soil samples represent current existing exposure to receptors, while the composite samples represent possible future exposure following restoration actions that may include excavation, re-grading and movement of the sub-surface soil to create topography more suitable to target habitat including wetland complexes, upland maritime forest and grassland habitat.

The contaminants within the soils (both surface and composite sub-surface samples) were evaluated by comparing a "screening value", representing the lesser of the 95% Upper Confidence Limit (UCL) on the mean or the maximum measured chemical concentration at the site, with toxicological benchmarks including the NYSDEC Soil Cleanup Objectives (SCOs) (NYSDEC, 2012) and NOAA Effects Range-Low (ER-L) and Effects Range- Median (ER-M) sediment guidance benchmarks (Long et al., 1995).

Chemicals of Potential Concern (COPCs) were identified by calculating Hazard Quotients (HQs):

$$HQ = \frac{\text{“Screening Value” (95\% UCL or Maximum Chemical Concentration)}}{\text{NYSDEC SCOs, ER-Ls, ER-Ms}}$$

Hazard Quotients for appropriate screening values exceeding one, may be an indication of a potential unacceptable impact from the COPC. The NYSDEC SCOs included thresholds for Unrestricted Use, Residential Use, Restricted Residential Use, Commercial Use, Industrial Use, Protection of Ecological Resources and Protection of Groundwater. Given the primary exposure pathways following restoration actions are to ecological receptors, and the sites intended use as natural areas, with little to no human presence, the most appropriate benchmark to evaluate the restoration sites is the Protection of Ecological Resources, as well as the Effects Range-Median values for benthic invertebrates. The only human health exposure would be from a trespasser scenario where the exposure to COPCs would be much reduced. The COPCs are identified with HQs >1.

The primary conclusions from the evaluation are presented below for each restoration site included in the Jamaica Bay Restoration "Source" Feasibility Study. HQs (presented parenthetically) after the COPC, provides an indication of the level or magnitude of potential risk posed by each chemical for the receptors associated with each screening benchmark. The detailed screening evaluation and COPCs identified at each site for existing and future exposure are presented in Tables 1 through 10.

BAYSWATER POINT STATE PARK

Surface Soils (Current Exposure- Table 1)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include:
  - Chlordane (2.4, Unrestricted Use only; 3/4 samples Non-Detected [ND]), DDD (3.5, 3/4 samples ND), DDE (24.2), DDT (45.3), lead (2.1), mercury (1.2) and hexavalent chromium (6.2, assuming 100% present as hexavalent Cr; trivalent Cr HQ = 0.2)
- The 95% UCL concentrations exceeded sediment ER-Ms for DDE (3), DDT (21.4), amd total DDT (4.8). DDD was less than the ER-M.
- Mercury 95% UCL was less than the Rural Soil Background Concentration (RSBC).

Composite Soils (Future Exposure post Restoration- Table 2)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include:
  - DDD (7.6, 6/9 samples ND), DDE (9.4, 6/9 samples ND), DDT (2.9, 6/9 samples ND), hexavalent chromium (8.2 assuming 100% hexavalent; trivalent Cr HQ= 0.3) and zinc (1.4).
  - Minimal exceedences for benzo(a)anthracene (1.1), chrysene (1.3), benzo(b)flouranthene (1.4), benzo(a)pyrene (1.0) for Unrestricted Use, Residential, and Restricted Residential.

- The 95% UCL concentrations exceeded the sediment ER-M screening value for flourene (1.3), phenanthrene (1.7), total HMW PAHs (1.2), DDD (1.3), DDE (1.1), DDT (1.4) and total DDT (1.1).
- The AVERAGE concentrations for all COPCs (except Hex Cr) were below the thresholds.
- For most COPCs, the restoration action decreases the current exposure to receptors following re-grading in order to create 4.8 acres of habitat (including 2.9 acres low marsh, .4 acres high marsh, .8 acres creek/pool, and .7 acres of dune) as well as protection of the existing seawall and existing marshes, beaches and grasslands.
- The capping of the upland soils with sand from the northern portion of the site with an additional 12 inches of growing medium will further reduce any remaining exposure to receptors. Moreover, given the future use of the site, many of the human health benchmarks overestimate risk or do not apply.
- Removal of invasive dominated areas by regrading and creating a tidal channel and associated salt marsh.
- Protection of the eroding point by creating hard structures.
- Restoration totals 4.8 acres including 2.9 acres of low marsh, 0.4 acres of high marsh, 0.8 acres of creek/pool and 0.7 acres of dune.
- While the number of acres is not as great at Bayswater State Park as in other areas, in the absence of any action, this site will continue to experience severe erosional forces which have already caused the existing seawall to fall into disrepair. This could lead to the continued loss of existing marshes, beaches, and grasslands.

Figure 1: Sample Locations and Recommended Plan - Bayswater State Park (Alternative 2)

DUBOS POINT

Surface Soils (Current Exposure- Table 3)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include hexavalent chromium ONLY (2.4) assuming 100% Cr Hex. Trivalent chromium (0.1) is more likely present.

Composite Soils (Future Exposure Post Restoration- Table 4)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include:
    - Hexavalent chromium ONLY (6.7, assuming 100% Cr Hex; trivalent Cr [0.2] is more likely present), mercury (2.9, 6/9 samples ND, sample DP-HA-C-6 elevated), and DDE (1.9, 9/10 samples ND, DP-GP-C-2 single detection) (Figure 2).
- Concentrations measured in sub-surface soils were below sediment ER-Ms following the restoration of future tidal wetlands (including 3.5 acres of low marsh, .6 acres of high marsh, and .07 acres of creek/pool).
- The restoration action poses minimal risk and exposure to chemicals in the sub-surface soils. Furthermore, the capping of the upland soils with 12 inches of growing medium if needed would further reduce exposure to receptors in the future 2 acres of maritime forest. In addition, the use of human health benchmarks would overestimate risk given exposure would be through a trespasser scenario.
- Maximizes remaining marsh habitat protection by implementing toe protection surrounding the entire western and northern shore.
- Restores marsh by creating tidal channels in an existing upland common reed stand and regrading the area to salt marsh elevations for a tidal wetland.
- Tidal channels in the northern tip will be reopened to allow salt water flushing and fish migration to alleviate the local overabundance of mosquitoes and the soil will be used for landscaping onsite.
- A total of 6.8 acres will be restored at this site including, 3.5 of low marsh, 0.6 of high marsh, 0.7 of creek or pool, and 2 acres of maritime forest.

Figure 2: Sample Locations and Recommended Plan for Dubos Point (Alternative 3)

HAWTREE POINT

Surface Soils (Current Exposure ONLY- Table 5)

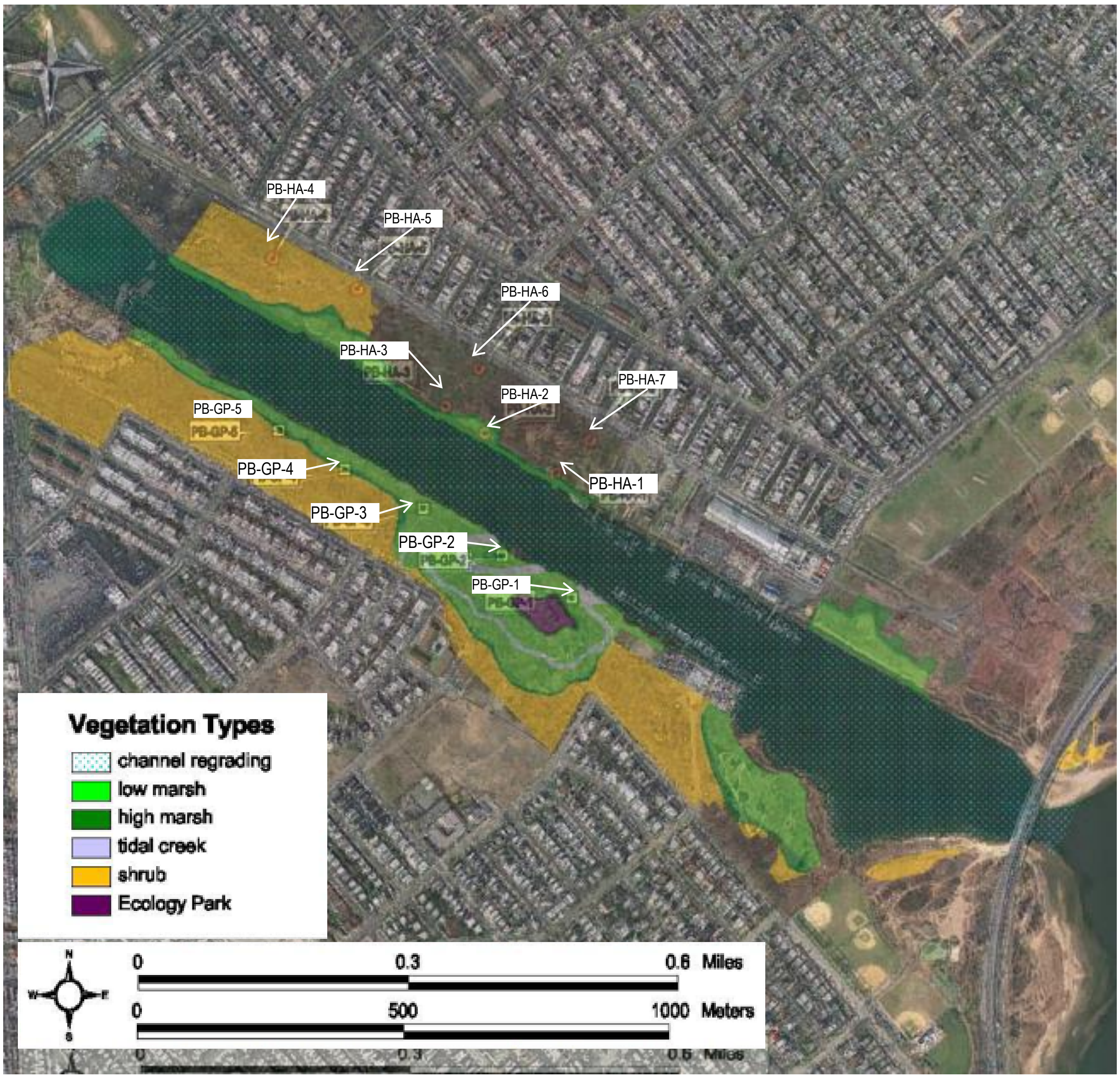
- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include:
  - Hexavalent chromium (20.7, assuming 100% Cr Hex; trivalent chromium (0.7) is more likely present), copper (1.3), lead (5.3), mercury (1.3), zinc (1.4) and DDT (3.3).
- DDT (1.6) exceeded the sediment ER-M for 1 sample (H-HA-2) (Figure 3).
- Potential exposure to COPCs is minimal and the proposed recommended alternative would not result in increased risk.
- Recommended alternative protects remaining marshes by replacing invasive dominated areas with 1.7 acres of coastal shrub and grassland habitat.
- Creation of a barrier to motorized vehicles by placing boulders along the boundary of the restoration area.
- The newly created habitats as well as the preserved existing marshes will be protected from vehicle access, but will still be accessible to pedestrians.

Figure 3: Sample Locations and Recommended Plan for Hawtree Point (Alternative 1)

FRESH CREEK

Surface Soils (Current Exposure- Table 6)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use, Residential, Restricted Residential, Protection of Ecological Resources and/or Protection of Groundwater SCOs include:
  - Hexavalent chromium (0.6-61.5, assuming 100% Cr Hex), trivalent chromium (0.3-2), copper (1.4-46.6, elevated at FC-HA-1 and HA-2), lead (1.6-11.7), mercury (3.0-13.6), nickel (0.2-1.7), zinc (0.2-19.5), benzo(a)anthracene (2.7), chrysene (0.8-3.1), benzo(b)flouranthene (2.1-3.5), benzo(k)flouranthene (0.3-1.7), Endrin keytone (1.4), benzo(a)pyrene (0.1-2.7), indeno(1,2,3-cd)pyrene (0.1-2.1), endrin ketone (0.0-1.4), endrin aldehyde (0.0-1.6) and total PCBs (0.1-1.9).



  - Exceeding only the Unrestricted Use and Protection of Ecological Resources SCOs, DDD (176), DDE (186) and DDT (1260) were significantly elevated at a single location at FC-HA-4 (Figure 4).
- Assuming sediment concentrations are similar to adjacent soils, 95% UCL concentrations exceeded sediment ER-Ms for copper (8.6), lead (3.4), mercury (3.5), zinc (5.2), phenanthrene (2), flouranthene (1.1), pyrene (2.3), benzo(a)anthracene (1.7), chrysene (1.1), benzo(a)pyrene (1.7). dibenzo(a,h)anthracene (1.2), total LMW PAHs (1.5), total HMW PAHs (2.8), DDD (29), DDE (22.7), DDT (593), DDT Total (111) and Total PCBs (1.1).

Composite Soils (Future Exposure Post Restoration- Table 7)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use, Residential, Restricted Residential, Protection of Ecological Resources and/or Protection of Groundwater SCOs include:
  - Hexavalent chromium (0.5-53.3, assuming 100% Cr Hex), trivalent chromium (0.3-1.8), copper (0.1-2.2), lead (1.1-7.6), mercury (0.2-4), zinc (0.2-3.7), phenol (0.0-1.6), benzo(b)flouranthene (0.6-1).
  - Exceeding only Unrestricted Use and Protection of Ecological Resources SCOs, DDD (3.5) and DDE (2.2) and DDT (1.7) were detected in only 1/11 samples (FC-HA-C-6 for DDD and DDE/FC-HAS-T-1 for DDT) (Figure 4).
- Concentrations in subsurface soils slightly exceeded the sediment ER-Ms for lead (2.2) and mercury (1, elevated 1/11 samples). Therefore, there is likely minimal risk and the restoration action results in improved conditions for aquatic receptors following the restoration of 33 acres of tidal marsh system and 60.1 acres of shallow water habitat.
- The placement of cover of the upland soils with 12 inches of growing medium will further reduce exposure to receptors following the creation of 4.5 acres of maritime forest and 11 acres of coastal shrub. Overall, the restoration actions would decrease the concentrations of the COPCs at the surface and decrease the potential risk to receptors. In addition, the use of human health benchmarks would likely overestimate risk based on the future use of the site and the minimal exposure as a result of a trespasser scenario.
- The recommended plan includes basin recontouring where the head of the basin will be partially filled to the proper elevation that will support the restored tidal marshes and creeks, along with recontouring the basin to the mouth of Fresh Creek, ending at approximately 10' below MLW.
- Recontouring the basin will decrease residence time of water, thus improving the dissolved oxygen levels and water quality throughout the basin.
- 33 acre tidal marsh system with protective buffers will be created, which includes 13 acres of low marsh, 2.4 acres of high marsh, 2.1 acres of creek/pool, 4.5 acres of maritime forest and 11 acres of coastal shrub, as well as 60.1 acres of shallow water will be restored at this site.

Figure 4: Sample Locations and Recommendation for Fresh Creek (Alternative 5)

Brant Point

Surface Soils (Current Exposure – Table 8)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include:
    - Hexavalent chromium (17.9, assuming 100% Cr Hex; however, trivalent Cr [0.6] is more likely), copper (1.2), lead (6.2), mercury (4) and zinc (3.6), chlordane (9.4), DDD (9.7), DDE (3.6), DDT (15.2) and endrin (aldehyde) (3.4).

- COPCs (HQ) exceeding NYSDEC Unrestricted Use, Residential, Restricted Residential, Commercial, Industrial and/or Protection of Groundwater SCOs include:
  - Benzo(a)anthracene (1.8), chrysene (0.5-1.9), benzo(b)fluoranthene (1.4-2.3), benzo(k)flouranthene (0.3-1.4), benzo(a)pyrene (0.1-1.8), Indeno(1,2,3-cd)pyrene (0.2-3) and total PCBs [Aroclor1260 only] (0.4-14).
- Concentrations in surface soils, if similar to adjacent sediments, exceeded the ER-Ms for lead (1.8), acenapthylene (1.5), phenanthrene (1.1), pyrene (2.1), benzo(a)anthracene (1.1), total LMW PAHs (1.1), total HMW PAHs (2.3), DDD (1.6), DDT (7.1), DDT Total (1.6) and Total PCBs (7.8).
- Surface soil samples BP-HA-1 and/or BP-HA-3 (Figure 5) appear to be elevated with the above COPCs.

Composite Soils (Future Exposure Post Restoration- Table 9)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use, Residential, Restricted Residential, Protection of Ecological Resources and/or Protection of Groundwater SCOs include:
  - Hexavalent chromium (0.2-22.5), assuming 100% Cr Hex; however, trivalent Cr [<0.7] is more likely), copper (0.1-2.1), lead (1.8-12.7), mercury (0.7-3.1) and zinc (0.1-6) primarily elevated in1 of 4 composite samples (BP-GP-C-3).
- COPCs (HQ) exceeding NYSDEC Unrestricted Use and/or Protection of Ecological Resources include:
  - Chlordane (0.1-1.9), DDD (6.1), DDE (11.4), DDT (40.3), endrin (ketone) (3), total PCBs (0.8-8.2) primarily elevated in 1 of 4 composite samples (BP-GP-C-3; as well as BP-GP-C-4 for DDT and Aroclor 1260).
- COPCs (HQ) exceeding NYSDEC Unrestricted Use, Residential, Restricted Residential, Commercial, Industrial and/or Protection of Groundwater SCOs include:
  - Benzo(a)anthtracene (1.8-19.4), chrysene (0.2-19.4), benzo(b)flouranthene (2.1-22.8), benzo(a)pyrene (0.8-16.9), indeno (1,2,3-cd)pyrene (0.5-12) and dibenz(a,h) anthracene (0.0-5.4), elevated in 1 of 4 composite samples (BP-GP-C-4) .
- Concentrations in sub-surface soils exceeded the sediment ER-Ms for lead (3.7), zinc (1.6), napthlathene (1.1), 2-Methylnapthalene (2.8), acenapththylene (1.6), flourene (12.9), phenanthrene (26.9), anthracene (11.5), flouranthene (8.3), pyrene (15.6), benzo(a)anthracene (12.1), chrysene (6.9), benzo(a)pyrene (10.5), dibenz(a,h) anthracene (6.8), total LMW PAHs (22.7) total HMW PAHs (19.1), DDE (1.4), DDT (19), DDT Total (2.9), total PCBs (4.6), elevated in 1 of 4 composite samples (BP-GP-C-4).
- The COPCs above could be present within the restored 7.5 acres of marsh and associated habitat. The placement of 12 inches of clean growing medium within the maritime forest and grasslands will reduce the exposure to upland receptors.
- Avoidance of elevated concentrations of COPCs at location BP-GP-C-4 (Figure 5) should be considered during re-grading and movement of subsurface soils to surface soils. The use of cleaner soils for surface grading would significantly reduce exposure to receptors and improve exposure at the site.

- The recommended alternative (Figure 5) maximizes marsh habitat protection and creates macroinvertebrate habitat by creating offshore rubble mounds, restores 7.5 acres of marsh and associated habitat that includes 1.9 acres of low marsh, 0.7 acres of high marsh, 2.4 acres of maritime forest and 2.5 acres of meadow of marsh and associated habitat and protects an already existing 1.2 acres of marsh

Figure 5: Sample Locations and Recommended Plan for Brant Point (Alternative 2)

DEAD HORSE BAY

Surface Soils (Current Exposure- Table 10)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources SCOs include:
    - Hexavalent chromium (73.5, assuming 100% Cr Hex; however, trivalent Cr [2.4] is more likely), copper (1.5), lead (7.6), mercury (7), silver (1), zinc (2.5), DDD (10.6), DDE (8.1) and DDT (13.1). Elevated concentrations of metals were primarily identified at one of six locations (DHB-HA-5) and DDD, DDE or DDT at three locations (DHB-HA-1, HA-2 and HA-5) (Figure 8).
- Concentrations in surface soils exceeded the sediment ER-Ms for lead (2.2) and mercury (1.8), DDD (1.7), DDT (6.2) and DDT total (1.9).

Composite Soils (Future Exposure Post Restoration- Table 11)

- COPCs (HQ) exceeding NYSDEC Unrestricted Use, Residential, Restricted-Residential, Protection of Ecological Resources and/or Protection of Groundwater include:
    - Hexavalent chromium (26.8, assuming 100% Cr Hex; however, trivalent Cr [0.9] is more likely), lead (1.2-8.3) and mercury (1.2-5.3).
- COPCs (HQ) exceeding NYSDEC Unrestricted Use and Protection of Ecological Resources include**:**
    - DDD (1.6), DDE (19.5), DDT (3.5), DDT total (5.1), dieldrin (1.3-1.5), Total PCBs (8.1 – Unrestricted Use only), copper (4.5), nickel (1.1), silver (2.4) and zinc (5.3).
- Concentrations in subsurface soils exceeded the sediment ER-Ms for lead (2.4), mercury (1.3), silver (1.3), zinc (1.4), DDD (3.2), DDT (2.4) and total DDT (1.8), total PCBs (4.5).
- Four of the nine samples (DHB-GP-C-4, DHB-HA-C-2, DHB-HA-C-3, DHB-HA-C-4) contained levels of COPCs (including lead, mercury, copper, nickel, zinc) in excess of above benchmarks. Two of nine composite samples (DHB-HA-C-2 and DHB-HA-C-3) contained elevated DDD, DDE and DDT and four samples (DHB-GP-C-3, DHB-HA-C-4, DHB-HA-C-2 and DHB-HA-C-3) contained elevated levels of PCBs (Aroclor 1254).
- Risks can be reduced and overall improvement can occur as a result of the restoration action given the avoidance of specific areas where COPCs were identified, as well as using cleaner areas for capping and grading at the surface.
- The recommended plan maximizes marsh habitat by creating a tidal channel in the northern portion of the site and regrading the existing upland *Phragmites* stand to salt marsh elevations to create a 31 acre tidal marsh system.
- Sand will be beneficially reused on site to create additional restoration opportunities and buffer areas.
- In total this plan restores 130.7 acres which includes 31 acres of low marsh, 7 acres of high marsh, 4 acres of creek, and 27.7 acres of dunes.

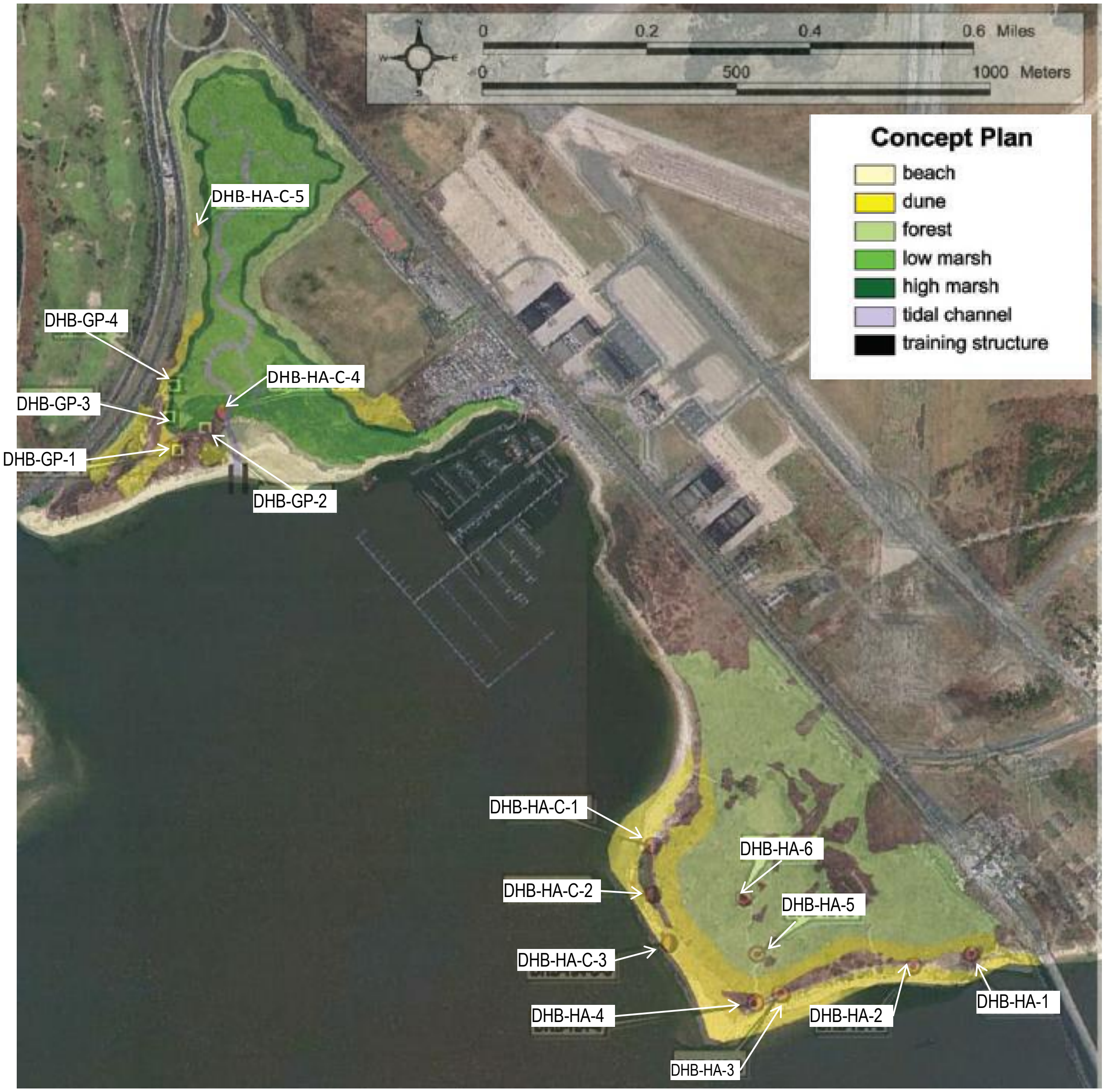


Figure 6: Sample Locations and Recommended Plan for Dead Horse Bay

TABLES

CONTAMINANTS OF POTENTIAL CONCERN

CURRENT AND FUTURE EXPOSURE

Table 1: Bayswater Point State Park - Surface Soil Samples - Contaminants of Potential Concern for Current Exposure

Contaminant	Soil Concentrations - Summary Statistics (ppm)						RSBC	Ecological Screening Hazard Quotients			NYSDEC Soil Cleanup Objectives Hazard Quotients						
								Sediment				Protection of Public Health					
	# Detect (N=4)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ	Other HQ	Unrestricted HQ	Residential HQ	Restricted Residential HQ	Commercial HQ	Industrial HQ	Protection of Ecological Resources HQ	Protection of Groundwater HQ
Metals																	
Antimony	1	nd	2.4	1.1	2.1	2.1				**3.4**							
Chromium, hexavalent	4	3.1	6.2	5.2	6.8	6.2	NE	0.1	0.0		**6.2**	0.3	0.1	0.0	0.0	**6.2**	0.3
Lead	4	23.4	147	66.8	135	135.0		**2.9**	0.6		**2.1**	0.3	0.3	0.1	0.0	**2.1**	0.3
Mercury	4	0.03	0.24	0.09	0.2	0.2	0.3	**1.4**	0.3		**1.2**	0.3	0.3	0.1	0.0	**1.2**	0.3
PCBs and Pesticides																	
Chlordane	1	nd	0.26	0.10	0.22	0.22					**2.4**	0.2	0.1	0.0	0.0	0.2	0.1
4,4'-DDD	1	nd	0.01	0.01	0.01	0.01		**5.8**	0.6		**3.5**	0.0	0.0	0.0	0.0	**3.5**	0.0
4,4'-DDE	3	nd	0.08	0.04	0.09	0.08		**36.4**	**3.0**	**38.6**	**24.2**	0.0	0.0	0.0	0.0	**24.2**	0.0
4,4'-DDT	3	nd	0.15	0.07	0.15	0.15		**149.5**	**21.4**	**125.6**	**45.3**	0.1	0.0	0.0	0.0	**45.3**	0.0
DDT Total	3	nd	0.50	0.18	0.23	0.23		**143.8**	**4.8**								

1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al.
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark

Table 2: Bayswater Point State Park - Composite Soil Samples: Future Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics (ppm)						RSBC	Ecological Screening Hazard Quotients			NYSDEC Soil Cleanup Objectives Hazard Quotients						
								Sediment			Unretstricted Use HQ	Protection of Public Health				Protection of Ecological Resources HQ	Protection of Groundwater HQ
	Detect (N=9)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ	Other HQ		Residential HQ	Restricted Residential HQ	Commercial HQ	Industrial HQ		
Metals																	
Chromium, hexavalent	9	3.8	11.8	6.5	8.2	8.2	NE	0.1	0.0		**8.2**	0.4	0.1	0.0	0.0	**8.2**	0.4
Lead	9	1.8	83.8	33.0	59.6	59.6		**1.3**	0.3		0.9	0.1	0.1	0.1	0.0	0.9	0.1
Zinc	9	5.5	438	67.0	153	153		**1.0**	0.4		**1.4**	0.1	0.0	0.0	0.0	**1.4**	0.1
Semivolatiles																	
Naphthalene	4	nd	0.70	0.21	0.34	0.34		**2.1**	0.2		0.0	0.0	0.0	0.0	0.0		0.0
2-Methylnaphthalene	4	nd	0.62	0.19	0.30	0.30		**4.2**	0.4								
Acenaphthylene	5	nd	0.60	0.19	0.30	0.30		**6.9**	0.5		0.0	0.0	0.0	0.0	0.0		0.0
Fluorene	5	nd	1.80	0.34	0.68	0.68		**35.9**	**1.3**		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenanthrene	6	nd	6.50	1.32	2.62	2.62		**10.9**	**1.7**		0.0	0.0	0.0	0.0	0.0		0.0
Anthracene	6	nd	2.10	0.44	0.84	0.84		**9.9**	0.8		0.0	0.0	0.0	0.0	0.0		0.0
Fluoranthene	6	nd	5.90	1.50	2.77	2.77		**4.6**	0.5		0.0	0.0	0.0	0.0	0.0		0.0
Pyrene	6	nd	5.30	1.40	2.54	2.54		**3.8**	1.0		0.0	0.0	0.0	0.0	0.0		0.0
Benzo(a)anthracene	6	nd	2.30	0.61	1.12	1.12	1	**4.3**	0.7		**1.1**	**1.1**	**1.1**	0.2	0.1		**1.1**
Chrysene	6	nd	2.50	0.73	1.30	1.30	1	**3.4**	0.5		**1.3**	**1.3**	0.3	0.0	0.0		**1.3**
bis(2-Ethylhexyl)phthalate	2	nd	3.20	0.54	1.16	1.16				**6.4**							
Benzo(b)fluoranthene	6	nd	2.80	0.75	1.40	1.40	1			0.8	**1.4**	**1.4**	**1.4**	0.3	0.1		0.8
Benzo(k)fluoranthene	6	nd	1.10	0.31	0.58	0.58	0.8			**8.2**	0.7	0.6	0.1	0.0	0.0		0.3
Benzo(a)pyrene	6	nd	2.00	0.56	1.03	1.03	1	**2.4**	0.6		**1.0**	**1.0**	**1.0**	**1.0**	0.9	0.4	0.0
Indeno(1,2,3-cd)pyrene	6	nd	1.00	0.26	0.47	0.47	0.5			**7.0**	0.9	0.9	0.9	0.1	0.0		0.1
Dibenz(a,h)anthracene	6	nd	0.27	0.08	0.13	0.13	0.1	**2.1**	0.5		0.4	0.4	0.4	0.2	0.1		0.0
Benzo(g,h,i)perylene	6	nd	0.85	0.28	0.44	0.44				**2.6**	0.0	0.0	0.0	0.0	0.0		0.0
Total LMW PAHs	6	nd	3.01	0.59	1.22	1.22		**2.2**	0.4								
Total HMW PAHs	6	nd	23.32	6.16	11.56	11.56		**6.8**	**1.2**								
PCBs and Pesticides																	
4,4'-DDD	3	nd	0.06	0.01	0.03	0.03		**12.6**	**1.3**		**7.6**	0.0	0.0	0.0	0.0	**7.6**	0.0
4,4'-DDE	3	nd	0.08	0.01	0.03	0.03		**14.1**	**1.1**	**15.0**	**9.4**	0.0	0.0	0.0	0.0	**9.4**	0.0
4,4'-DDT	3	nd	0.02	0.01	0.01	0.01		**9.6**	**1.4**	**8.1**	**2.9**	0.0	0.0	0.0	0.0	**2.9**	0.0
DDT Total	4	nd	0.12	0.03	0.05	0.05		**34.3**	**1.1**								

Notes:
1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al., 1995)
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark

Table 3: Dubos Point - Surface Soil Samples: Current Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics						RSBC	Ecological Screening Hazard Quotients			NYSDEC Soil Cleanup Objectives Hazard Quotients						
								Sediment			Unrestricted Use HQ	Protection of Public Health				Protection of Ecological Resources HQ	Protection of Groundwater HQ
	Detect (N=2)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ	Other HQ		Residential HQ	Restricted Residential HQ	Commercial HQ	Industrial HQ		
Metals																	
Chromium, hexavalent	2	2	2.4	NA	NA	2.40	NE	0.0	0.0		**2.4**	0.1	0.0	0.0	0.0	**2.4**	0.1

Notes:

1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al., 1995)
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark

Table 4: Dubos Point - Composite Soil Samples: Future Contaminants of Concern

Contaminant	Soil Concentrations - Summary Statistics (ppm)						RSBC	Ecological Screening Hazard Quotients			NYSDEC Soil Cleanup Objectives Hazard Quotients						
								Sediment			Unrestricted Use HQ	Protection of Public Health				Protection of Ecological Resources HQ	Protection of Groundwater HQ
	# Detect (N=10)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ	Other HQ		Residential HQ	Restricted Residential HQ	Commercial HQ	Industrial HQ		
Metals																	
Antimony	1	nd	1.3	0.66	0.80	0.80				**1.3**							
Chromium, hexavalent	10	3.8	8.1	5.9	6.7	6.7	NE	0.1	0.0		**6.7**	0.3	0.1	0.0	0.0	**6.7**	0.4
Mercury	3	nd	1.60	0.23	0.53	0.53	0.3	**3.5**	0.7		**2.9**	0.7	0.7	0.2	0.1	**2.9**	0.7
Semivolatiles																	
Acenaphthylene	4	nd	0.04	0.12	0.17	0.04		**1.0**	0.1		0.0	0.0	0.0	0.0	0.0		0.0
Fluorene	3	nd	0.06	0.16	0.20	0.06		**3.4**	0.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anthracene	6	nd	0.09	0.11	0.16	0.09		**1.0**	0.1		0.0	0.0	0.0	0.0	0.0		0.0
Benzo(k)fluoranthene	6	nd	0.26	0.06	0.11	0.11	0.8			**1.6**	0.1	0.1	0.0	0.0	0.0		0.1
Indeno(1,2,3-cd)pyrene	6	nd	0.37	0.08	0.15	0.15	0.5			**2.2**	0.3	0.3	0.3	0.0	0.0		0.0
Benzo(g,h,i)perylene	6	nd	0.36	0.15	0.21	0.21				**1.3**	0.0	0.0	0.0	0.0	0.0		0.0
Total HMW PAHs	7	nd	4.83	1.00	1.93	1.93		**1.1**	0.2								
PCBs and Pesticides																	
4,4'-DDE	1	nd	0.012	0.005	0.006	0.006		**2.8**	0.2	**3.0**	**1.9**	0.0	0.0	0.0	0.0	**1.9**	0.0

Notes:

1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al., 1995)
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark

Table 5: Hawtree Point - Surface Soil Samples: Future Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics						RSBC	Screening Values (ESVs) and Hazard Quotients		NYSDEC Soil Cleanup Objectives (SCOs) and Hazard Quotients						
								Sediment		Unrestricted Use HQ	Protection of Public Health				Protection of Ecological Resources HQ	Protection of Groundwater HQ
	Detect (N=2)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ		Residential HQ	Restricted Residential HQ	Commercial HQ	Industrial HQ		
Metals																
Chromium, hexavalent	2	8.1	20.7	--	--	20.7	NE	0.3	0.1	**20.7**	0.9	0.2	0.1	0.0	**20.7**	**1.1**
Copper	2	31	65.2	--	--	65.2		**1.9**	0.2	**1.3**	0.2	0.2	0.2	0.0	**1.3**	0.0
Lead	2	76.8	332	--	--	332		**7.1**	**1.5**	**5.3**	0.8	0.8	0.3	0.1	**5.3**	0.7
Mercury	2	0.03	0.23	--	--	0.2	0.3	**1.5**	0.3	**1.3**	0.3	0.3	0.1	0.0	**1.3**	0.3
Zinc	2	64.5	153	--	--	153		**1.0**	0.4	**1.4**	0.1	0.0	0.0	0.0	**1.4**	0.1
Semivolatiles																
Acenaphthylene	2	0.01	0.07	--	--	0.07		**1.7**	0.1	0.0	0.0	0.0	0.0	0.0		0.0
PCBs and Pesticides																
4,4'-DDT	1	nd	0.01	--	--	0.01		**11.0**	**1.6**	**3.3**	0.0	0.0	0.0	0.0	**3.3**	0.0
DDT Total	1	nd	0.01	--	--	0.01		**6.9**	0.2							

Notes:

1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al., 1995)
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark
6. NE = Not Established

Table 6: Fresh Creek - Surface Soil Samples- Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics						RSBC	Ecological Screening Values (ESVs) and Hazard Quotients						NYSDEC Soil Cleanup Objectives (SCOs) and Hazard Quotients													
								Sediment						Un-restricted Use	HQ	Protection of Public Health								Protection of Ecological Resources	HQ	Protection of Ground-water	HQ
	Detect (N=5)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L	HQ	ER-M	HQ	Other	HQ			Residential	HQ	Restricted-Residential	HQ	Commercial	HQ	Industrial	HQ				
Metals																											
Antimony	1	nd	3.2	1.8	2.6	2.6						0.63	**4.1**														
Arsenic	5	5.1	16.6	10.3	14.3	14.3	16	8.2	**1.7**	70	0.2			13 [a]	**1.1**	16 [a]	0.9	16 [a]	0.9	16 [a]	0.9	16 [a]	0.9	13 [a]	**1.1**	16 [a]	0.9
Chromium, hexavalent	5	15.9	80.3	37.6	61.5	61.5	NE	81	0.8	370	0.2			1 [b,c]	**61.5**	22 [c]	**2.8**	110 [c]	0.6	400 [c]	0.2	800 [c]	0.1	1 [b,c]	**61.5**	19 [c]	**3.2**
Chromium, trivalent	5	15.9	80.3	37.6	61.5	61.5	30							30 [a,c]	**2.0**	36 [c]	**1.7**	180 [c]	0.3	1,500 [c]	0.0	6,800 [c]	0.0	41 [c]	**1.5**	NS [c]	
Copper	5	25.5	3570	879	2328	2328		34	**68.5**	270	**8.6**			50	**46.6**	270	**8.6**	270	**8.6**	270	**8.6**	10,000 [d]	0.2	50	**46.6**	1,720	**1.4**
Lead	5	166	844	503	740	740		47	**15.7**	218	**3.4**			63 [a]	**11.7**	400	**1.8**	400	**1.8**	1,000	0.7	3,900	0.2	63 [a]	**11.7**	450	**1.6**
Mercury	5	0.2	3.6	1.10	2.45	2.5	0.3	0.15	**16.4**	0.71	**3.5**			0.18 [a]	**13.6**	0.81 [e]	**3.0**	0.81 [e]	**3.0**	2.8 [e]	0.9	5.7 [e]	0.4	0.18 [a]	**13.6**	0.73	**3.4**
Nickel	5	15.5	56.8	34.7	51.7	51.7		21	**2.5**	52	1.0			30	**1.7**	140	0.4	310	0.2	310	0.2	10,000 [d]	0.0	30	**1.7**	130	0.4
Zinc	5	119	3170	916	2130	2130		150	**14.2**	410	**5.2**			109 [a]	**19.5**	2200	1.0	10,000 [d]	0.2	10,000 [d]	0.2	10,000 [d]	0.2	109 [a]	**19.5**	2,480	0.9

Notes for Summary Statistics and ESVs:

1. All summary statistics and ecological screening values are in parts per million (ppm).
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006)
3. NE = Not Established
4. Screen Value is the lesser of the Maximum and the 95% UCL
5. HQ = Hazard Quotient (Screen Value/Benchmark)
6. ER-L= Effects Range-Low (Long et. al.)
7. ER-M= Effects Range- Median (Long et. al.)

Notes for SCOs:

1. All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified. See Technical Support Document (TSD).

[a] For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the [Track 1*/Track 2**] SCO value for this use of the site.

[b] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the [Track 1*] SCO value.

[c] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.

[e] This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1.

* Track 1 SCO values apply to Unrestricted Use only

** Track 2 SCO values apply to Restricted Use only

Table 7: Fresh Creek - Composite Soil Samples- Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics						RSBC	Ecological Screening Values (ESVs) and Hazard Quotients						NYSDEC Soil Cleanup Objectives (SCOs) and Hazard Quotients													
								Sediment						Un-restricted Use	HQ	Protection of Public Health								Protection of Ecological Resources	HQ	Protection of Ground-water	HQ
	Detect (N=13)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L	HQ	ER-M	HQ	Other	HQ			Residential	HQ	Restricted-Residential	HQ	Commercial	HQ	Industrial	HQ				
Metals																											
Antimony	4	nd	4.4	1.2	1.8	1.8						0.63	**2.8**														
Chromium, hexavalent	13	5.9	184	30.2	53.3	53.3	NE	81	0.7	370	0.1			1 [b,c]	**53.3**	22 [c]	**2.4**	110 [c]	0.5	400 [c]	0.1	800 [c]	0.1	1 [b,c]	**53.3**	19 [c]	**2.8**
Chromium, trivalent	13	5.9	184	30.2	53.3	53.3	30							30 [a,c]	**1.8**	36 [c]	**1.5**	180 [c]	0.3	1,500 [c]	0.0	6,800 [c]	0.0	41 [c]	**1.3**	NS [c]	
Copper	13	4.7	244	76	111	111		34	**3.3**	270	0.4			50	**2.2**	270	0.4	270	0.4	270	0.4	10,000 [d]	0.0	50	**2.2**	1,720	0.1
Lead	13	3.6	1290	295	476	476		47	**10.1**	218	**2.2**			63 [a]	**7.6**	400	**1.2**	400	**1.2**	1,000	0.5	3,900	0.1	63 [a]	**7.6**	450	**1.1**
Mercury	11	nd	2.4	0.41	0.72	0.72	0.3	0.15	**4.8**	0.71	**1.0**			0.18 [a]	**4.0**	0.81 [e]	0.9	0.81 [e]	0.9	2.8 [e]	0.3	5.7 [e]	0.1	0.18 [a]	**4.0**	0.73	1.0
Zinc	13	11.3	782	280	401	401		150	**2.7**	410	1.0			109 [a]	**3.7**	2200	0.2	10,000 [d]	0.0	10,000 [d]	0.0	10,000 [d]	0.0	109 [a]	**3.7**	2,480	0.2

Notes for Summary Statistics and ESVs:

1. All summary statistics and ecological screening values are in parts per million (ppm).
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006)
3. NE = Not Established
4. Screen Value is the lesser of the Maximum and the 95% UCL
5. HQ = Hazard Quotient (Screen Value/Benchmark)
6. ER-L= Effects Range-Low (Long et. al.)
7. ER-M= Effects Range- Median (Long et. al.)

Notes for SCOs:

1. All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified. See Technical Support Document (TSD).

[a] For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the [Track 1*/Track 2**] SCO value for this use of the site.

[b] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the [Track 1*] SCO value.

[c] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.

[e] This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1.

Table 8: Brant Point - Surface Soil Samples- Contaminants of Potential Concern for Current Exposure

Contaminant	Soil Concentrations - Summary Statistics						RSBC	Ecological Screening Values (ESVs) and Hazard Quotients						NYSDEC Soil Cleanup Objectives (SCOs) and Hazard Quotients													
								Sediment						Un-restricted Use	HQ	Protection of Public Health								Protection of Ecological Resources	HQ	Protection of Ground-water	HQ
	Detect (N=3)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L	HQ	ER-M	HQ	Other	HQ			Residential	HQ	Restricted-Residential	HQ	Commercial	HQ	Industrial	HQ				
Metals																											
Chromium, hexavalent	3	1.5	17.9	9.2	23.1	17.9	NE	81	0.2	370	0.0			1 [b,c]	**17.9**	22 [c]	0.8	110 [c]	0.2	400 [c]	0.0	800 [c]	0.0	1 [b,c]	**17.9**	19 [c]	0.9
Copper	3	2	59.7	25.2	76.6	59.7		34	**1.8**	270	0.2			50	**1.2**	270	0.2	270	0.2	270	0.2	10,000 [d]	0.0	50	**1.2**	1,720	0.0
Lead	3	7.9	389	249	603	389		47	**8.3**	218	**1.8**			63 [a]	**6.2**	400	1.0	400	1.0	1,000	0.4	3,900	0.1	63 [a]	**6.2**	450	0.9
Mercury	2	nd	0.72	0.32	0.93	0.7	0.3	0.15	**4.8**	0.71	**1.0**			0.18 [a]	**4.0**	0.81 [e]	0.9	0.81 [e]	0.9	2.8 [e]	0.3	5.7 [e]	0.1	0.18 [a]	**4.0**	0.73	1.0
Selenium	1	nd	1.1	0.66	1.3	1.1	4					1	**1.1**	3.9 [a]	0.3	36	0.0	180	0.0	1,500	0.0	6,800	0.0	3.9 [a]	0.3	4 [a]	0.3
Zinc	3	10.6	391	235	570	391		150	**2.6**	410	1.0			109 [a]	**3.6**	2200	0.2	10,000 [d]	0.0	10,000 [d]	0.0	10,000 [d]	0.0	109 [a]	**3.6**	2,480	0.2

Notes for Summary Statistics and ESVs:

1. All summary statistics and ecological screening values are in parts per million (ppm).
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006)
3. NE = Not Established
4. Screen Value is the lesser of the Maximum and the 95% UCL
5. HQ = Hazard Quotient (Screen Value/Benchmark)
6. ER-L= Effects Range-Low (Long et. al.)
7. ER-M= Effects Range- Median (Long et. al.)

Notes for SCOs:

1. All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified. See Technical Support Document (TSD).

[a] For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the [Track 1*/Track 2**] SCO value for this use of the site.

[b] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the [Track 1*] SCO value.

[c] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.

[e] This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1.

* Track 1 SCO values apply to Unrestricted Use only

** Track 2 SCO values apply to Restricted Use only

Table 9: Brant Point - Composite Soil Samples- Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics						RSBC	Ecological Screening Values (ESVs) and Hazard Quotients: Sediment				NYSDEC Soil Cleanup Objectives (SCOs) and Hazard Quotients													
														Protection of Public Health											
	Detect (N=4)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L	HQ	ER-M	HQ	Un-restricted Use	HQ	Residential	HQ	Restricted-Residential	HQ	Commercial	HQ	Industrial	HQ	Protection of Ecological Resources	HQ	Protection of Ground-water	HQ
Metals																									
Chromium, hexavalent	4	2.6	23.1	11.4	22.5	22.5	NE	81	0.3	370	0.1	1 [b,c]	**22.5**	22 [c]	**1.0**	110 [c]	0.2	400 [c]	0.1	800 [c]	0.0	1 [b,c]	**22.5**	19 [c]	**1.2**
Copper	4	3.2	121	45.5	106	106		34	**3.1**	270	0.4	50	**2.1**	270	0.4	270	0.4	270	0.4	10,000 [d]	0.0	50	**2.1**	1,720	0.1
Lead	4	19.7	919	316	798	798		47	**17.0**	218	**3.7**	63 [a]	**12.7**	400	**2.0**	400	**2.0**	1,000	0.8	3,900	0.2	63 [a]	**12.7**	450	**1.8**
Mercury	4	0.02	0.64	0.23	0.56	0.6	0.3	0.15	**3.8**	0.71	0.8	0.18 [a]	**3.1**	0.81 [e]	0.7	0.81 [e]	0.7	2.8 [e]	0.2	5.7 [e]	0.1	0.18 [a]	**3.1**	0.73	0.8
Zinc	4	19.7	756	266	658	658		150	**4.4**	410	**1.6**	109 [a]	**6.0**	2200	0.3	10,000 [d]	0.1	10,000 [d]	0.1	10,000 [d]	0.1	109 [a]	**6.0**	2,480	0.3
Semivolatiles																									
Chlordane	1	nd	0.18	0.12	0.22	0.18						0.094	**1.9**	0.91	0.2	4.2	0.0	24	0.0	47	0.0	1.3	0.1	2.9	0.1
4,4'-DDD	1	nd	0.02	0.01	0.02	0.02		0.002	**10.0**	0.02	**1.0**	0.0033 [d]	**6.1**	2.6	0.0	13	0.0	92	0.0	180	0.0	0.0033 [d]	**6.1**	14	0.0
4,4'-DDE	1	nd	0.04	0.02	0.04	0.04		0.002	**17.0**	0.03	**1.4**	0.0033 [d]	**11.4**	1.8	0.0	8.9	0.0	62	0.0	120	0.0	0.0033 [d]	**11.4**	17	0.0
4,4'-DDT	2	nd	0.14	0.06	0.13	0.13		0.001	**133.1**	0.01	**19.0**	0.0033 [d]	**40.3**	1.7	0.1	7.9	0.0	47	0.0	94	0.0	0.0033 [d]	**40.3**	136	0.0
DDT Total	2	136	0.14	0.07	0.16	0.14		0.002	**87.5**	0.05	**2.9**														
Endrin (keytone)	1	nd	0.05	0.02	0.04	0.04						0.014	**3.0**	2.2	0.0	11	0.0	89	0.0	410	0.0	0.014	**3.0**	0.06	0.7
Dieldrin	0	nd	nd	nd	nd	nd	0.01					0.005 [g]	--	0.039	--	0.2	--	1.4	--	2.8	--	0.006	--	0.1	--
Endrin (aldehyde)	0	nd	nd	nd	nd	nd						0.014	--	2.2	--	11	--	89	--	410	--	0.014	--	0.06	--
Heptachlor	0	nd	nd	nd	nd	nd						0.042	--	0.42	--	2.1	--	15	--	29	--	0.14	--	0.38	--
Methoxychlor	1	nd	0.21	0.06	0.18	0.18																			
Aroclor-1248	0	nd	nd	nd	nd	nd																			
Aroclor-1254	0	nd	nd	nd	nd	nd																			
Aroclor-1260	1	nd	0.98	0.27	0.83	0.83																			
Aroclor-1262	0	nd	nd	nd	nd	nd																			
Total PCBs	1	nd	0.98	0.25	0.82	0.82		0.02	**38.0**	0.18	**4.6**	0.1	**8.2**	1	0.8	1	0.8	1	0.8	25	0.0	1	0.8	3.2	0.3

Notes for Summary Statistics and ESVs:

1. All summary statistics and ecological screening values are in parts per million (ppm).
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006)
3. NE = Not Established
4. Screen Value is the lesser of the Maximum and the 95% UCL
5. HQ = Hazard Quotient (Screen Value/Benchmark)
6. ER-L= Effects Range-Low (Long et. al.)
7. ER-M= Effects Range- Median (Long et. al.)

Notes for SCOs:

1. All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified. See Technical Support Document (TSD).

[a] For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the [Track 1*/Track 2**] SCO value for this use of the site.

[b] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the [Track 1*] SCO value.

[c] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.

[e] This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1.

* Track 1 SCO values apply to Unrestricted Use only

** Track 2 SCO values apply to Restricted Use only

Table 10: Dead Horse Bay - Surface Soil Samples: Current Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics (ppm)						RSBC	Ecological Screening Hazard Quotients			NYSDEC Soil Cleanup Objectives Hazard Quotients					
								Sediment			Unrestricted Use HQ	Protection of Public Health			Protection of Ecological Resources HQ	Protection of Groundwater HQ
	Detect (N=6)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ	Other HQ		Restricted Residential HQ	Commercial HQ	Industrial HQ		
Metals																
Antimony	2	nd	38.1	7.3	19.7	19.7				**31.3**						
Chromium, hexavalent	6	3	130	33.1	73.5	73.5	NE	0.9	0.2		**73.5**	0.7	0.2	0.1	**73.5**	**3.9**
Chromium, trivalent	6	3	130	33.1	73.5	73.5	30				**2.4**	0.4	0.0	0.0	**1.8**	
Copper	6	5.4	96.3	45.0	74.3	74.3		2.2	0.3		**1.5**	0.3	0.3	0.0	**1.5**	0.0
Lead	6	21.4	885	202	478	478		**10.2**	**2.2**		**7.6**	**1.2**	0.5	0.1	**7.6**	**1.1**
Mercury	5	nd	2.2	0.57	1.3	1.3	0.3	**8.4**	**1.8**		**7.0**	**1.6**	0.5	0.2	**7.0**	**1.7**
Silver	3	nd	2.7	1.1	2.0	2.0		**2.0**	0.5		**1.0**	0.0	--	0.0	**1.0**	0.2
Zinc	6	9.5	524	105	274	274		**1.8**	0.7		**2.5**	0.0	0.0	0.0	**2.5**	0.1
PCBs and Pesticides																
4,4'-DDD	4	nd	0.05	0.02	0.03	0.03		**17.5**	1.7		**10.6**	0.0	0.0	0.0	**10.6**	0.0
4,4'-DDE	2	nd	0.04	0.01	0.03	0.03		**12.2**	**1.0**	**12.9**	**8.1**	0.0	0.0	0.0	**8.1**	0.0
4,4'-DDT	3	nd	0.06	0.02	0.04	0.04		**43.2**	**6.2**	**36.3**	**13.1**	0.0	0.0	0.0	**13.1**	0.0
DDT Total	6	nd	0.14	0.05	0.09	0.09		**57.4**	**1.9**							

Notes:
1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al., 1995)
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark

Table 11: Dead Horse Bay - Composite Soil Samples: Fuuture Contaminants of Potential Concern

Contaminant	Soil Concentrations - Summary Statistics (ppm)						RSBC	Ecological Screening Hazard Quotients			NYSDEC Soil Cleanup Objectives Hazard Quotients						
								Sediment			Unrestricted Use HQ	Protection of Public Health				Protection of Ecological Resources HQ	Protection of Groundwater HQ
	Detect (N=9)	MIN	MAX	AVG	95% UCL	Screen Value		ER-L HQ	ER-M HQ	Other HQ		Residential HQ	Restricted Residential HQ	Commercial HQ	Industrial HQ		
Metals																	
Arsenic	4	nd	26.2	6.3	11.5	11.5	16	**1.4**	0.2		0.9	0.7	0.7	0.7	0.7	0.9	0.7
Cadmium	6	nd	2.4	1.1	1.8	1.8	2.5	**1.5**	0.2		0.7	0.7	0.4	0.2	0.0	0.4	0.2
Chromium, hexavalent	9	2.6	35.8	17.3	26.8	26.8	NE	0.3	0.1		**26.8**	**1.2**	0.2	0.1	0.0	**26.8**	**1.4**
Copper	9	0.45	408	128	223	223		**6.6**	0.8		**4.5**	0.8	0.8	0.8	0.0	**4.5**	0.1
Lead	9	2.3	951	299	525	525		**11.2**	**2.4**		**8.3**	**1.3**	**1.3**	0.5	0.1	**8.3**	**1.2**
Mercury	6	nd	1.5	0.57	0.95	0.9	0.3	**6.3**	**1.3**		**5.3**	**1.2**	**1.2**	0.3	0.2	**5.3**	**1.3**
Nickel	9	1.6	54.4	21.1	34.2	34.2		**1.6**	0.7		**1.1**	0.2	0.1	0.1	0.0	**1.1**	0.3
Silver	6	nd	13.8	2.1	4.8	4.8		**4.8**	**1.3**		**2.4**	0.1	0.0	--	0.0	**2.4**	0.6
Zinc	9	5	1240	309	575	575		**3.8**	**1.4**		**5.3**	0.3	0.1	0.1	0.1	**5.3**	0.2
Semivolatiles																	
Naphthalene	3	nd	0.490	0.194	0.274	0.274		**1.7**	0.1		0.0	0.0	0.0	0.0	0.0		0.0
Di-n-butylphthalate	2	nd	0.310	0.210	0.234	0.234				**2.0**							
bis(2-Ethylhexyl)phthalate	3	nd	0.450	0.246	0.306	0.306				**1.7**							
PCBs and Pesticides																	
Chlordane	2	nd	0.300	0.087	0.148	0.148					**1.6**	0.2	0.0	0.0	0.0	0.1	0.1
4,4'-DDD	3	nd	0.160	0.031	0.064	0.064		**32.2**	**3.2**		**19.5**	0.0	0.0	0.0	0.0	**19.5**	0.0
4,4'-DDE	2	nd	0.025	0.007	0.012	0.012		**5.3**	0.4	**5.6**	**3.5**	0.0	0.0	0.0	0.0	**3.5**	0.0
4,4'-DDT	2	nd	0.031	0.010	0.017	0.017		**16.9**	**2.4**	**14.2**	**5.1**	0.0	0.0	0.0	0.0	**5.1**	0.0
DDT Total	3	nd	0.214	0.039	0.086	0.086		**53.8**	**1.8**								
Dieldrin	2	nd	0.014	0.006	0.008	0.008	0.01			**10.7**	**1.5**	0.2	0.0	0.0	0.0	**1.3**	0.1
Aroclor-1254	4	nd	2.300	0.370	0.825	0.825				**13.0**							
Total PCBs	4	nd	2.300	0.348	0.810	0.810		**37.5**	**4.5**		**8.1**	0.8	0.8	0.8	0.0	0.8	0.3

Notes:
1. Total PCBs and DDT are sum of DETECTS only.
2. RSBC = Rural Soil Background Concentration (NYSDEC, 2006).
3. ER-L and ER-M: Effects Range Low and Effects Range Medium Sediment Screening Values (Long et.al., 1995)
4. NYSDEC Remedial Program Soil Cleanup Objectives (NYSDEC, 2012)- Subpart 375-6
5. HQ= Hazard Quotient = Screen Value (lesser of Maximum and 95% UCL)/Screening Benchmark

Exhibit A

NYSDEC Letter dated April 2013

New York State Department of Environmental Conservation
Office of Natural Resources, Region 2
Division of Materials Management, Region 2
47-40 21st Street, Long Island City, NY 11101-5407
Phone: (718) 482-4900; **Website:** www.dec.ny.gov

Joe Martens
Commissioner

April 11, 2013

Frank Santomauro, P.E.
Chief, Planning Division
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0040

Subject: Jamaica Bay Ecosystem Restoration Feasibility Study – Soil Management

Dear Mr. Santomauro,

The Department has conceptually reviewed the summary of the contaminant evaluation/risk analysis provided for the Jamaica Bay Ecosystem Restoration Feasibility Study for the eight recommended restoration sites outlined in the draft Feasibility Report.

The Department is very supportive of the advancement of these much needed restoration actions within the Jamaica Bay watershed. Each of the proposed restoration projects will improve habitat quality within the region. Based on the design information provided to date, and the detailed risk evaluation conducted by the USACEs NY District (NY District), it appears these projects will also lower the overall risk of exposure to contaminants for both ecological and human receptors. The additional site characterization and design work slated to occur during the Preliminary Engineering Design (PED) phase is expected to bolster these benefits.

The Department's Division of Materials Management has determined that the eight proposed restoration sites filled with historical fill along the perimeter of Jamaica Bay can be managed pursuant to the provisions of 6 NYCRRPart 360-1.7(b)(9). This designation provides greater flexibility for managing soils on site during construction of the restoration projects.

The Department will continue to work with the NY District to develop and review additional sampling needs during the PED that will aid in the specific detailed designs, logistics and excavation plans. The design the NY District has developed to date includes a minimum of 12 inch deep growing media layer within the maritime forested area. This growing media layer may also serve as an effective cover layer from the perspective of limiting exposure to soil contaminants. The need for cover in wetland areas would be reviewed on a case by case basis.

If additional volume is needed for cover in upland areas due to increased contaminant levels identified during the PED, or if cover or additional construction actions are required to implement the restoration action at the site (in wetland areas), the Department acknowledges that the costs of those actions associated with contamination (i.e., Hazardous Toxic Reactive Waste [HTRW] materials) would be borne 100% by the non-federal sponsor.

In closing, the Department will continue to work closely with the NY District to advance the restoration actions recommended within Jamaica Bay. We look forward to seeing the study authorized and granting individual site approvals. We restate here our willingness to participate as a local cost share partner in the construction phase. We continue to maintain funds for this purpose in our Jamaica Bay Damages Account.

Please contact Steve Zahn at smzahn@gw.dec.state.ny.us or Kenneth Brezner at kbbrezne@gw.dec.state.ny.us with any questions you may have.

Respectfully,

Stephen M. Zahn
Natural Resources Supervisor

Kenneth B. Brezner, P.E.
Regional Materials Management Engineer

cc: K. Prather; DEC DMM-Albany