FINAL INTEGRATED ECOSYSTEM RESTORATION FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

Spring Creek North Ecosystem Restoration Project
Spring Creek Park
Brooklyn and Queens, NY

Continuing Authorities Program (CAP) Section 1135

April 2018

U.S. Army Corps of Engineers
New York District

Finding of No Significant Impact (FONSI)

I. NAME OF ACTION

Spring Creek Ecosystem Restoration, Brooklyn and Queens, Kings and Queens Counties, New York.

II. DESCRIPTION OF ACTION

Recommended Action: The recommended action would involve the restoration of 35.1 acres of coastal habitats including up to 13 acres of salt marsh (7.6 acres of low marsh and 5.4 acres of high marsh), and about 22.1 acres of maritime upland habitat. The project involves the excavation of 6-8 feet of historic fill and removal of invasive plant species from an area that was previously salt marsh, regrading the site to appropriate elevations for the target community, and planting with native coastal plant species.

Alternatives: In addition to No Action, eight restoration alternatives were developed for this project. From these nine alternatives, one was selected for further development and analysis based on project objectives and cost limits. The eight rejected alternatives were assessed as not meeting project goals and objectives.

III. ANTICIPATED ENVIRONMENTAL IMPACTS

No long-term, adverse impacts are anticipated as a result of implementing the recommended plan. Implementation of the recommended plan will result in a change of land cover types primarily from fragmented salt marshes, disturbed wetland and upland areas dominated by invasive species to tidal marsh and maritime upland ecosystems.

The excavation of the site will alter the existing topography; however the site will be restored to elevations similar to historical levels. A temporary increase in turbidity is expected as a result of the earthwork; however, this will be minimized through the use of best management practices for erosion and sedimentation control. If an increase in sedimentation or turbidity does occur, it will likely settle out quickly or be dissipated by the tide.

No adverse impacts are anticipated as a result of Hazardous Toxic Radioactive Waste (HTRW); furthermore there are no anticipated adverse impacts to surface water or ground water resources.

Implementation of the recommended plan will result in the permanent conversion of a historic fill area, presently covered with invasive species, to valuable salt marsh and maritime upland habitats.

The selected plan will increase the availability of quality wetland and provide an increase in habitat through the planting of maritime scrub/shrub transition areas and maritime upland habitat. Implementation of the selected plan may result in the temporary displacement of mobile fish and wildlife species, however it is expected that these species will relocate to adjacent wetlands during construction. Less mobile species may be lost to heavy machinery, vegetation, and earthwork activities; however these losses are expected to be minor. The selected plan will enhance habitat diversity through the increase in the amount and quality of upland and wetlands habitat and food sources. Furthermore, newly created salt marsh areas will provide additional nesting and foraging habitat for wildlife, avian and fish species.

Northern harrier and common tern have been observed in the vicinity of the restoration area. These species may be temporarily displaced during construction activities, however adjacent habitat is available for their use until construction is complete.

The Spring Creek Ecosystem Restoration Project will have no effect on the Cultural Resources of the area. One beneficial impact is that the Project will help to restore what the Spring Creek area looked like before the deposition of dredge material thereby returning the landscape to a pre-twentieth century condition.

During construction, there will be temporary but minor adverse impacts to the aesthetic and scenic resources on site due to the presence of construction equipment, vegetation clearing and the earthwork. Invasive vegetation will be removed and replaced with more diverse vegetation, thus enhancing aesthetic and scenic resources. Diverse vegetation will provide the opportunity for an increase in the number of bird species utilizing the site, which will also enhance aesthetic and scenic resources.

Project implementation will result in new recreation opportunities for the public.

Heavy equipment used during construction may contribute to a temporary increase in noise levels and decrease in air quality; however, noise levels will not exceed those cited in local ordinances, and air impacts are expected to be minor. Both will be limited to the duration of construction.

These temporary impacts will ultimately lead to positive long term impacts related to the improvement of the currently degraded environment. Project related positive impacts/improvements include increased fish and wildlife habitat, improved aesthetic viewsheds, and increased opportunities for passive recreation. The recommended plan will have an overall positive cumulative impact; project related improvements will act additively with those of restoration projects taking place around Jamaica Bay.

IV. CONCLUSION

Given that there are no anticipated long-term, adverse impacts associated with the implementation of the recommended plan, a Finding of No Significant Impact (FONSI) has been determined for this action. Furthermore, as the recommended plan will have no negative impacts on the quality of the environment, an Environmental Impact Statement is not required.

Date: 20180423

Thomas D. Asbery
Colonel, Corps of Engineers
District Engineer

FINAL Integrated Ecosystem Restoration Feasibility Report/Environmental Assessment Spring Creek (North), Brooklyn, New York

Syllabus

This report presents the results of an investigation to determine the feasibility of salt marsh ecosystem restoration at Spring Creek (North) Park, in the Boroughs of Brooklyn and Queens, New York. The Spring Creek Integrated Ecosystem Restoration Feasibility Report and Environmental Assessment (FR/EA) has been prepared by the New York District of the U.S. Army Corps of Engineers (USACE, Corps) with the non-federal project partner, New York City Department of Parks and Recreation (NYC Parks). USACE has authority under Section 1135 of WRDA 1986, as amended, to participate with environmental restoration projects in areas degraded by previous federal actions.

The study area encompasses all of Spring Creek Park and the northeastern portion of Jamaica Bay. The project site is comprised of undeveloped City of New York parkland that straddles the boundary between the Boroughs of Brooklyn and Queens in Kings and Queens Counties, New York. A portion of the 47 acre project site has been evaluated for opportunities to be restored to intertidal salt marsh and maritime upland. This area, referred to as the restoration area, is bound to the north by Flatlands Avenue, to the east by 77th Street, and to the west by the New York City Department of Environmental Protection (NYCDEP) Spring Creek Auxiliary Waste Water Treatment Plant. The restoration area is bound to the south by Spring and Ralph's Creeks.

Over an 80 year period (1920's to the present), the salt marsh community at Spring Creek was altered by the dredging and filling activities associated with the construction and maintenance of the Jamaica Bay Federal Navigation Channel, as well as locally constructed dredging and filling projects directly related to the Federal Navigation Channel and permitted by the Corps. Between 1939 and 1948, the Federal Navigation Channel was extended from the Canarsie Piers into the eastern part of the bay; by 1970, the channel dredging was extended northward into Old Mill Creek and the southern part of Spring Creek. Dredge material was deposited on the marshes surrounding Mill Creek, Spring Creek, Betts Creek, and Ralph's Creek. Today the majority of Mill Creek and all of Betts Creek are filled or piped.

The recommended plan is the National Ecosystem Restoration (NER) plan. The goal of this project is to contribute to the National Ecosystem Restoration by restoring degraded ecosystem structure, function, and dynamic processes to less degraded and more natural conditions. This goal would be accomplished by excavating and re-contouring uplands to intertidal elevations, removing invasive plant species, and replanting with native plant species. The overall project purpose is to improve the environmental quality (water, diversity and wildlife habitat) of Spring Creek and its associated salt marshes as part of the overall Jamaica Bay Ecosystem. The NER plan has a total average annual cost of $429,827 with 7.6 acres of low marsh, 5.4 acres of high marsh, 22.1 acres of maritime upland (including non-federal enhancement actions), for a total of 35.1 acres.

Plan formulation for ecosystem restoration at the Spring Creek site considered a wide variety of restoration measures and elements to address problems of ecosystem degradation and opportunities associated with ecosystem restoration. Eight (8) potential restoration scenarios were developed based on design guidelines identified in a series of meetings. These alternatives were developed considering variations in percentage and type of habitat restored (low marsh, high marsh, upland), and considering options for relocating a sewer pipe that transects the site, and material disposal requirements. The alternatives were then subjected to an initial screening to evaluate the technical, institutional, and economic feasibility of restoration. They were evaluated using the following parameters: potential ecological benefits, potential costs, methods of implementation, requirements for success, real estate considerations, and support of local stakeholders and the non-federal project partner (NYC Parks). As a result of the screening process, it was determined by the design team that Alternative 3-C provided features closest to the requirements of the NER plan. It was also determined that the plan could further be optimized with regard to engineering considerations, ecological/biological opportunities and constraints, and cost effectiveness.

The costs of project implementation for the NER plan will be shared by the federal government and the non-federal project partner (NYC Parks) on a 75 percent/25 percent basis. All operations and maintenance costs will be borne by the non-federal project partner. Project implementation costs $12,031,000 will be shared as follows: $9,023,000 federal and $3,008,000 non-federal with an annual O&M cost of $3,600 (non-federal), less any applicable credits. In addition, Non-Federal Enhancement Actions (100% non-fed) are $5,517,000.

The non-federal sponsor is required to conduct restoration in upland areas of the Compositing Facility (Areas G & F) which has been designated as “Non-Federal Enhancement Actions.” This upland restoration (including removal of portions of the concrete, cost of clean cover material and seeding in Areas G & F) is estimated to be $5,517,000 which will be paid for at 100% non-federal sponsor expense. The cost of grading and placement of excavated material in Areas G & F is included in the project costs and will be cost shared.

The non-federal project partner, NYC Parks, has indicated its support for the RECOMMENDED PLAN and is willing to enter into a Project Partnership Agreement with the federal government for the implementation of the plan. At this time, there are no known major areas of controversy or unresolved issues regarding the study and selected plan among agencies or the public interest.

The magnitude and complexity of the project is of a scale within an 1135 Continuing Authorities Program (CAP) project. The costs, including the study and the expected construction costs are within the limits of the ceiling under Section 1135, as amended by the Water Resource Reform and Development Act of 2014 (f) with a maximum federal expenditure to $10,000,000.

Pertinent Data

Description
The identified plan provides for restoration of salt marsh habitat degraded by historical dredge and fill operations in the project site and Jamaica Bay, in general.

Location
Brooklyn and Queens Counties, New York

Salt Marsh Restoration Elements

7.6 acres of low marsh, 5.4 acres of high marsh, 22.1 acres of maritime upland, for a total of 35.1 acres.

Low Marsh	7.6 acres restored
High Marsh	5.4 acres restored
Maritime Upland	22.1 acres restored
NYC Parks Maritime Upland	2.4 acres restored

Economics

Initial Project cost (October 2017 price level)	$11,374,536
Annualized Operations and Maintenance (O&M) Costs	$3,600
Total Annual Cost (interest rate of 2.75% over 50 years)	$429,827

Cost Apportionment (Fully Funded Cost)

Total Fully Funded Project Costs	$12,031,000
Federal Cost (75%)	$9,023,000
Non-Federal Cost (less O&M) (25%)	$3,008,000
Non-Federal Enhancement Actions (100% non-fed)	$5,517,000

Final Integrated Ecosystem Restoration Feasibility Report/Environmental Assessment Spring Creek (North), Brooklyn, New York

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Acronyms

A list of the acronyms used in this report is provided below:

Acronym	Title
bgs	Below Ground Surface
BMP	Best Management Practice
CE	Cost Effectiveness
CBG-DR	Community Development Block Grants- Disaster Recovery
CSRM	Coastal Storm Risk Management
cy	Cubic yards
EA	Environmental Assessment
EFH	Essential Fish Habitat
EP	Environmental Policy
EPW	Evaluation of Planned Wetlands
ER	Environmental Regulation
FCI	Functional Capacity Index
FCU	Functional Capacity Unit
FMC	Fishery Management Council
FMP	Fishery Management Plan
FR/EA	Feasibility Report/Environmental Assessment
FS	Fish (nontidal river/stream)
FT	Fish-tidal
GOSR	Governor’s Office of Storm Recovery
HEP	Harbor Estuary Program
HTRW	Hazardous/Toxic/Radiological Waste
HUD	Housing and Urban Development
ICA	Incremental Cost Analysis
JABERRT	Jamaica Bay Ecosystem Research and Restoration Team
kg	Kilograms
MCACES	Micro-Computer Aided Cost Estimating System
MHHW	Mean Higher High Water
MHW	Mean High Water
MHWS	Mean High Water Spring
MLLW	Mean Lower Low Water
MLW	Mean Low Water
mph	Miles Per Hour
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTL	Mean Tide Level
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum 1988

NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NFWF	National Fish and Wildlife Foundation
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NYCDCP	New York City Department of City Planning
NYCDEP	New York City Department of Environmental Protection
NYC Parks	City of New York Department of Parks and Recreation
NYC LPC	New York City Landmarks Preservation Commission
NYCT	New York City Transit
NYRCR	New York Rising Community Reconstruction
NYSCMP	New York State Coastal Management Program
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSOPRHP	New York State Office of Parks, Recreation and Historic Preservation
O&M	Operation and Maintenance
PCA	Project Cooperation Agreement
PCB	Pesticides/Polychlorinated Biphenyls
SB	Shoreline Bank Erosion Control
SFA	Sustainable Fisheries Act
SHPO	State Historic Preservation Office
SS	Sediment Stabilization
TAGM	Technical and Guidance Memorandum
TCLP	Toxicity Characteristic Leaching Procedure
UH	Uniqueness/Heritage
ULURP	Uniform Land Use Review Procedures
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WL	Wildlife
WQ	Water Quality
WRP	Waterfront Revitalization Program

Part 1 – Introduction

The New York District of the U.S. Army Corps of Engineers (USACE) has prepared an Integrated Ecosystem Restoration Feasibility Report and Environmental Assessment (FR/EA) to address the proposed habitat restoration plans for the project site located along Spring and Ralph's Creeks in the Boroughs of Brooklyn and Queens, New York. The purpose of the Spring Creek (North) Integrated FR/EA is to evaluate the feasibility of modifying the existing project site for the purpose of improving environmental quality. More specifically the report will:

- Describe existing conditions within the study area and project site;
- Identify the water resources problem and what will happen in the absence of federal action;
- Assess opportunities and alternative plans for the restoration of the degraded ecosystem at the Spring Creek site;
- Evaluate the technical, environmental, and institutional feasibility of the federal action to address ecosystem restoration opportunities;
- Determine if there is local support for implementation of the plan for ecosystem restoration; and
- Recommend a restoration plan for construction.

This Integrated FR/EA meets the requirements of and includes the required documentation pursuant to the National Environmental Policy Act (NEPA), *Procedures for Implementing NEPA* Engineer Regulation (ER)200-2-2 (USACE, 1988), *Ecosystem Restoration – Supporting Policy Information* EP 1165-2-502 (USACE, 1999), and *Planning Guidance Notebook* ER 1105-2-100 (USACE, 2000).

1.1. PROJECT AUTHORIZATION

The Spring Creek (North) ecosystem restoration is being conducted under Section 1135 of the Water Resources Development Act of 1986, as amended. Under Section 1135, the USACE is authorized to review the need for modifications of existing projects to improve environmental quality. Section 1135 authorizes the USACE to address degradation of the environment caused by a past USACE project either within or directly adjacent to the project area or corridor.

The construction of the Jamaica Bay Federal navigation project was a prelude to a planned port development within Jamaica Bay, and consisted of dredging of channels; straightening, widening and bulk-heading of tributaries; and filling in of large tracts of shallow water and wetland habitat to create upland facilities. Though the port was never developed as planned, the actions, and subsequent improvements and maintenance of the current navigation channels caused both direct (dredging and filling) and indirect (loss of wetland function) impacts throughout Jamaica Bay and its immediate tributaries, including the Spring Creek wetland system. Figure 1 and Figure 2 show the current navigation channels location within the Study Area and proximity to the project site. The original Congressional authorization for a federal channel entering and extending through Jamaica Bay was given in 1910 and modified in 1945, 1950, and 1986. The current federal channel consists of 19.5 miles of channel of various width and depth, providing for a central entrance channel through Rockaway Inlet and two main branches along the northern and southern portions of the bay. The construction, maintenance, and improvement of the network of channels within Jamaica Bay required the dredging of millions of cubic yards of material. The majority of this material was deposited in shallow waters, embayments and wetlands within the bay and its tributaries. The creation of channels and the widening/deepening of channels and basins were performed by the New York City Department of Docks and Ferries, acting as an agent for the USACE. These activities occurred from 1911 through 1945. Historic topographic maps show when the existing basins in Jamaica Bay, including Old Mill Basin into which Spring Creek empties, were excavated from large tidal creeks. During the excavation, the majority of the surrounding marshland was bulk-headed and filled with the resulting dredged material.

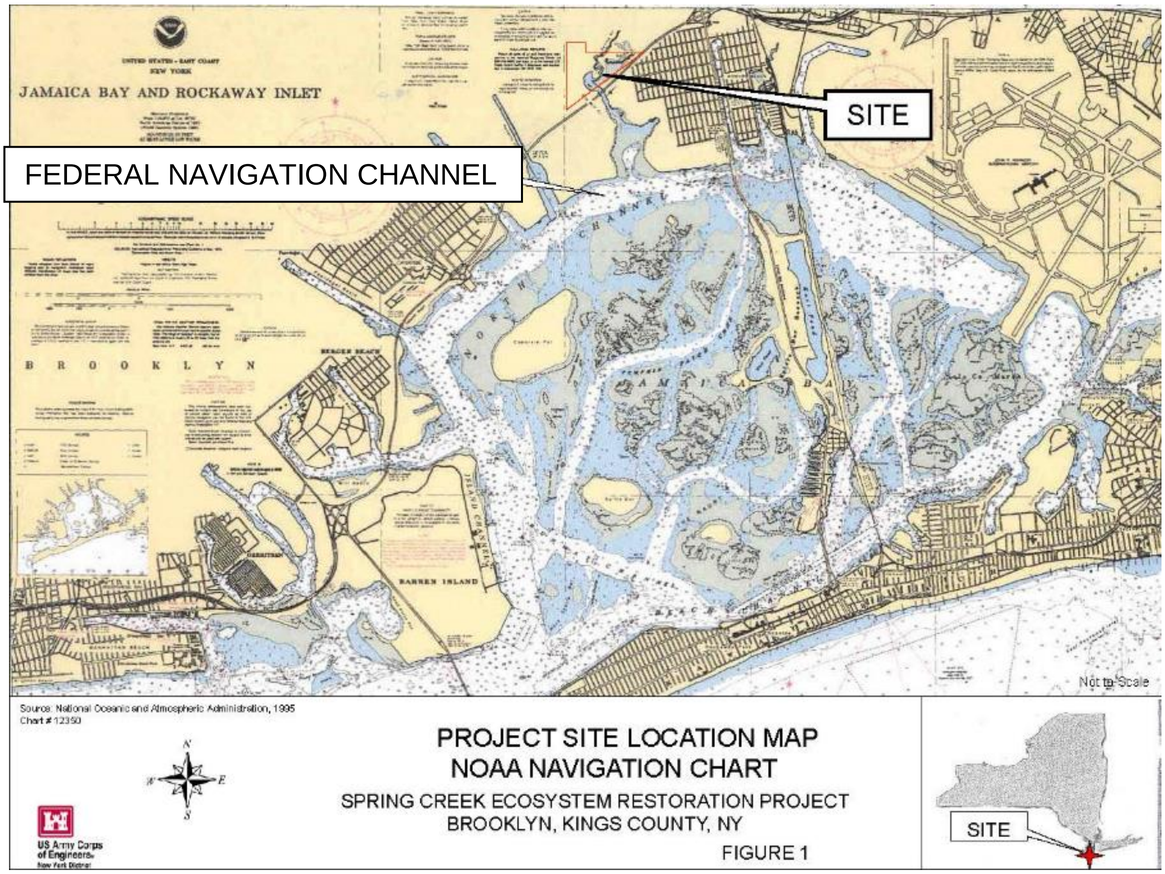


Figure 1. Project Site Location Map

During reconnaissance level investigations for Spring Creek, USACE investigated the adverse impacts associated with the construction and maintenance of the surrounding channel system and the subsequent filling that occurred within the surrounding salt marshes, and determined that corrective efforts to restore native estuarine marsh communities in the study area were warranted. Based upon the discussion above, the Spring Creek Ecosystem Restoration project falls within the jurisdiction of the Section 1135 program.

Section 1135(b) of the Water Resource Development Act (WRDA) of 1986, Public Law 99-662, as amended [33 U.S.C. 2309(a)] authorizes federal funds to be appropriated annually to carry out projects for the purpose of: (1) making such modifications in the structures and operations of water resources projects constructed by the Secretary of the

Army which the Secretary determines will improve the quality of the environment, or (2) undertaking measures for restoration of environmental quality when the Secretary determines that construction or operation of a water resources project has contributed to the degradation of the quality of the environment.The Water Resource Reform and Development Act of 2014 (f), further amended Section 1135(d) of WRDA 1986 (33 U.S.C. 2309a (d)) increasing the $5,000,000 maximum federal expenditure to *$10,000,000*.

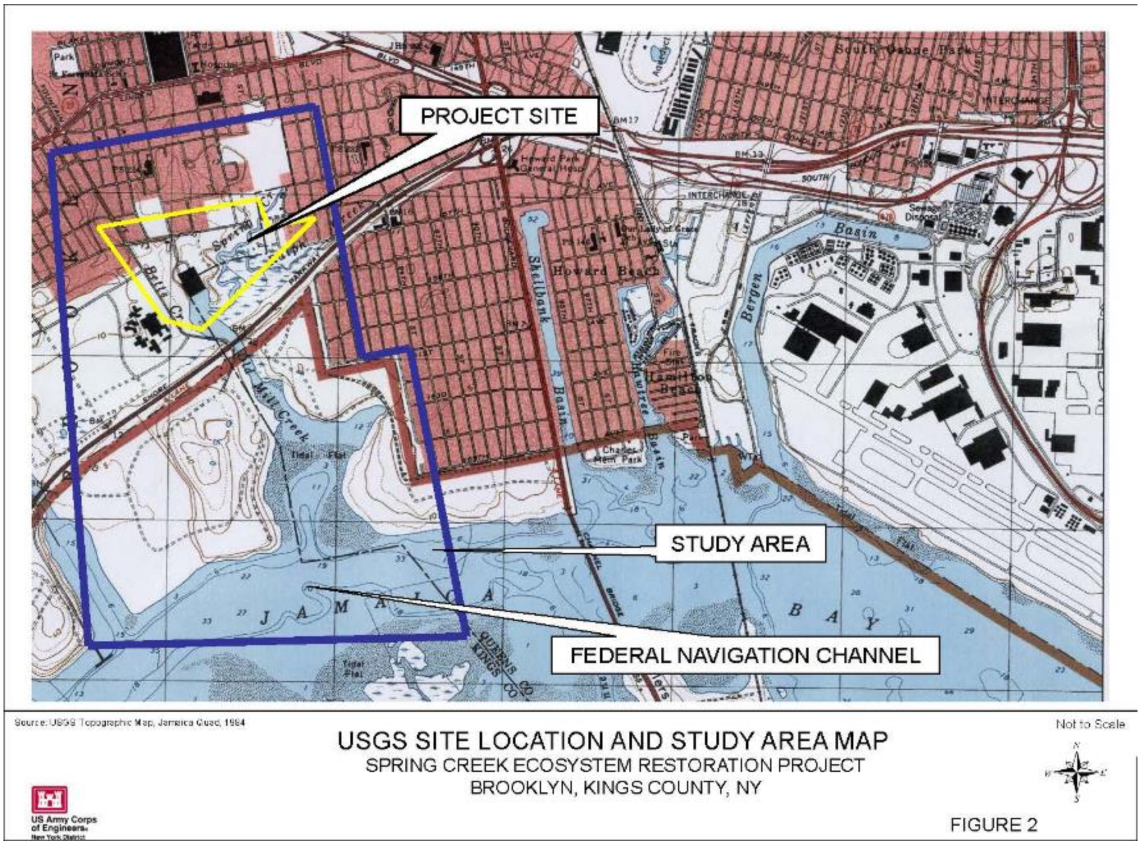


Figure 2. USGS Site Locations and Study Area Map

1.2. SITE DESCRIPTION AND LOCATION

The Spring Creek North project area is a 47 acre portion of Spring Creek Park located adjacent to the banks of Spring Creek and Ralph's Creek. *The Site has been identified as Spring Creek "North" to prevent confusion with the adjacent "Spring Creek South" project on the eastern side of the Belt Parkway.* Ralph's Creek is a tributary to Spring Creek, which in turn is a tributary to the Mill Creek Basin, which empties into Jamaica Bay. The entire site lies within the Jamaica Bay Watershed. The overall Study Area encompasses all of Spring Creek Park and the northeastern portion of Jamaica Bay (See Figure 2).

The project area consists of undeveloped City of New York parkland that straddles the boundary between the Boroughs of Brooklyn and Queens in Kings and Queens Counties respectively, New York City, New York. The project area is bound to the north by Flatlands Avenue, to the south by Belt Parkway, to the West by Fountain Avenue, and to the east by residential development (77th Street and 157th Avenue) (Figure 2). A portion of the 47-acre project area is being evaluated for opportunities to be restored to intertidal salt marsh and maritime upland. This area, referred to as the restoration area, is bound to the north by Flatlands Avenue, to the east by 77th Street, and to the west by the New York City Department of Environmental Protection (NYCDEP) 26th Ward Waste Water Treatment Plant (WWTP). To the south, the restoration area is bound by Spring and Ralph's Creeks.

1.3. BACKGROUND INFORMATION

In the early 1900's, the salt marshes of Spring Creek were part of the extensive coastal wetland community of Jamaica Bay. The salt marshes were renowned for the abundance and diversity of its shellfish and its ecological importance as a nursery and feeding ground for countless species of birds and fish. In fact, at the turn of the century, almost the entire area located south of Flatlands Avenue was wetland.

From 1899 through the early 1970's, the Spring Creek system was dominated by Old Mill Creek of which Spring Creek was a smaller tributary. Between the turn of the Century and the early 1920's, the Old Mill Creek system was surrounded by pristine and extensive intertidal salt marsh. Three major tributaries (Spring Creek, Ralph's Creek and Betts Creek) entered Old Mill Creek prior to its confluence with Jamaica Bay.

Over an 80-year period (1920's to the present), the salt marsh community at Spring Creek was altered by the dredging and filling activities associated with the construction and maintenance of the Jamaica Bay Federal Navigation Project, initially planned to support creation of an extensive Port system within Jamaica Bay, as well as locally constructed dredging and filling projects directly related to the federal project. After the port plans were stymied by the stock market collapse and recession of 1929, additional work was undertaken between 1939 and 1948 to extend the Federal Navigation Channel from the Canarsie Piers into the eastern part of the bay; by 1970, the channel dredging was extended northward into Old Mill Creek and the southern part of Spring Creek. Dredged material was deposited on the marshes surrounding Mill Creek, Spring Creek, Betts Creek, and Ralph's Creek. Today the majority of Mill Creek and all of Betts Creek are filled or piped.

The creation of deep water navigation channels around the outside edge of the bay has significantly altered the tidal currents and sediment patterns in the Old Mill/Spring Creek system and Jamaica Bay. Other direct impacts to the Spring Creek system, besides those associated with its use for disposal of dredged materials, include the creation and operation of the Pennsylvania and Fountain Avenue Landfills, paving the majority of the Spring Creek watershed, ongoing storm water and treated wastewater discharge, and periodic releases of partially treated sewage effluent from overloaded treatment plants such as neighboring 26th Ward WWTP.

The existing WWTP, located on a 57.3-acre site on Flatlands Avenue adjacent to Hendrix Creek in southeast Brooklyn treats wastewater from a 6,000-acre service area that is almost exclusively combined sewers. The WWTP has a design dry weather capacity of 85 million gallons per day (MGD) and a wet weather capacity of 170 MGD. The treatment plant originally came online in the 1890s with basically primary treatment and disinfection; the facility was converted to an activated sludge facility in 1949 with a design flow of 60 MGD; and additional expansions to the plant from 1970s were done to comply with secondary treatment standards in accordance with the EPA Clean Water Act (CWA) that resulted in the plants current dry weather capacity of 85 MGD. The treatment plant was recently upgraded for Biological Nitrogen Removal and typically removes approximately 70% of the influent nitrogen entering the treatment plant prior to the effluent being discharged into Hendrix Creek. The plant is currently undergoing some upgrades on its head works to improve wet weather capture throughout the collection system during rain events.

Spring Creek Auxiliary Waste Water Treatment Plant (AWWTP) Facility (Figure 3) was placed into service in the early 1970’s and has a minimum storage capacity of approximately 19.3 MG of combined sewage overflows (CSO), approximately 9.9 million gallons (mg) in basin storage and approximately 9.4 mg in influent barrel storage. Wet weather CSO flow is conveyed to the Facility by four overflow barrels from the Autumn Avenue regulator (26W-R3) located in the Borough of Brooklyn, and by two overflow barrels from the 157th Avenue regulator (JA-R2) located in the Borough of Queens. The Spring Creek AWWTP Facility was upgraded around 2007 that refurbished much of the structures and equipment along with also slightly increasing its CSO storage capacity to operate as a flow-through retention facility for tributary drainage areas in Brooklyn and Queens within the 26th Ward and Jamaica WWTP drainage areas. The total tributary area is composed of 3,256 acres, of which 1,874 acres are in Brooklyn and 1,382 acres are in Queens. The CSO captured at the Spring Creek AWWTP is sent back to the WWTP when the wet weather flows in the sewer system recede; with a portion of flow being returned via gravity and remaining flow is pumped back to the WWTP. On average the Spring Creek AWWTP reduces annual volume of CSO discharges into Spring Creek by about 50% to 70% and reduces the number of CSO events by about 70% to 90%.

Figure 3. Spring Creek Auxiliary Waste Water Treatment Plant and Sewer Line Alignment

As a result of these historic direct impacts of intense development and population, Spring Creek and its surrounding salt marshes are far less functional and extensive than the pre-development condition that existed at the turn of the 20th Century.

The historic loss of wetlands has had a cumulative, negative effect on water quality and wildlife habitat not only in the Spring Creek system, but Jamaica Bay at large. As wetlands disappear and natural patterns of sedimentation are altered, water quality treatment functions such as nitrogen and phosphorous removal by these impacted wetlands significantly decrease. The decrease in water quality treatment functions is exacerbated by the intense scale of development and high population density, which result in large volumes of treated sewage effluent, and storm water discharged to Old Mill Creek basin. In turn, wildlife habitat functions are lost through degrading and fragmenting habitat, major changes in vegetation cover, and poor water quality. Consequently, the ecological value of the remaining tracts of wetland acreage is significantly reduced. The remaining estuarine wetlands in the Spring Creek area have been degraded to the point where their ability to provide habitat for numerous species of migratory and nesting birds, fish, and invertebrates has been reduced or lost, resulting in a significant disruption to the entire area's interconnected coastal ecology.

1.3.1. Existing Project and Other Ongoing Studies/Efforts

The Spring Creek North Ecosystem Restoration project is an important component of the overall comprehensive restoration of Jamaica Bay. The Spring Creek North study area is also within the study areas of the USACE Hudson Raritan Estuary (HRE) Ecosystem Restoration Feasibility study (which has incorporated the USACE Jamaica Bay, Marine Park and Plumb Beach Feasibility Study) and the East Rockaway to Rockaway Inlet-Jamaica Bay Reformulation Study.

Although this project is recommended and justified under the USACE's ecosystem restoration mission and CAP Section 1135 Authorization, this restoration serves as Natural/Nature Based Features (NNBF) that provide secondary coastal storm risk management (CSRM) benefits to the Howard Beach Community. This project is an important component of the non-federal sponsor (the New York City Department of Parks and Recreation [NYC Parks]) and other partner's initiatives. Most importantly, this Study is being coordinated with other parallel activities conducted by NYC Parks, the Governor's Office of Storm Recovery (GOSR) and New York State Department of Environmental Conservation (NYSDEC) to improve resiliency and provide CSRM benefits within the Spring Creek North Study Area and adjacent Howard Beach Community.

The NYC Parks has received a National Fish and Wildlife Foundation (NFWF) Sandy Coastal Resiliency Competitive Grant for $4.85 Million for the construction of adjacent berms, storm water detention, and maritime forest within the Spring Creek North Study Area. The NYC Parks is advancing projects in in 2017/2018 within the study area to complement the ecosystem restoration recommendation as well as evaluate additional CSRM measures on-site to reduce the risks of flooding to the Howard Beach Community. NYC Parks' work includes the removal of debris, management of invasive vegetation, the installation of storm water detention basins along the northern perimeter of the sites, and planting of native plant species.

The Spring Creek North restoration is also being coordinated with other adjacent and related efforts including:

1) Spring Creek South: NYSDEC has received a Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant for coastal restoration at Spring Creek South. NYSDEC has contracted the USACE through the Interagency and International Services (IIS) Program. The ecosystem restoration design originally prepared by the USACE, has been reevaluated for CSRM benefits and is being coordinated with that National Park Service (NPS), NYC Parks and other partner agencies as designs progress. Study and construction of Spring Creek South is being coordinated with Spring Creek North to leverage and optimize programs, data collection/solutions, and construction.

2) Howard Beach- New York Rising Community Reconstruction Plan (NYRCR) (Governor's Office of Storm Recovery [GOSR], March 2014): The Howard Beach Planning Committee for NY Rising has proposed recommendations tallying up to $18.4 Million of Housing and Urban Development (HUD) Community Development Block Grants-Disaster Recovery (CDBG-DR) implementation funds to restore and reduce flooding to the adjacent Howard Beach Community. Spring Creek North was highlighted in the NYRCR as an important component and improvement adjacent the Howard Beach Community. The following projects were highlighted in the NYRCR Plan (Figure 4) (GOSR, 2014).

    a. Upper Spring Creek (or Spring Creek North) Ecosystem Restoration (Area C- Figure 3) Recommendations included enhancement of this CAP restoration project by the NYC Parks to include berms and other coastal protection measures to manage flood risk. Any complementary CSRM features would be examined during the Design & Implementation (D&I) Phase which would be funded by NY Rising and NYC Parks. Up to $250,000 has been allocated for design of features at locations where flooding occurred in Lindenwood. The NYRCR Plan highlighted that this project would restore and enhance 11 acres of salt marsh and 16 acres of coastal forest and scrubland. The restoration would excavate the fill and significantly increase ecosystem function along one of the few semi-natural tributaries remaining on Jamaica Bay's north shore. These combined efforts of restoring the park would create new passive open space and allow for environmental education. In addition, these efforts would increase storm water capture and reduce runoff to the combined sewer system.

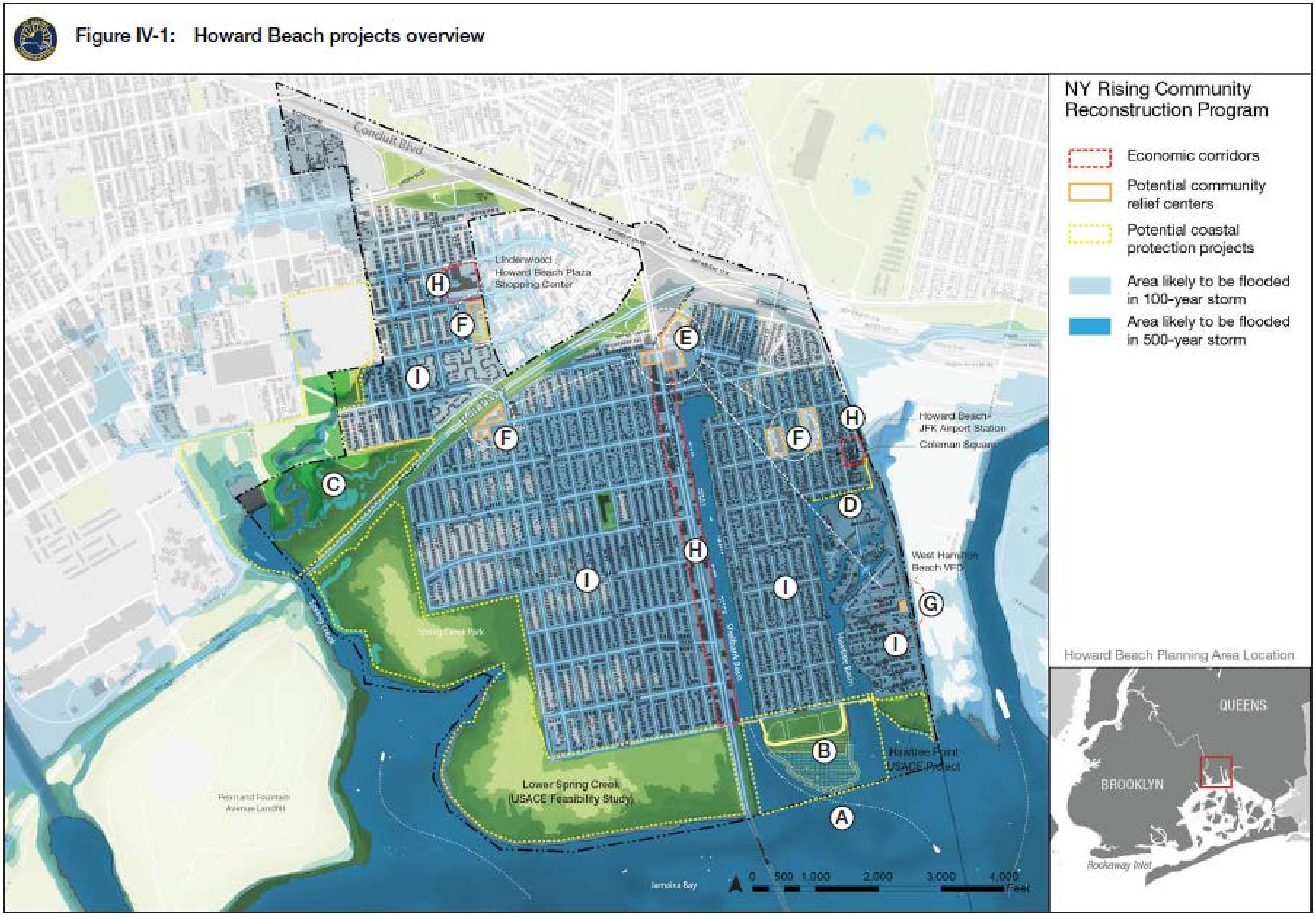


Figure 4. New York Rising Community Reconstruction Program Recommendation

b. Howard Beach Comprehensive Coastal Protection Study (Area A: Figure 3): Study the cost and feasibility of tide gates at Shellbank and Hawtree Basins and a berm at Charles Memorial Park. Protection measures will be integrated with the Spring Creek (South) HMGP project and the East Rockaway to Rockaway Inlet-Jamaica Bay Reformulation Study. Alternatives for the coastal storm risk management measures (including tide gates, berms, levees, floodwalls, Natural/Nature Based Features (NNBFs) at Shellbank Basin, Hawtree Basin, and Charles Memorial Park will be evaluated in order to protect the Howard Beach community from flooding. The tide gates and the berm would connect with flood risk management features in Spring Creek South. The feasibility study would analyze the steps needed to supplement the flood risk management addressed by the **Upper Spring Creek (North)**, Lower Spring Creek (South), and Hawtree Point projects.

3) Hudson Raritan Estuary (HRE) Feasibility Study: Spring Creek North restoration has also been highlighted as a restoration opportunity within the Jamaica Bay Planning Region of the updated HRE Comprehensive Restoration Plan (USACE, 2016). In addition, the Jamaica Bay Marsh Islands (south), Hawtree Point (east), Fresh Creek (west), Dead Horse Bay, Brant Point, Dubos Point, Bayswater Point State Park may be recommended as restoration opportunities for near-term construction as part of the HRE Draft Integrated Feasibility Report and Environmental Assessment (USACE, 2017).

4) East Rockaway to Rockaway Inlet-Jamaica Bay Reformulation Study: The Reformulation Study has evaluated the feasibility of CSRM measures (i.e., Perimeter Plan along the shoreline and Hurricane Barrier at the entry of Jamaica Bay) to protect the communities within Jamaica Bay. The Spring Creek North restoration was integrated into the evaluation of a perimeter plan. However, the Hurricane Barrier was identified as the Tentatively Selected Plan (TSP) for the Study in March 2016 (USACE, 2016). Therefore, actions at Spring Creek North, Spring Creek South and NY Rising efforts will be important for providing ecosystem restoration and secondary CSRM benefits for the Howard Beach Community during low level storm events.

1.4. NON-FEDERAL SPONSOR

All Section 1135 projects require a non-federal sponsor to provide 25% of the cost of initial construction and 100% of the cost associated with operation and maintenance (O&M). NYC Parks is the non-federal sponsor for the Spring Creek ecosystem restoration project. The NYC Parks has been a committed sponsor for other successful efforts in Jamaica Bay including Gerritsen Creek Ecosystem Restoration and Plumb Beach Shoreline Stabilization efforts.

Part 2 – Project Purpose, Need and Scope

2.1. PURPOSE AND NEED

The purpose of the Spring Creek ecosystem restoration project is to: 1) rectify the adverse impacts associated with the historic dredge and fill activities executed as part of constructing and maintaining the Jamaica Bay navigation channel; and 2) address the associated indirect ecosystem degradation within the Spring Creek Study Area. The goal of this project is to contribute to National Ecosystem Restoration (NER) by restoring degraded ecosystem structure, function, and dynamic processes to less degraded conditions. This goal would be accomplished by excavating and re-contouring uplands to intertidal elevations, removing invasive plant species, and replanting with native species. The overall project purpose is to improve the environmental quality of Spring Creek and its associated salt marshes as part of the overall Jamaica Bay system.

The Spring Creek ecosystem is an integral part of Jamaica Bay, which has been targeted for special protection and restoration in EPA's Comprehensive Conservation and Management Plan (CCMP) for the New York/New Jersey Harbor Estuary Program (HEP), prepared under the authorization of National Estuary Act by the USEPA in 1987. In a report entitled *Significant Habitats and Habitat Complexes of the New York Bight Region* (USFWS, 1999), Jamaica Bay was recognized as a coastal habitat deserving special protection in the form of preservation and restoration of habitats that contribute to sustaining and expanding the region's native living resources. Jamaica Bay was singled out as a highly productive habitat for a variety of fish and wildlife species. Of particular note are certain species of fish that breed in the area and/or use the area as a nursery for juveniles, migratory waterfowl that overwinter in the area, and migratory birds (*i.e*., shorebirds, raptors, waterfowl, and land birds) that stop-over in the area during fall and spring migrations.

The City of New York, recognizing the importance of the bay and its watershed, finalized a Jamaica Bay Improvement and Management plan in 2012. The plan recommends that the remnant wetland and grassland areas in Jamaica Bay be restored and protected, and invasive species (*e.g*., common reed) be controlled. The New York City Audubon Society identified the existing undeveloped habitats within Jamaica Bay as crucial to the area's continued use by important fish and wildlife species (NYC Audubon Society, 2003).

The Spring Creek Ecosystem Restoration Project will further the goals of HEP's CCMP by preserving and restoring ecologically important habitat, and restoring and maintaining communities that support an optimum diversity of living resources such as fish, wildlife, and plant communities. The bay itself has also been recognized as a major migratory stopping area on the northeast flyway.

Although the size of the area involved in the proposed Spring Creek Restoration project is only a fraction of the wetland acreage that historically existed in the region, the effect of its restoration on the ecological resources of the degraded Jamaica Bay system will be supplemented by other restoration projects recently completed in the bay and its tributaries, including five marsh islands in the bay proper, totaling over 160 acres of restored marsh and restoration of 18 acres of marsh and 23 acres of coastal grassland in Gerritsen Creek, a tributary to the bay some 5 miles west of Spring Creek.

The Spring Creek North restoration will also advance the overall restoration goals and Target Ecosystem Characteristics (TECs) outlined in the HRE Comprehensive Restoration Plan (CRP) (USACE, 2016). The Spring Creek North restoration advances the following applicable HRE CRP targets:

- Wetlands: Create and restore coastal and freshwater wetlands at a rate exceeding the annual loss or degradation to produce a net gain in acreage;
- Habitat for Waterbirds: Restore and protect roosting, nesting, and foraging habitat (e.g., inland trees, wetlands, shallow shorelines) for long-legged wading birds;
- Coastal and Maritime Forests: Create a linkage of forests accessible to avian migrants and dependent plant communities; and
- Habitat for Fish, Crab and Lobsters: Create functional related habitats in each of the eight regions of the HRE.

This project supports cumulative improvements of the bay's resources in conjunction with the implementation of other restoration sites in Jamaica Bay under ongoing *Jamaica Bay Navigational Channels and Shoreline Environmental Surveys Report* (USACE, 1997) and the Hudson Raritan Estuary Restoration Feasibility Study's Draft Integrated Feasibility Report and Environmental Assessment (USACE, 2017). Furthermore, the NYCDEP is proposing improvements to its wastewater treatment facilities that discharge into Jamaica Bay and its sewer overflow abatement system to improve the overall water quality of Jamaica Bay. These improvements, in concert with those proposed for Spring Creek, have the potential to successfully play a vital role in improving the environmental quality of the region.

Part 3 – Existing Conditions

In the early 1900's, the salt marsh community of Spring Creek was part of the extensive coastal wetland community of Jamaica Bay, known for the abundance and diversity of its shellfish and its ecological importance as a nursery and feeding ground for countless species of birds and fish. The Jamaica Bay area is a designated U.S. Fish and Wildlife Service and New York State Department of State Significant Habitat and Habitat Complex. Jamaica Bay is of regional importance due to the location and rich food resources found within the complex. Over the past century, the salt marsh community at Spring Creek has been altered by dredging and filling activities, such as the construction and maintenance of the Jamaica Bay federal navigation channel and illegal dumping of the remaining tracts of wetland acreage. Specifically, these impacts reduced the area's ability to provide habitat for numerous species of migratory and nesting birds, mammals, reptiles, fish, and invertebrates, resulting in a significant disruption to the area's entire interconnected coastal ecology.

A literature review and field investigations were undertaken to characterize the current conditions of the Spring Creek project site. The field investigations were initiated over the winter of 2002 and continued through the summer of 2003. They involved qualitative and quantitative characterization of the current conditions in order to evaluate the potential for restoring a tidal salt marsh system. Data collected under the Jamaica Bay Ecosystem Restoration (JABERRT) project was also utilized for site characterization. JABERRT data were collected under the direction of the National Park Service (NPS). In some cases, data were not collected at the actual project site, but instead at an adjacent, comparable potential restoration site to the south. Existing site conditions are described below.

More recently the NYC Parks has conducted an evaluation of the Spring Creek North Study Area during 2010 through 2015 to determine if there have been any significant changes to the
Spring Creek salt marshes since 2004. The NYC Parks monitoring activities have confirmed that the conditions on-site from 2004 are still valid. In addition, the USACE and NYC Parks conducted site visits in fall of 2014 and winter 2015 and qualitatively assessed site conditions have not changed as outlined below.

3.1. TOPOGRAPHY

The project area was surveyed during the spring and summer of 2003 to provide better resolution of the area's current topography and bathymetry. The topography and bathymetry was produced by surveying along multiple profile lines across the area. Twenty-four profiles were surveyed at 100-foot intervals along Spring Creek and twenty-one profiles were surveyed at 100-foot intervals along Ralph's Creek. The landward portion of the survey was completed using land-based surveying techniques, while land under water was surveyed via watercraft-based techniques.

For the optimization of the selected plan, (discussed in Section 5.5) data from the above survey was combined with data derived from a LIDAR Survey that took place in November 2012, immediately after Superstorm Sandy. The LIDAR provided higher resolution data for all land areas and the 2003 survey provided needed channel cross-sections and near-shore bathymetry.

The Spring Creek project area had been broken down into four distinct restoration areas Southwest, Southeast, Northeast, and Northwest Quadrants (Figure 5). The highest elevations within these four areas exist due to historic land filling. Slightly sloping, low marsh and high marsh habitats dominate the southern and eastern portions of the project area. Marsh habitat elevations in the western portion of the project area range from (–) 5.1 feet in the channel to 2.8 feet on the marsh

The *southwest quadrant* of the project area is bound by Spring Creek to the east, Spring Creek Auxiliary Waste Water Treatment Plant and Old Mill Creek to the west, and the existing access road to the north. The elevations in this area range from (–) 5.1 feet within Spring Creek to 11.9 feet on the filled portions of the restoration area. The average slope in the filled portions of the southwest area is approximately 21%. In general, all land and wetland surfaces in this area slope towards Spring Creek and Old Mill Creek.

The *southeast quadrant* of the area is bound by the sewer easement to the north, Spring Creek to the west, and Ralph's Creek to the east. The elevations in this area range from (–) 5.1 feet in Spring Creek and (–) 4.0 in Ralph's Creek to 15.6 feet at the top of the fill. The marsh plain generally occurs between elevations 1.8 and 2.6. The average slope in this area is approximately 6%. In general, the land and wetland surfaces in this area slope towards Spring Creek and Ralph's Creek. In the southeastern area, slightly sloping, low marsh and high marsh habitats dominate the portion along Spring Creek and the area along Ralph's Creek.

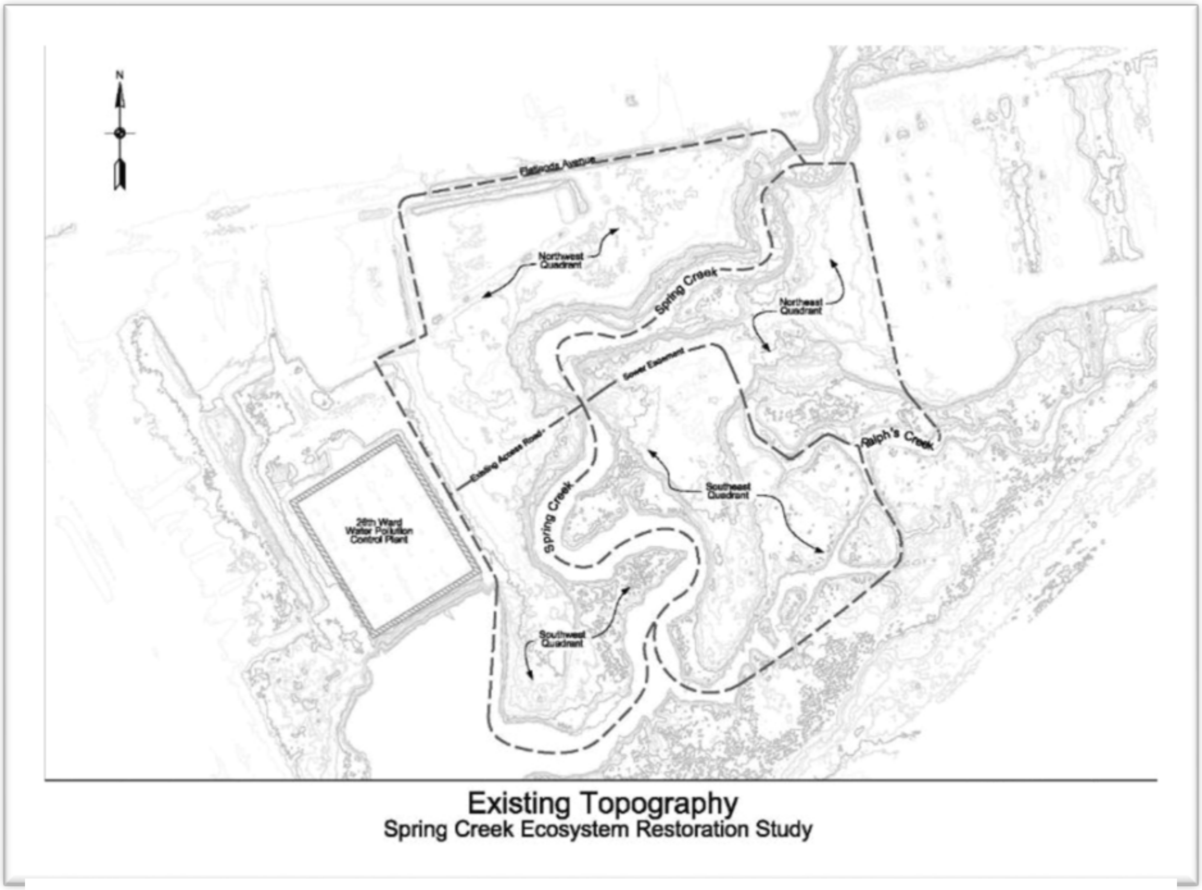


Figure 5. Existing Topography

The *northeast quadrant* is bound by the sewer line easement to the south, Spring Creek to the north, and the upland area to the east. The elevations in this area range from (–) 2.7 feet within Spring Creek to 19.4 feet in the uplands. The average slope in this area is approximately 15%. In general, the land slopes towards Spring Creek. The land slopes steeply up to the Parks access road from Flatlands and is dominated by disturbed vegetation and fill. About 2 to 3 feet along Spring Creek is dominated by fringing low and high marsh.

The *northwest quadrant* is bound by Flatlands Avenue to the north, Spring Creek to the east, and the 26th Ward Water Pollution Control Plant to the west. The elevations in this area range from an average of (–) 2.7 feet within Spring Creek to 14 feet in the fill area. The portion nearest Flatlands Avenue possesses higher elevations averaging 25 feet. The average slope in this area is approximately 5%. In general, the land slopes towards Spring Creek. The land slopes steeply up to the compost facility next to Flatlands Avenue and is dominated by disturbed vegetation and fill. Along Spring Creek, low and high fringe marsh, occur between elevations 2.0 and 3.0 NAVD88.

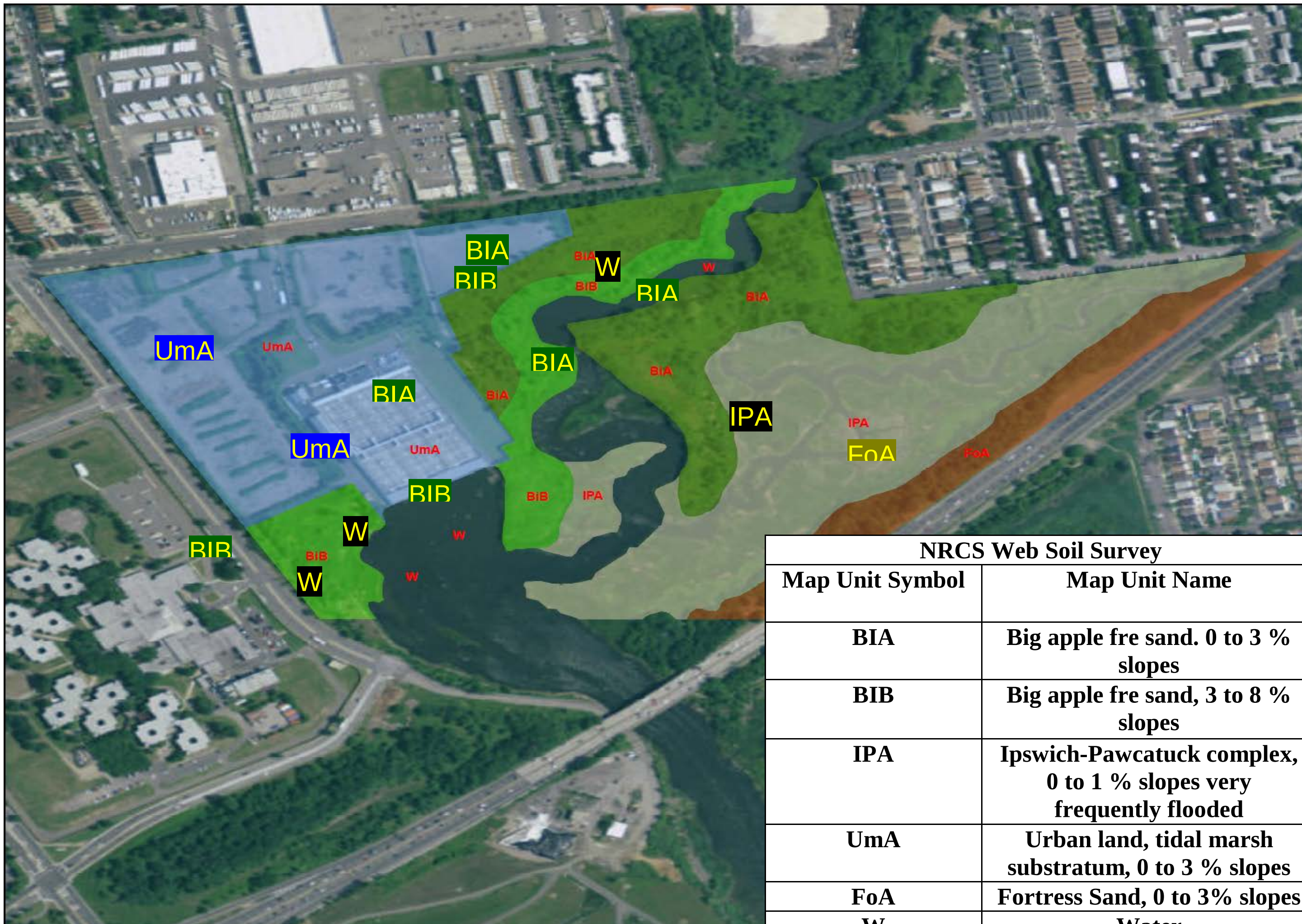
3.2. Soils

A soil map and descriptions were obtained for the Spring Creek site from the National Resources Conservation Service (NRCS) Web Soil Survey (2016) and are presented in Figure 6. Based on the NRCS map, the site contains four mapped units of soil complexes.

The majority of the site is mapped as the Ipswich-Pawcatuck-Matunuck mucky peat complex. These soils are very poorly drained, formed in sandy or organic sediments, have thin (8-16 inches) to thick (>51 inches) organic horizons, and are subject to daily salt water flooding. They occur in the salt marshes on site.

The northwestern portion of the site is mapped as Urban Land, Tidal Marsh Substratum, and 0-3 % slope. This complex is composed of well drained soils, with a very low capacity to transmit water. The complex is primarily formed of asphalt over human-transported material of cement and very gravely sand. They occur in human created/modified landscapes in a thick mantle of human transported soil material mixed with construction debris, or where a thick layer of construction debris has been placed over natural surfaces, or where loamy fill has been placed over or intermingled with demolished construction debris. The upland, non-paved areas adjacent to the waterways are primarily Big Apple Fine Sands of 0-3% and 3-8% slopes. These soils are primarily composed of sandy dredge material and have a moderately to very high capacity to transmit water.

The final complex, Fortress Sands, 0-3% slopes, are located within the southern part of the area that borders the Belt Parkway. Fortress Sands are primarily composed of sands dredge deposits and are located in anthropogenic fill areas near coastal waterways. These soils are moderately well drained with a loamy fine to coarse sand texture.



NRCS Web Soil Survey	
Map Unit Symbol	**Map Unit Name**
BIA	**Big apple fre sand. 0 to 3 % slopes**
BIB	**Big apple fre sand, 3 to 8 % slopes**
IPA	**Ipswich-Pawcatuck complex, 0 to 1 % slopes very frequently flooded**
UmA	**Urban land, tidal marsh substratum, 0 to 3 % slopes**
FoA	**Fortress Sand, 0 to 3% slopes**
W	**Water**

Figure 6. Spring Creek North NRCS Soil Map

3.2.1. Geotechnical

Subsurface exploration was conducted at Spring Creek utilizing soil borings and geoprobes at several locations in the project area (Figure 7 and Figures in Appendices F and G). The purpose of the investigation was to determine the geotechnical properties of the soils in the site and to determine the extent of placed debris in the project area. A Geotechnical report can be found in the engineering appendix (G).

3.2.1.1. Site History

Spring Creek is located at the northern edge of Jamaica Bay, west of JFK International Airport, and north of the Belt Parkway (see Figure 1 for location map). Historically, the creek was part of a tidal wetland draining into Jamaica Bay. Anthropogenic activities have degraded the wetland over time. Municipal waste was placed in the area approximately forty-five years ago. Demolition debris has also been disposed of in the area of the creek. The placed material has resulted in a narrowing of the historic creek channel and has displaced the wetlands.

3.2.1.2. Subsurface Exploration Plan

Soil borings were collected from several locations within the study area during 4 sampling events (Figure 7) (Appendices F and G). A derelict bridge was used as a point of reference to plan the drilling. Drilling was performed north of the derelict bridge, along the edge of the creek every 200 feet. A second area, south of the first, was also explored. Several samples were taken at a mound area in the middle of the project area. Soil in a municipal placement area was also sampled by geoprobe along with an area west of the mound area.

3.2.1.3. Subsurface Exploration Results

Spring Creek

Five borings were executed along Spring Creek at locations designated SCSC 1-5 (See appendix F). Debris was found to a depth of between 10 and 14 feet (10-14') at the five sample locations. The debris consisted of wood, glass, slag, metal, and rubber. Below the debris, natural soil was found. The first indication of natural soil below the debris was the presence of a meadow mat material consisting of organics and clay. Below the organic clay layer there is a layer of gray sand occurring between seventeen and eighteen feet (17-18'). No Shelby Tubes were taken in the clay layers.

Mound Area

There were six borings conducted in the mound area of the project at locations designated SCMA 1-6 (Figure 3 in Appendix F). The borings were augered to a depth of ten to fourteen feet (10-14') and then SPT sampling was conducted. Generally, sand was found in the mound area (borings 1, 2, 3, and 5), the northern-most boring, boring 4, had a clay layer at the top and then sand. Boring 6, separated and to the west of the other five borings also had sand and no clay layers.

Placement Area

Geoprobes were conducted at the municipal placement area at locations designated SC2B 1-9 (Figure 2 in Appendix F). The placement area has packed gravel placed over soil, approximately four feet (4') deep. The debris includes material such as ash, glass, and metal. Natural soil was found ten to eighteen feet (10-18') below the ground surface, indicated by the presence of meadow mat. Below the meadow mat, a layer of medium to coarse grained sand was found.

West Area

Several geoprobes per site were taken west of the Mound Area at locations designated SCSC-5, SCM-9 and 10 on (Figure 1 of Appendix F). A layer of asphalt, two feet deep, covers the area. The geoprobes went to a depth of between seven and sixteen feet (7 and 16'), finding fill material for most of that distance. Fill included glass, metal, wood, cinder, roofing debris, and coal. Meadow mat was found at SC2B 1 (Figure 2, Appendix F) and natural soil was not found at any other probe location.

3.2.2. Hazardous, Toxic, and Radioactive Waste Sampling/Analysis

An HTRW investigation (Phase I) was conducted according to ER 1165-2-132 Hazardous, Toxic, and Radioactive Waste Guidance for Civil Works projects. Sub-surface soil characterization of the site took place in four (4) sampling events to determine the areal and vertical extent of potentially contaminated soils and for geotechnical analyses. The areas sampled coincide with proposed excavation locations as part of an overall plan to restore the creek to past environmental condition. To the extent feasible geotechnical and contaminant sampling was conducted at the same locations. A full description of the areas sampled, procedures employed and results can be found in Appendix F. Appendix F presents chemical concentrations measured in all samples collected in 2002 through 2003 and were compared to NYSDEC Soil Cleanup Objectives (SCOs) (established in 1994) to identify Contaminants of Potential Concern (COPCs). Chemical concentrations were also compared to current NYSDEC SCOs (6 NYCRR Environmental Remediation Programs Part 375-6.8(a) Unrestricted Use and Ecological Resources SCOs- effective 2006 and CP-51 Soil Cleanup Guidance [date issued: 10-21-2010]) and Saltwater Sediment Guidance Values (NYSDEC, 2014) and the COPCs remain unchanged. The COPCs for each sampling event are summarized in Table 1.

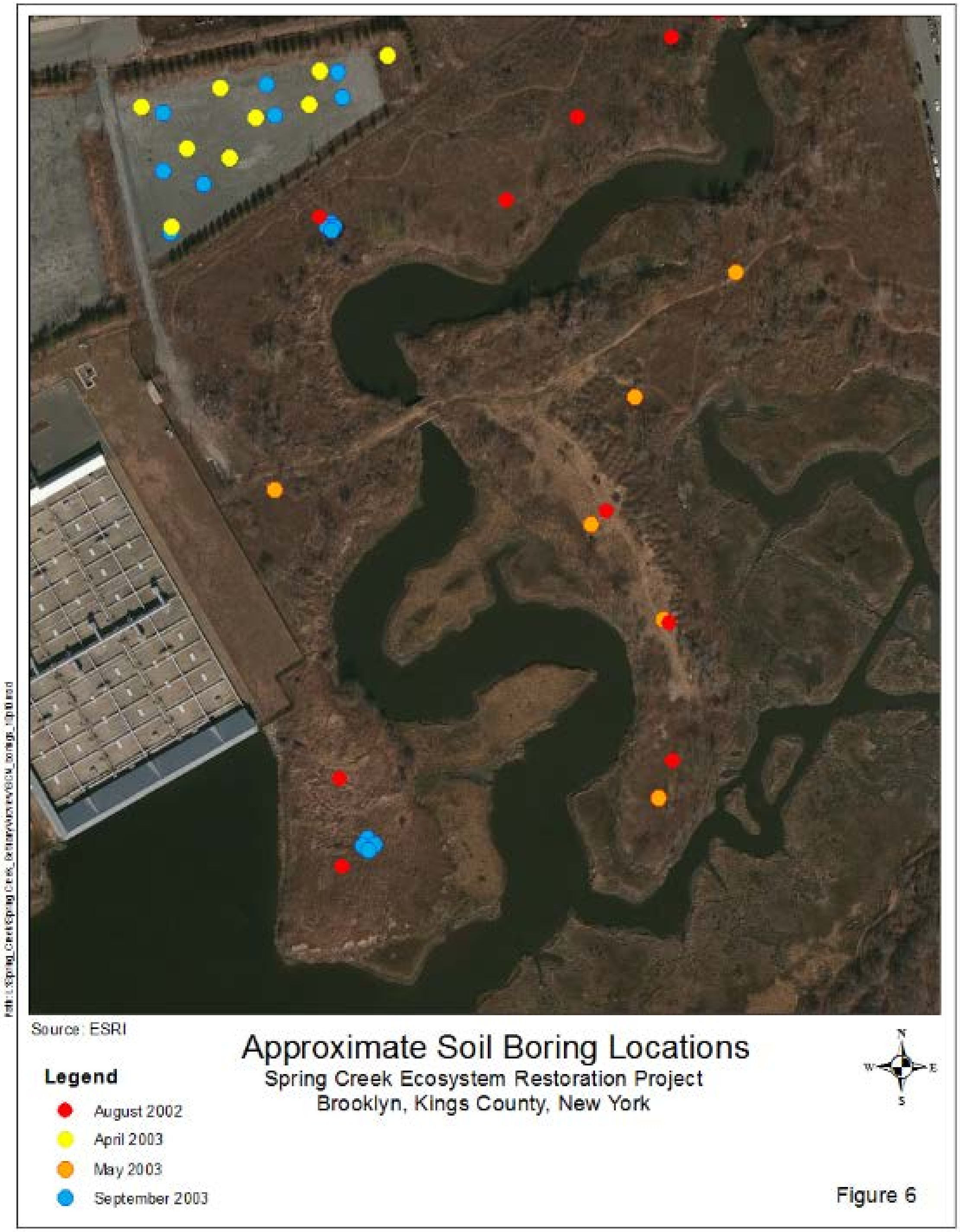


Figure 7. Approximate Soil Boring Locations

Table 1: Analysis and Contaminants of Potential Concern

Sampling Event	# Boring Samples (ft bgs)	Locations (see Figure 7)	Analysis	Contaminants of Potential Concern
August 2002	6 (12-18 ft)	Wetlands/North (see Figure 1 in Appendix F)	Volatile Organic Compounds (VOA) + 15, Semi-volatile organic compounds (SVOCs) + 25, Pesticides/Polychlorinated biphenyls (PCBs), Resource Conservation and Recovery Act (RCRA) Metals, pH, Percent (%) solids.	Metals (Hg, As, Ba, Cd, Cr, Pb, Se)
	5 (0- .5ft)	“The Mound” (Wetlands/South) (See Figure 1 in Appendix F)		SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b/k]fluoranthene, indeno[1,2,3-cd]pyrene) and Metals (Hg, As, Ba, Cd, Cr, Pb, Se)
Dec 2002	3	Wetlands (SC-10, SCM-9 and SCM-10) (Figure 1, Appendix F)	Lead- Toxicity Characteristic Leaching Procedure (TCLP)	NONE (no exceedences)
April 2003	8 (8-12 ft) (16-18 ft) (18-20 ft)	North Upland/West area [below 4ft of asphalt] (Figure 2, Appendix F)	VOCs, Pesticides/PCBs, SVOCs, Total Petroleum Hydrocarbons (TPHC), RCRA metals, pH	Metals (As, Ba, Cd, Cr and Pb)
May 2003	11 (13-26 ft)	“Mound Area” (Figure 3, Appendix F)	VOCs, Pesticides/PCBs, RCRA Metals and TCLP	NONE
September 2003	8 (7-16 ft)	North Upland (Figure 4, Appendix F)	SVOCs and RCRA Metals, pH % solids	Metals (As, Ba, Cd, Cr, Pb, Hg, Ag)
	10 (6-8 ft)	Mound Area and North Upland (Figures 5A & 5B, Appendix F)	RCRA Metals and TCLP Analysis	Metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)

Table 1 identifies the COPCs on site that reflect areas of either wetland or upland restoration actions. The soil within wetland restoration areas (e.g., “the mound”) would be excavated and used beneficially and placed in upland areas (e.g., North Upland) to create upland maritime habitat. Although COPCs (primarily metals) did exceed NYSDEC Unrestricted Soil Cleanup Objectives, soils were not considered Resource Conservation Recovery Act (RCRA) Hazardous Waste from Toxicity Characteristic Leaching Procedure (TCLP) analysis. 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 District has had ongoing discussions with NYSDEC about restoration at Spring Creek North and adjacent similar restoration sites within Jamaica Bay (e.g., Spring

Creek South). A more detailed HTRW evaluation will be conducted during the D&I Phase to determine the need for this clean growing media. If additional actions are required following further HTRW investigations during the D&I Phase, the local sponsor (NYC Parks) would be responsible for 100% of the costs. 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.

3.3. WATER RESOURCES

3.3.1. Regional Surface Watershed and Groundwater Resources

The Spring Creek site lies within the Southern Long Island watershed, contained within the Coastal Plain Physiographic region. Surficial deposits on Long Island are glacial in origin with morainal deposits to the north and outwash deposits to the south. The surficial deposits form an 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. Within Kings and Queens Counties, the aquifers are not utilized as the sole or principal source of drinking water; however, the geographic boundaries of Kings and Queens Counties are recharge zones for the aquifers underlying the southeastern portion of Queens County. There are no documented freshwater springs in the area. Average annual precipitation is approximately 42 inches and, in general, is evenly distributed throughout the year.

3.3.2. On-Site Surface Water

The project site is influenced by both tidal and freshwater inputs. Spring Creek and Ralph's Creek are both brackish water systems tidally connected to Jamaica Bay via Old Mill Creek and affected by precipitation and surface water runoff from areas north of the project site. Spring Creek meanders through the site, flowing from the north-northeast to the south southwest into Old Mill Basin, constricted in the middle by culverts under the NYCDEP sewer line transecting the site at the position of 157th Ave. Ralph's Creek is a tributary to Spring Creek, wholly contained within the project site flowing generally from east to west. The low marsh fringes of the 47-acre site are inundated twice daily by the tides conveyed by Spring Creek and Ralph's Creek, while the high marsh areas receive tidal flushing only during the bi-monthly lunar high tides. The project site is also subject to freshwater discharge events from the Spring Creek Auxiliary Waste Water Treatment Plant (AWWTP) Facility. The function of the Spring Creek AWWTP Facility is to capture Combined Sewer Overflows (CSO) from tributary drainage areas. These events are associated with periods of heavy precipitation and runoff, and often include episodic discharges of primarily stormwater mixed with untreated sewage. The remaining areas of the site, located at elevations outside the tidal range, receive inputs primarily from direct precipitation and overland flow. These freshwater discharge events are not expected to impact the success of the restoration and increase the presence of invasive species (personal communication with John McLaughlin, NYCDEP; April 2017). The District will monitor the effects of freshwater input on the restored marsh as part of the monitoring and adaptive management plan (Appendix J) through bi-annual soil salinity sampling.

Due to Spring Creek's urban setting, it was not feasible as part of the FR/EA to calculate the actual acreage of the site's tributary area. Surface water is routed in various directions via an extensive, underground storm water management system. However, it is estimated that approximately 229 acres, in the immediate vicinity (including the Spring Creek site), are likely tributary to the existing marshes as well as Spring and Ralph's Creeks.

3.3.3. Tidal Influences

From April 11, 2003 to July 19, 2003, tidal data was collected in three areas of the project site: Spring Creek North, Spring Creek South, and Ralph's Creek. The tide data was collected using a WATERLOG Model DH-21 Submersible Logger Pressure Transducer, which consists of a surface unit and subsurface probe mounted to a fixed structure or piling. Readings from the gauges were automatically taken at 15-minute intervals over a period of three months. The locations of each tide gauge are shown in Figure 8. There appears to have been a problem with the Ralph's Creek tide gauge data and it was not used.

The high tides and low tides from these gauges were used to estimate the following tidal datum relative to NAVD 88.

Mean Higher High Water (MHHW): The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch.

Mean High Water (MHW): The average of all the high tides (maximum elevation reached during each tidal cycle) over the observation period

Mean Tide Level (MTL): The average of MHW and MLW.

Mean Low Water (MLW): The average of all the low tides (minimum elevation reached during each tidal cycle) over the observation period.

Mean Lower Low Water (MLLW): The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch.

Figure 8. Spring Creek North Tide Gauge Locations

The tidal datum estimated for Spring Creek gauges ("Spring Creek" and Flatlands") were compared to the tidal datum estimated from data collected in the vicinity of the project site in earlier studies and epoch-based datum from the National Oceanic and Atmospheric Administration – National Ocean Service (NOAA-NOS) station located at Sandy Hook, New Jersey. Table 2 represents the tidal datum for Spring Creek. The surrounding tidal datum is provided in Table 3. The locations of the neighboring tide gauges are presented in Figure 9. It should be noted that tidal datum based on observed data may be best used to represent current physical processes, whereas epoch-based datum are best used for long term considerations.

Table 2. Average Tidal Datum (Feet) for Spring Creek and Ralph's Creek (NAVD88)

Gauge Location	**#1 Spring Creek**	**#3 Flatlands**
Date Recorded	April 2003- July 2003	Oct 2003- Nov 2003
MHHW	2.72	2.70
MHW	2.69	2.66
MLW	-1.70	-1.28
MLLW	-1.70	-1.32
MTL	0.49	0.69
Tide Range	4.39	3.94

Note: #2 Ralph's Creek Datum were not usable and are not presented.

The mean tide data collected from the two usable on-site gauging stations, provided in Table 2, demonstrate that the site possesses three different tide ranges and can be divided into three distinct hydrologic areas: Spring Creek South, which is the reach of Spring Creek located south of the culvert downstream to its confluence with Mill Basin; Ralph's Creek which encompasses Ralph's Creek and its surrounding tidal marshes to its confluence with Spring Creek, and Spring Creek North which includes the entire reach of Spring Creek located north of the culvert.

MHW and MHHW estimated from the Spring Creek South and Spring Creek North tide gauges were comparable to the MHW and MHHW estimated from the closest tide gauge, located in Spring Creek during the JABERRT study. However, the MLW and MLLW estimated from the Spring Creek South gauge was higher than the corresponding datum estimated from the observed and epoch-based datum at the neighboring gauges and reference station. This is likely due to the placement of the tide gauge in a shallow area where extremely low tides could not be recorded. Since results for MHW and MHHW from the surrounding areas were comparable to Spring Creek South, the results from the surrounding areas were used in the analysis. The effect of sea level rise between the time of data collection (2003) and present day will also be considered during the D&I Phase.

In summary, a comparison of the tidal datum from the Spring Creek gauge with neighboring tide gauges indicates that the tidal datum estimated for these areas are within acceptable levels and can be used for scientific and engineering purposes such as analysis and design.

3.3.4. Coastal Processes

The coastal processes that characterize the Spring Creek project area include the interaction of waves, tidal currents, and coastal sediment transport. Each of the processes is described below.
Wave conditions at Spring Creek are generated primarily by wind. Wind generated waves are estimated to be minimal due to the small fetch (width) of Old Mill Basin and the creeks. While waves can be produced by boat or jet-ski activity (wakes), navigation near the project site is limited to small vessels such as canoes, or Jon boats, which do not typically produce waves. Therefore, this type of wave is not considered to be part of the coastal processes at the project site.

Tidal currents were not measured as part of this project; however, field observations indicate the currents are minimal. The marsh is located on two tributaries upstream of Old Mill Creek, so tidal currents are limited by the presence of the northern boundary of the creeks. It is presumed that normal tidal currents are low.

Coastal sediment transport is observed to be limited to the eroding marsh edge, which breaks off in chunks as the organic material washes into the creek when marsh grass root masses are broken off. Further evaluation and Salt Marsh Trend Analysis conducted by NYC Parks indicates erosion has occurred and will continue along Ralph's Creek.

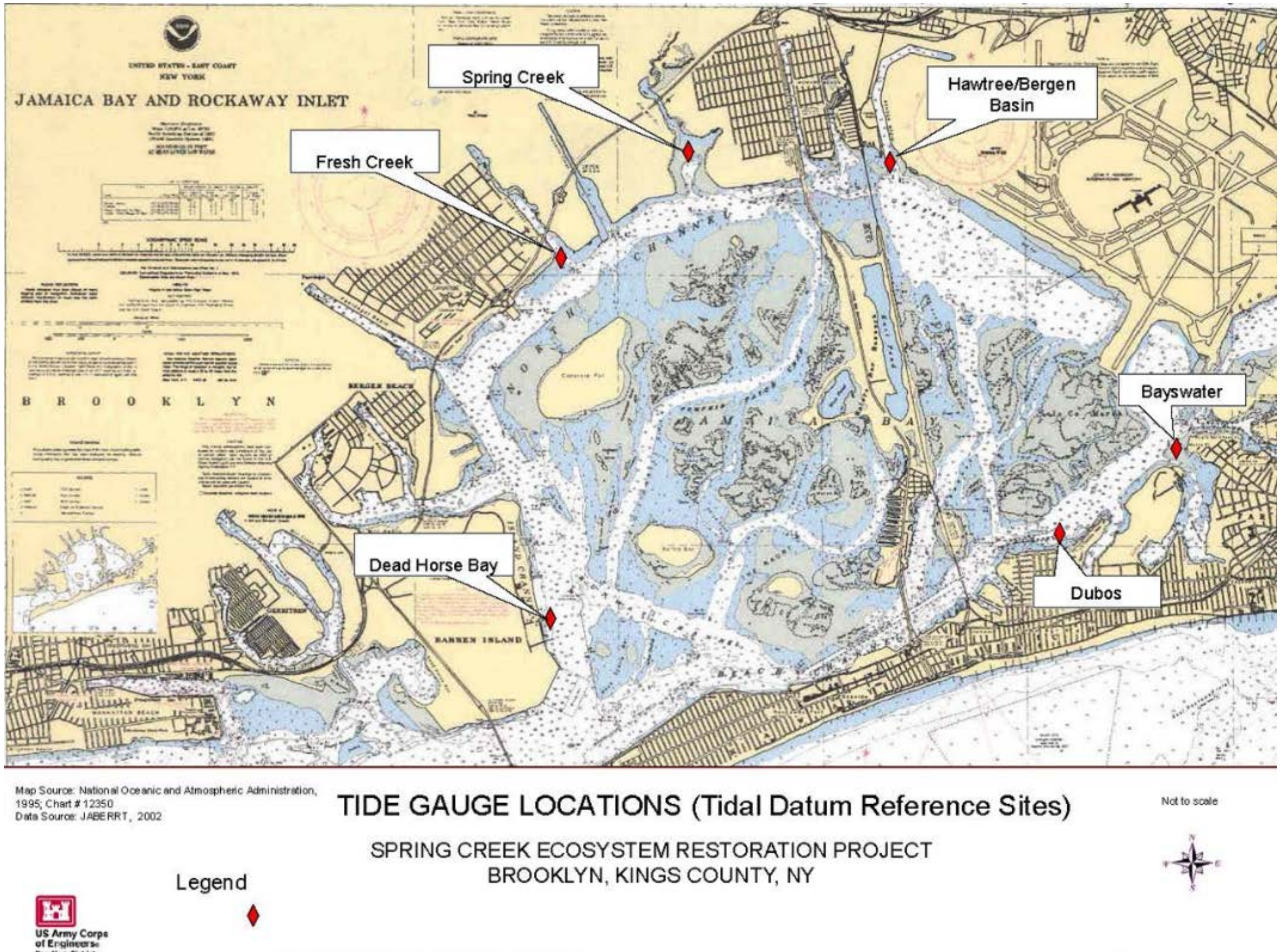


Figure 9. Jamaica Bay Reference Tide Gauge Locations

Table 3. Average Tidal Datum (Feet) for The Surrounding Area

	Jamaica Bay Ecosystem Restoration Sites*									Reference Station
	Dubos	Bayswater	Hawtree/ Bergen Basin	Spring Creek	Fresh Creek N	Fresh Creek S	Canarsie Pier	Dead Horse E	Dead Horse I	Sandy Hook
Date Recorded	Oct – Nov 2001	Oct – Nov 2001	Oct –Nov 2001	Oct – Nov 2001	Oct - Nov 2001	Oct - Nov 2001	Oct - Nov 2001	Oct - Nov 2001	Oct - Nov 2001	Epoch 1960-1978
MHHW	2.43	2.9	1.93	2.18	2.56	2.64	2.34	2.09	2.52	2.14
MHW	2.39	2.89	1.88	2.18	2.49	2.57	2.23	2	2.52	1.8
MLW	-2.21	-2.02	-3.12	-2.29	-2.19	-2.75	-3.27	-3		-2.86
MLLW						-2.84	-3.34			-3.06
MHWS	3.46	3.83	3.17	3.25	3.72	3.82	3.29	2.97	3.31	
MTL	0.09	0.43	-0.62	-0.05	0.15	-0.09	-0.52	-0.5		-0.53
Tide Range	4.6	4.86	5	4.47	4.67	5.32	5.5	5		

* From Table 2 Tide Gauge Data report for Jamaica Bay Ecosystem Restoration Sites.
* Please note that not all of the tide gauging stations referenced above are shown on Figure 8 and Figure 9.

3.3.5. Floodplains

The project area is located within the floodplain of Spring and Ralph's Creeks. The extent of the flood plain extends from the shoreline including the Belt Parkway, south of the project area, and extending to the residential neighborhood northeast of the study area.

The areas located within the channel of Spring Creek are designated by the Federal Emergency Management Agency as Zone AE, which is defined as an area inundated by 100-year flooding for which base flood elevations have been determined (Figure 10). Additional to the 100-year flooding zone, there are designated areas as Zone X500. These areas are located in the residential area adjacent to the project site to the northeast as well as within the project site where the Spring Creek AWWTP Facility is located. Zone X500 is defined as an area inundated by 500-year flooding or an area inundated by 100-year flooding with average depths of less than one foot

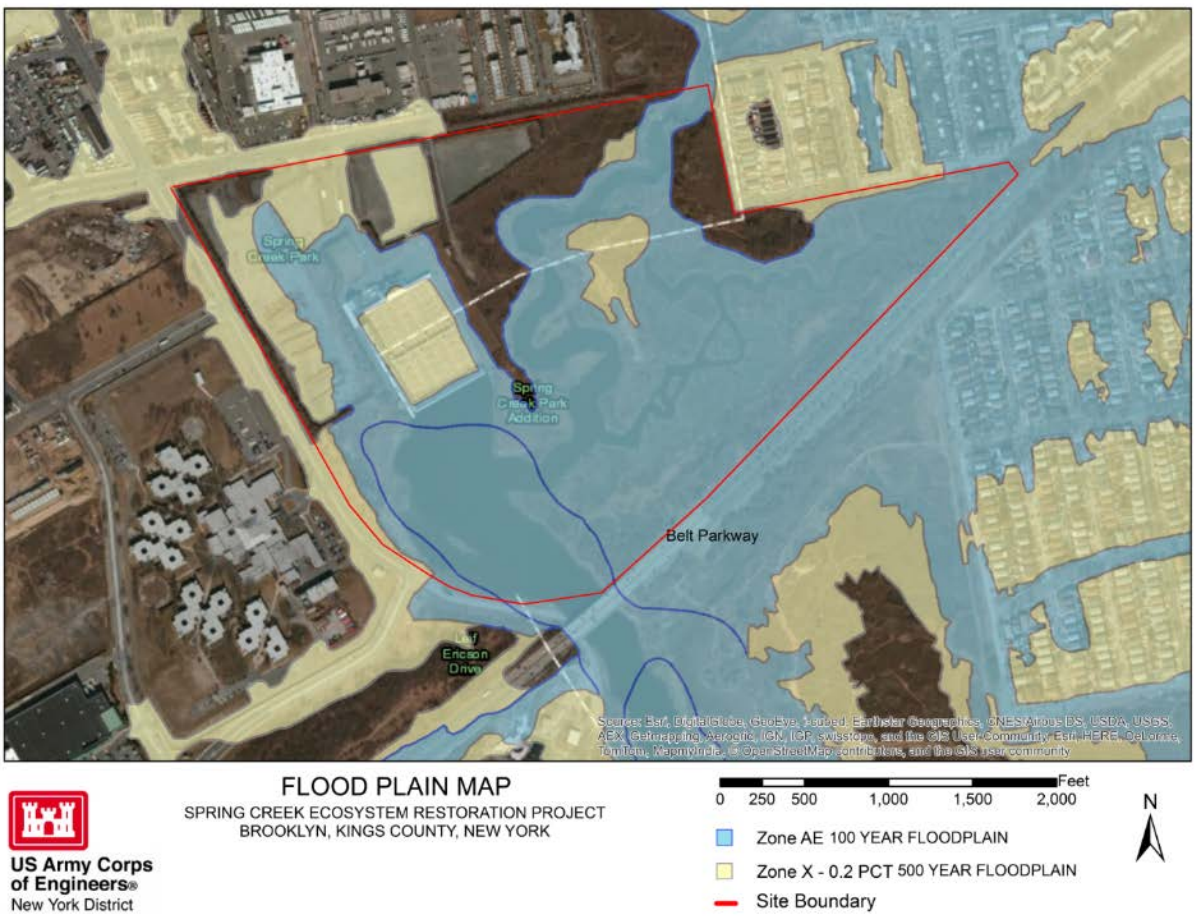


Figure 10. Flood Plain Map

3.3.6. Wetland Hydrology

Biological benchmarks (bio-benchmarks) were established in the summer of 2003, and then compared with the tidal analysis results described in Section 3.3.3 in order to determine the upper and lower elevations of each marsh habitat type. NYC Parks have confirmed this data remains valid through their field investigations since 2012. Low and high salt marsh vegetation typically grow within specific elevation ranges relative to the tide. Detailed maps of the vegetative communities located on the project site were developed using a combination of aerial photography and Global Positioning System (GPS) field data collection. These observations illustrate both optimal and marginal site conditions under which targeted restoration species thrive or decline. Biological benchmarks also indicate the elevations at which invasive and exotic species begin to out-compete target native species. A tidal wetland cross section developed from these data is presented in Figure 11.

The bio-benchmark locations are presented in Figure 12. The data utilized to develop the bio-benchmarks are presented in the separately bound Vegetation Survey Report. This data, in conjunction with the tidal analysis indicated in Section 3.4.3, identified a range of approximately -1.0 foot to 3 feet NAVD88 for all marsh areas, with optimal elevations for the establishment of low marsh vegetation between 1.6 feet and 2.6 feet NAVD88.

The two MHW elevations for Spring Creek North and Spring Creek South were identified at approximately 2.6 and 2.7 feet NAVD88. The MHW elevation typically functions as the transition point between the high and low marsh. On the low marsh side of the MHW mark, the marsh is inundated twice daily by the tides, while the high marsh side of this elevation is inundated only during the bi-monthly lunar high tides. The remaining areas of the site, located at elevations outside the tidal range, receive input primarily from direct precipitation and overland flow.

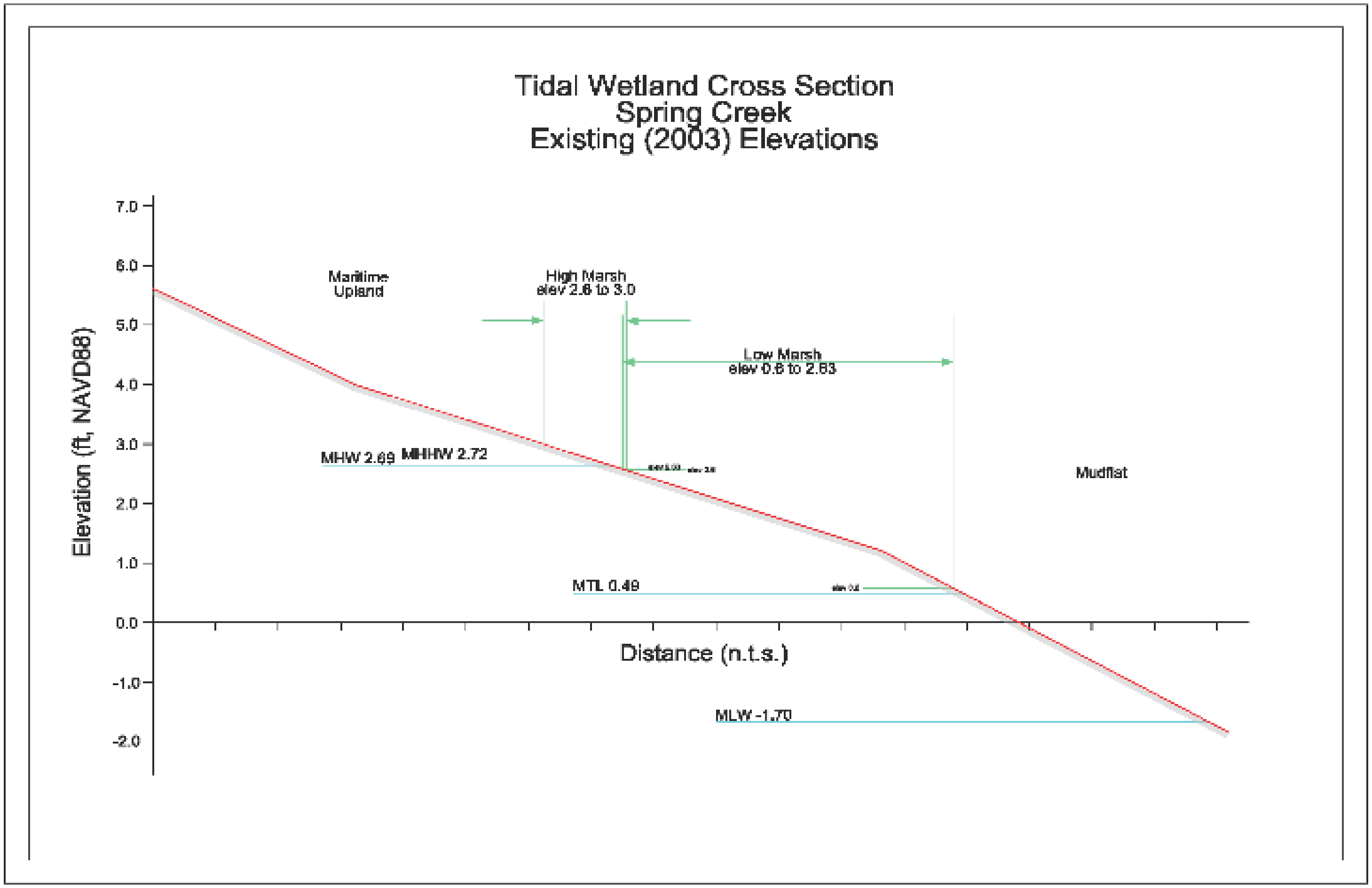


Figure 11. Existing Conditions Marsh Elevation

Figure 12. Bio-Benchmark Locations

Approximately 20 acres of wetlands currently exist at the project site, and include both high and low marsh, high marsh-scrub/shrub, and salt panne habitats (see Section 3.4.1). The bio-benchmark elevations of these habitat types are defined below:

> Low Marsh: The areas that generally lie between elevations –0.83 feet and 2.04 feet NAVD88.
>
> High Marsh: The area lying between 2.04 and 2.91 feet NAVD88.
>
> Salt panne: Depressional areas predominantly located within the low marshes which do not drain on the ebb tide resulting in high salinity concentrations. Salt panne elevations measured within the project site were generally located below elevation 1.9 NAVD88.
>
> Scrub/shrub transition: The area between elevations 2.04 feet and 4.16 feet NAVD88.
>
> Invasive/Exotic: This area tends to begin at elevation 3.0 feet and continues to the highest elevations observed on the project site.

3.4. VEGETATION

Several site visits were conducted in December 2002, and in June and July 2003 to determine existing marsh and upland vegetation communities as well as document their composition. In general, the natural vegetative communities on the project site included intertidal marsh, salt pannes, and maritime upland areas dominated by a preponderance of invasive species. A map of existing vegetative communities is presented as Figure 13. The Vegetation Survey Report is available as a separate supporting document. The NYC Parks has been monitoring the Spring Creek salt marsh through a number of approaches over the last 5 years: 1) Visual Assessments have not indicated any apparent changes in the marsh function or conditions. There has been no recent major fill activity or significant anthropogenic disturbance in the salt marsh; 2) Surface Elevation Change monitoring (Surface Elevation Tables - SETs) data collection began in 2012 and does not indicate any apparent changes in marsh condition; and 3) Historic Marsh Loss Trends Analysis at this site compared the marsh area from 1974 aerial imagery to the area in 2012 (post Hurricane Sandy) imagery (Figure 14). This long term historic analysis indicates that the Spring Creek salt marshes have receded over the last forty years. However, there is no indication that there has been significant change in the vegetated marsh area since 2004. Finally, vegetation monitoring conducted across the marsh in 2012 indicated the same approximate distribution of low marsh and high marsh described in the below sections. These studies and observations support the assumption that the findings about the salt marsh conditions in this report are currently valid.

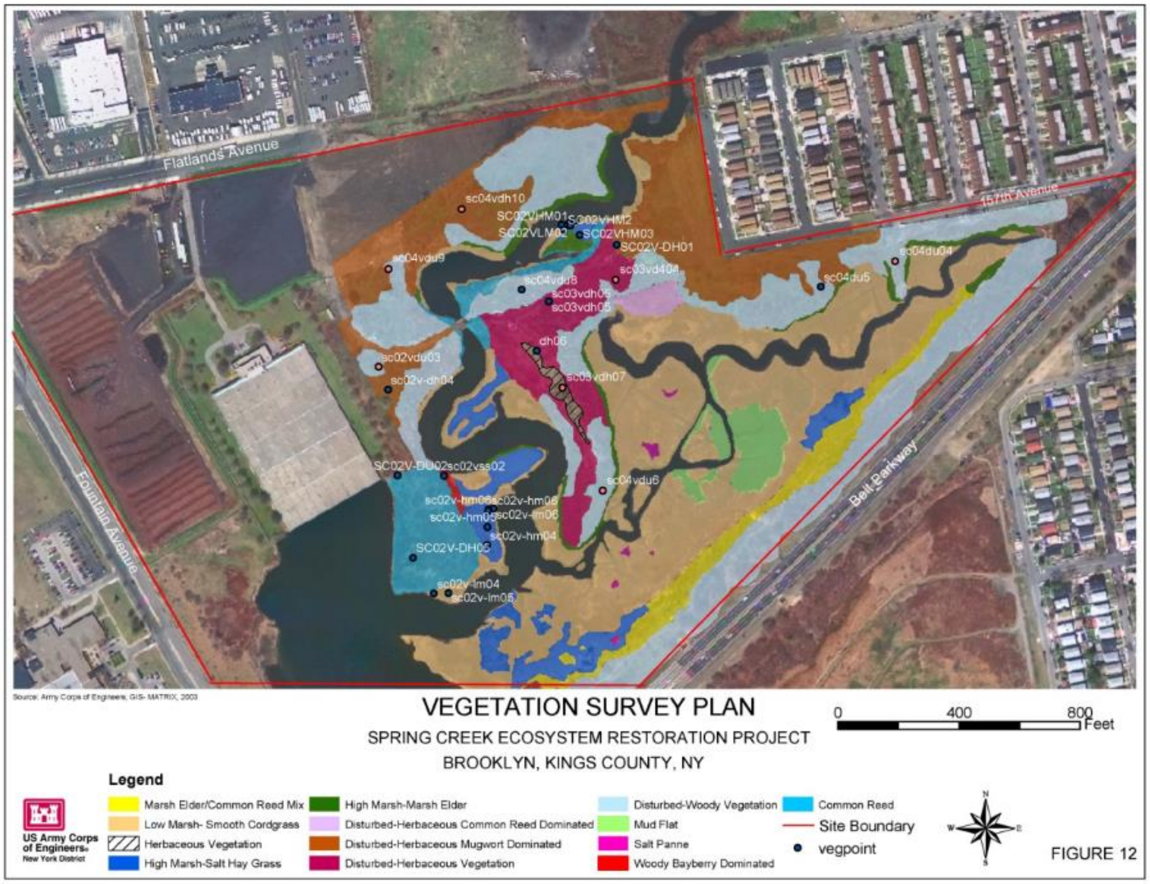


Figure 13. Vegetation Survey Plan

3.4.1. Wetlands Vegetation

The southeastern portion of the site, below the confluence of Spring Creek and Old Mill Creek and along both sides of Ralph's Creek, are characterized as intertidal salt marsh. Additional areas of salt marsh lie within an "s"-shaped meander of Spring Creek, and fringe the creek's edges within the interior portions of the site.

Delineations determined that low marsh habitat accounts for approximately 17 acres of the intertidal marsh area. This area is dominated primarily by smooth cordgrass (*Spartina alterniflora*). The high marsh area comprised another 3 acres of the intertidal marsh. These areas are dominated by salt meadow hay (*Spartina patens*) and spike grass (*Distichlis spicata*). Included within the high marsh acreage are salt pannes. Few plants can tolerate the hypersaline conditions of a salt panne, but among those that do are

Figure 14: NYC Parks Salt Marsh Trend Analysis

glassworts (*Salicornia* spp.). Approximately 1 acre was dominated by scrub/shrub transition habitat; plant species in this habitat included marsh elder or groundsel bush (*Iva frutescens*), northern bayberry (*Myrica pensylvanica*) and *Baccharis halmifolia*.

Approximately 2.3 acres of scrub/shrub habitat are located adjacent to the Belt Parkway. This area is considered disturbed and is dominated by a mix of marsh elder and common reed (*Phragmites australis*). On the project site, common reed is the invasive species most likely to threaten salt marsh vegetation. In the restoration areas, it can be found at elevations as low as 3.1 feet. These elevations correspond to the smooth cord grass/common reed interface on the marsh. At these elevations, common reed species could easily outcompete native vegetation by establishing dense monotypic stands.

3.4.2. Upland Vegetation

The upland area of the site, approximately 27 acres, is covered by vegetation commonly found in disturbed upland areas. Disturbed forested habitat accounts for approximately 12 of the 27 acres. Located throughout the site, the vegetation in the disturbed forested habitat includes tree of heaven (*Ailanthus altissima*), white mulberry (*Morus alba*), black cherry (*Prunus serotina*), black locust (*Robinia pseudoacacia*), and several willow (*Salix* spp.) species. Disturbed herbaceous habitat accounts for approximately 14 acres of the upland area while scrub-shrub occupies approximately 1 acre. Common mugwort (*Artemisia vulgaris*) is found throughout the disturbed herbaceous portions of the site in monotypic stands and interspersed with other vegetation. Common reed dominates 3 acres of the disturbed herbaceous upland area. An area of mixed-disturbed herbaceous vegetation (e.g., common milkweed (*Asclepias syriaca*) and Canada goldenrod (*Solidago canadensis*), with little to no mugwort or common reed, covers approximately 3 acres.

3.5. FISH AND WILDLIFE

Aquatic habitat within Spring Creek and Ralph's Creek is connected to the Jamaica Bay estuary through Old Mill Basin, and as such serves as an important habitat for fish, bird and other wildlife. Depending on the species, the study area may be used as a permanent residence; for specific activities such as feeding or reproduction; or simply as a temporary layover during migration.

3.5.1. Shellfish, Finfish and Benthic Resources

Beach seine samples collected south of the project area were dominated by Atlantic silversides (*Menidia menidia*). Atlantic menhaden (*Brevoortia tyrannus*), bluefish (*Pomatomus saltatrix*), Winter flounder (*Pseudopleuronectes americanus*), and Summer flounder (*Paralicthys dentata*) were collected in trawls south of the project area (USACE 2002). Of these, potential Essential Fish Habitat (EFH) is not designated for Atlantic silverside and Atlantic menhaden; however these species are of importance, providing forage for larger fish and predatory birds and mammals. It is likely that the above mentioned fish species also utilize the low marsh habitat within the Spring Creek project site. This habitat provides cover for juvenile fish above the mid-tide elevation. In addition, the site is connected to the open waters of Jamaica Bay through Old Mill Creek, and may therefore provide both refuge from predators and food sources for smaller and juvenile fishes.

Horseshoe crabs were found to be abundant at the nearby Jamaica Bay Wildlife Refuge, but there was little evidence of horseshoe crab egg-laying activity at sample stations south of the project site. Similarities in sediments between the sampling area and the Spring Creek restoration site led to the conclusion that the restoration site is probably of poor quality for horseshoe crabs.

Twenty macroinvertebrate species were identified in epibenthic samples collected at the Spring Creek restoration site (USACE 2002). It has been noted that large invertebrate populations of mollusks, worms, and crustaceans serve as an important food source to numerous species of fish as well as birds (Scaglione, 1991 and USDC, 1993). A more complete review of fish resources is presented in Appendix B, in the Essential Fish Habitat Assessment prepared for the project site.

3.5.2. Birds

As part of the JABERRT study, Veit *et al*. (2002) conducted a study of birds within the general area of Spring Creek. The study reported that 97 species of birds were observed in the area, including five species which nest in salt-marsh habitat. Species that may use the site for nesting include clapper rail (*Rallus longirostrus*), saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*), and willet (*Catoptrophorus semipalmatus*). Nine heron species were identified as utilizing the project site; the largest number of heron species of all the study sites. Thirteen species of migratory shorebirds were observed, making the project site one of the best sites in terms of shorebird diversity. Twelve species of waterfowl were also observed in the project site. Finally, it was found that the Spring Creek area does not support as great a number of passerine birds as other sites in the Jamaica Bay study area. Table 4 provides a list of the species sited in the project area, and the frequency at which they were sited.

Table 4. List of Bird Species Observed at Spring Creek

Common Name	Scientific Name	# Per Survey (n = 21)
Great Black-backed Gull	Larus marinus	0.90
Herring Gull	Larus argentatus	8.86
Ring-billed Gull	Larus delawarensis	3.33
Laughing Gull	Larus atricilla	8.76
Common Tern*	Sterna hirundo	1.10
Double-crested Cormorant	Phalacrocorax auritus	10.24
Red-breasted Merganser	Mergus serrator	0.48
Hooded Merganser	Lophodyets cucullatus	0.33
Mallard	Anas platyrhynchos	7.62
American Black Duck	Anas rubripes	7.52
Gadwall	Anas strepera	1.52
American Wigeon	Anas americana	6.19
American Green-winged Teal	Anas crecca	4.62
Canvasback	Aythya valisineria	0.24
Bufflehead	Bucephala albeola	0.29
Ruddy Duck	Oxyura jamaicencis	0.14
Canada Goose	Branta canadensis	8.76
Atlantic Brant	Branta bernicla	21.10
Glossy Ibis	Plegadis falcinellus	0.71
Great Blue Heron	Ardea herodias	0.71
Great Egret	Ardea alba	0.95
Snowy Egret	Egretta thula	0.43
Green Heron	Butorides virescens	0.52
Black-crowned Night-Heron	Nycticorax	0.76
Yellow-crowned Night-Heron	Nyctanassa violacea	0.48
American Coot	Fulica americana	0.67
Short-billed Dowitcher	Limnodromus griseus	0.57
Long-billed Dowitcher	Limnodromus scolopaceus	0.71
Least Sandpiper	Calidris minutilla	0.38
Greater Yellowlegs	Tringa melanoleuca	7.10
Lesser Yellowlegs	Tringa flavipes	3.67
Willet	Catoptrophorus semipalmatus	0.90
Spotted Sandpiper	Actitis macularia	0.19
Killdeer	Charadrius vociferus	0.19
Semi-palmated Plover	Mergus serrator	0.38
Ring-necked Pheasant	Phasianus colchicus	0.71
Mourning Dove	Zenaida macroura	7.05
Northern Harrier *	Circus cyaneus	0.29

Common Name	Scientific Name	# Per Survey (n = 21)
Belted Kingfisher	Ceryle alcyon	0.19
Downy Woodpecker	Picoides pubescens	0.19
Yellow-shafted Flicker	Colaptes auratus	0.43
Chimney Swift	Chaetura pelagica	0.38
Eastern Phoebe	Sayornis phoebe	0.19
Willow Flycatcher	Empidonax traillii	0.19
Blue Jay	Cyanocitta cristata	1.90
American Crow	Corvus brachyrhynchos	4.95
Fish Crow	Corvus ossifragus	0.43
European Starling	Sturnus vulgaris	60.86
Brown-headed Cowbird	Molothrus ater	0.29
Red-winged Blackbird	Agelaius phoeniceus	4.29
Common Grackle	Quiscalus quiscula	0.29
House Finch	Carpodacus mexicanus	0.90
American Goldfinch	Carduelis tristis	0.43
Savannah Sparrow	Passerculus sandwichensis	0.48
White-throated Sparrow	Zonotrichia albicollis	0.67
American Tree Sparrow	Spizella arborea	0.29
Song Sparrow	Melospiza melodia	7.48
Swamp Sparrow	Melospiza georgiana	0.38
Barn Swallow	Hirundo rustica	3.67
Tree Swallow	Tachycineta bicolor	0.62
Cedar Waxwing	Bombycilla cedrorum	1.48
Yellow Warbler	Dendroica petechia	0.33
Myrtle Warbler	Dendroica coronata	1.05
Western Palm Warbler	Dendroica palmarum	0.86
Common Yellowthroat	Geothlypis trichas	1.95
House Sparrow	Passer domesticus	4.81
Northern Mockingbird	Mimus polyglottus	0.67
Gray Catbird	Dumatella carolinensis	3.52
House Wren	Troglodytes aedon	0.24
Marsh Wren	Cistothorus palustris	2.48
Golden-crowned Kinglet	Regulus satrapa	0.14
Ruby-crowned Kinglet	Regulus calendula	0.48
Hermit Thrush	Catharus guttatus	0.29
American Robin	Turdus migratorius	3.86

Source: USACE, 2002
* = NYSDEC listed Threatened species.

Among the species observed were the common tern (*Sterna hirundo*) and the northern harrier (*Circus cyaneus*). Both species are listed as threatened in the State of New York; neither species is Federally-listed. It is not clear from the survey data what activity the birds were engaged in when observed. However, based on the observation dates, number observed, and general species information, some conclusions may be inferred. Common terns breed from late May through June, typically along the south coast of Long Island. This species was not present in surveys during those months; therefore, it is not likely that the site is used for nesting. It is more likely that the birds were observed during a migration or possibly while feeding.

A solitary northern harrier was observed in June and July 2000, and February 2001, while two harriers were observed in April 2001. A solitary harrier was also observed during many of the field visits conducted during 2002 and 2003 in support of preparing this document. It is not possible to determine if the solitary birds were the same individual; similarly, it is not possible to determine if the pair observed in April of 2001 was of the same or different gender. In each case, the birds may have been observed foraging, or during migration. Harrier nesting in the project area is possible, however, no nests were observed on the marsh face. Additionally, harrier nesting in the upland areas would subject the eggs and young to predation by the many mammals found on and near the project site.

In summary, the presence of common terns and northern harrier in this survey data indicates that they may be transient, or that they may use the site for foraging. While it is possible that both species use the project area for nesting, this is less likely due to the lack of appropriate habitat, and the presence of predatory species. The recommended restoration project would provide improved habitat for both terns and harriers. These habitat improvements are discussed in Section 6.6.2 below.

Previous USACE reports have indicated that more than 300 species of birds currently utilize the Jamaica Bay area, including a variety of species of herons, ducks, geese, plovers and sand pipers (USACE 1994a). Notably, Jamaica Bay provides nesting and foraging habitat for the federally-listed threatened piping plover (*Charadrius melodus*) and federally-listed endangered roseate tern (*Sterna dougallii dougallii*). Neither of these species was observed at Spring Creek during the JABERRT study, nor during subsequent site visits in 2002 or 2003.

3.5.3. Mammals, Reptiles and Amphibians

Mammalian use of the Spring Creek restoration area includes the typical urban complement of mammals, such as dogs, cats, and several species of rodents (Burke, 2002). Garter snakes and brown snakes were also found on the site. Both adult and hatchling diamond back terrapins have been found on the site, indicating that terrapin reproduction occurs in the project area (Burke, 2002). An adult diamond back terrapin was also observed during a field investigation in July 2003.

3.5.4. Rare, Threatened, Endangered and Special Concern Species

State and federal resource agencies were consulted regarding the presence of rare, threatened, endangered and special concern species on the project site. The NYSDEC, Division of Fish, Wildlife, and Marine Resources were contacted regarding State-listed species; the US Fish and Wildlife Service (USFWS) was contacted regarding the federally-listed species. The National Marine Fisheries Service (NMFS) was contacted regarding the documentation of Essential Fish Habitat (EFH) and compliance with the Endangered Species Act (ESA) within the project site and adjacent areas (Section 3.6.5). Correspondence with these agencies can be found in Appendix A.

Federal Species: Coordination with USFWS indicated that two federally-listed endangered/threatened species (red knot (threatened) and the roseate tern (endangered)) under USFWS jurisdiction have potential to occur in the project area. USFWS is not aware of comprehensive monitoring or other data for red knots on Long Island, New York, or within the project area. Although no observations of red knot have been documented within the project area, it is possible red knot utilize the site and have not been reported or it is possible that red knot may utilize the site once the project is completed. Similarly, there is no history of roseate terns nesting within the project area; however, it is possible that roseate terns may utilize the waters for foraging. The District has worked with USFWS during the finalization of the Fish and Wildlife Coordination Act Report (FWCAR). The District will incorporate the Services recommendations on future project phases, as outlined in the District response to the Draft FWCAR (included in the Final FWCAR {Appendix E}) and will continue coordination through the D&I Phase.

NMFS stated in a letter dated August 26, 2003, that loggerhead, green, Kemp's Ridley, and leatherback species of sea turtle may be present within the project area. Potential impacts on these species will be addressed in Section 6.6.2. While sea turtles are likely to occur in the main body of Jamaica Bay, it is unlikely that a sea turtle will venture up into the tributary. Additionally, planned in water construction activities will follow best management practices and occur outside the months when sea turtles may be present. Excavation of upland falls within habitat that does not possess the characteristics of sea turtle nesting habitat. Recent ESA coordination with NMFS (See Appendix B) states that no further Section 7 consultation is necessary.

State Species: The NYSDEC stated in a letter dated April 14, 2003, that there is no record of known occurrences of rare or State-listed species (plant or animal), significant natural communities, or other significant habitats on or in the immediate vicinity of the project area. However, common terns and northern harrier, both New York State-threatened species, have been observed on or near the project site (see Section 3.6.2). Potential impacts on the species' habitat will be addressed in Section 6.6.2.

3.5.5. Essential Fish Habitat

The regional fisheries management councils, with assistance from NMFS, are required under the 1996 amendments to Magnuson-Stevens Fishery Management and Conservation Act to delineate EFH for all managed species, minimize to the extent practicable adverse effects on EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH.

Table 5 lists the EFH species and life stages that need to be assessed. Windowpane flounder, winter flounder, and scup possess designated EFH in the study area for each stage of their life cycle. Red hake and whiting have EFH designated for egg to juvenile stages. Only the monkfish has EFH designated for eggs and larval stages. Butterfish and summer flounder have EFH designated for larval to adult stages. Bluefish, black sea bass, Atlantic sea herring and Atlantic mackerel have EFH designated for juvenile and adult stages. King mackerel, Spanish mackerel, cobia, sand tiger shark, dusky shark, and sandbar shark have EFH designations for the Jamaica Bay estuary with no salinity zone indicated. The full EFH assessment and recommendations from NMFS may be found in Appendix B.

Table 5. Essential Fish Habitat Species of Jamaica Bay

Common Name	Scientific Name	Eggs	Larvae	Juveniles	Adults
Whiting	Merluccius bilinearis	X	X	X	
Red Hake	Urophycis chuss	X	X	X	
Winter Flounder	Pseudopleuronectes americanus	X	X	X	X
Windowpane Flounder	Scopthalmus aquosus	X	X	X	X
Atlantic Sea Herring	Clupea harengus			X	X
Monkfish	Lophius americanus	X	X		
Bluefish	Pomatomus saltatrix			X	X
Atlantic Butterfish	Peprilus triacanthus		X	X	X
Atlantic Mackerel	Scomber scombrus			X	X
Summer Flounder	Paralicthys dentatus		X	X	X
Scup	Stenotomus chrysops	X	X	X	X
Black Sea Bass	Centropristus striata			X	X
King Mackerel *	Scomberomorous cavalla	X	X	X	X
Spanish Mackerel*	S. maculatus	X	X	X	X
Cobia*	Rachycentron canadum	X	X	X	X
Sand Tiger Shark*	Carcharius taurus		X		
Dusky Shark*	Carcharhinus obscurus		X		
Sandbar Shark *	C. plumbeus		X	X	X

* Migratory species

3.6. LAND USE AND ZONING

The project site is located in the Boroughs of Brooklyn and Queens in Kings and Queens Counties, respectively, New York City, New York and is within Congressional District 8. The site is bound to the north by Liberty Avenue, to the south by Belt Parkway, to the west by East Flatbush neighborhood, and to the east by John F. Kennedy Airport. The project site is located on undeveloped New York City parkland. Current on-site land uses include public open space and wildlife habitat.

The entire site is located within Spring Creek Park. However, the New York City zoning map (Figure 15) shows only the area west of Sheridan Avenue (a paper street) as being located within the park. This portion of the site is not zoned as zoning regulations usually do not apply to New York City parks. The eastern portion of the site is still zoned for residential use (R3-2) even though it is located within the park. The R3-2 zoning designation refers to a general residential district that allows for a broad range of residential building, but prohibits zero lot line buildings. The R3-2 zoning designation does not affect the use of the site as a park; therefore necessary steps have not been taken to change the current zoning designation to non-zoned, which is typical of park land.

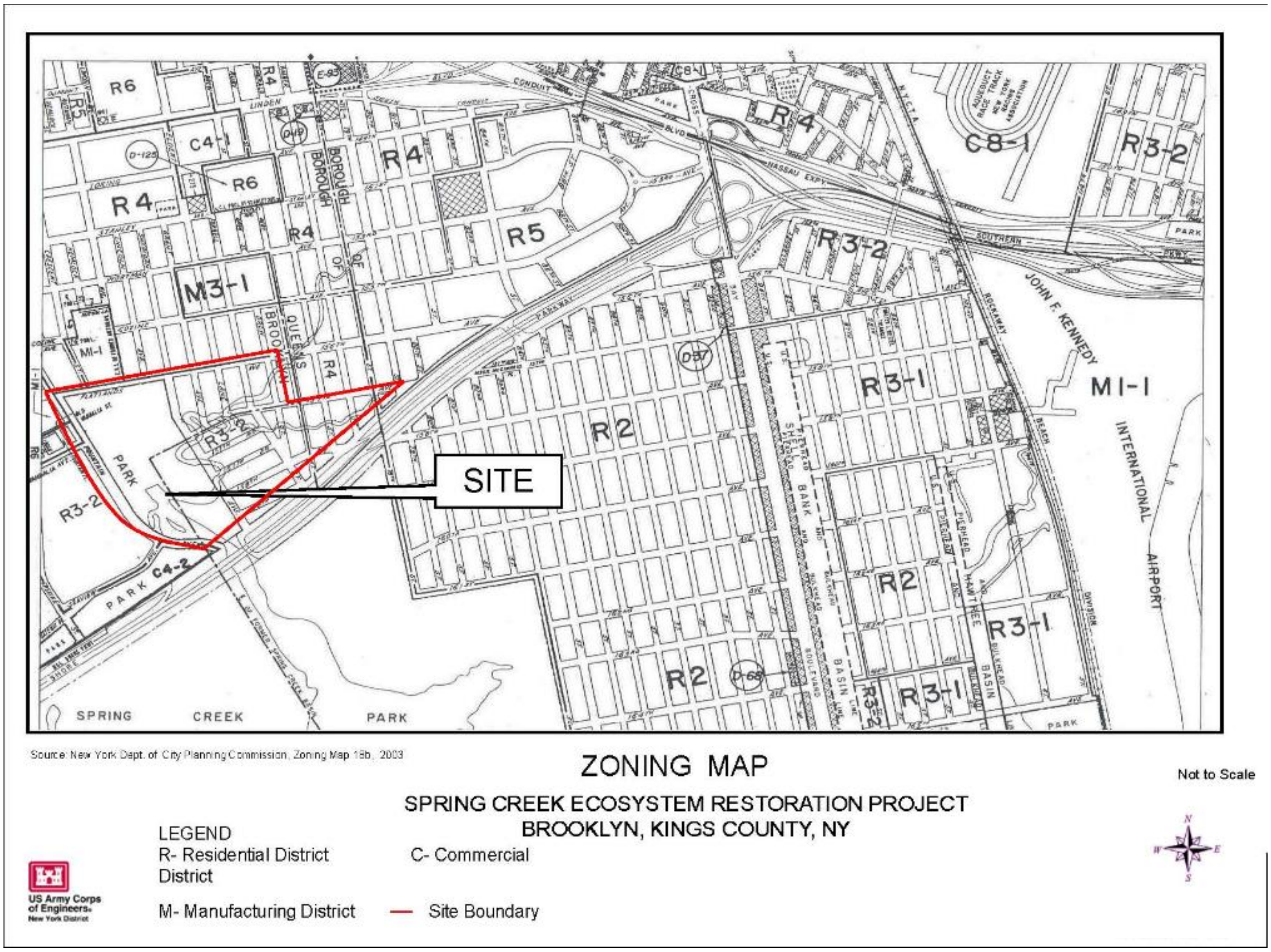


Figure 15: Zoning Map

The surrounding areas are also primarily zoned for residential use (R2, R3-2, R4, and R5) or are non-zoned public parkland. Areas zoned for light and heavy manufacturing uses are located to the north and west.

3.7. SOCIO-ECONOMICS

The project site is located within two Community Board Districts, Queens Board 10 and Brooklyn Board 5. Therefore, information regarding socio-economics (based on Year 2010 Census) was obtained from the New York City Department of City Planning (NYCDCP) website for both Community Boards and is presented as follows.

3.7.1. Population

Based on Year 2010 census data, the population of Queens Community Board 10 was estimated at 122,396, which was an -3.8% decrease from the 2000 data (NYCDCP website, 2014a). In Brooklyn Community Board 5, the population was estimated at 182,896, which represents a 5.6% increase from the 2000 census data (NYCDCP website, 2014b). At a broader level, the total population of New York City was estimated to be 8,175,133, representing a 2.1% increase over the 2000 census data. Brooklyn population was estimated to be 2,504,700, representing a 1.6% increase over the 2000 census data, and Queens population was estimated to be 2,230,722 or a 0.1% increase over the 2000 census data. Brooklyn and Queens are the largest boroughs in terms of population, with Brooklyn encompassing 30.6% of New York City's population (NYCDCP website, 2014c) and Queens encompassing 27.3% of the population (NYCDCP website, 2014d).

3.7.2. Economy and Income

After the longest period of employment gain ever recorded (1993-2001), New York City's economic expansion slowed as a result of the events that marked September 11, 2001. Prior to that event, the City had regained the 312,400 private-sector jobs it lost in the recession, from 1987 (3,009,600) to 1992 (2,697,200). In 2001, the number of employed people residing in New York City was 3,306,900. By 2013, the total number of private-sector jobs in New York City had increased to 3,580,100 (NYS Labor, 2014).

Within Brooklyn Community Board 5, median household income was estimated in 2010 to be $31,986, while in Queens Community Board 10, it was estimated to be $64,65047,260 (NYCDCP website, 2014e). At the broader level, the median household income for Brooklyn in 2010 was estimated to be $44,850; it was $54,373 in Queens and $50,711 for New York City. Out of the 59 community boards that have been set up across the city, Brooklyn Community Board 5 was ranked 53rd in income for year 2010 and Queens Community Board 10 was ranked 16th.

3.7.3. Housing

Residents of Brooklyn and Queens, like the rest of New York City, are more likely to be renters (US Census ACS, 2014a) and to travel using public transportation (US Census ACS, 2014b). In general, both commercial and residential districts are densely built so the opportunity for new housing is limited. Nonetheless, some new housing development continues to take place including a new residential development adjacent to the project site west of Fountain Avenue.

According to the NYCDCP, the number of new housing units for all of New York City fell by 14% from 1998 to 1999, although the number of new housing units were still almost 22 % greater in 1999 than in 1995 (NYCDCP, 1999). The greatest decline in new housing numbers occurred in Brooklyn, with a drop of 37 % from 1995 to 1999. In contrast, Queens had the greatest increase in new housing numbers with a 151 % increase from 1995 to 1999. Since the year 2000, there have been at least a 5% housing increase overall in both Kings and Queens County (US Census ACS, 2014c).

3.7.4. Environmental Justice

In 1990, the EPA established the Environmental Equity Workgroup to investigate the alleged inequity of environmental protection services in the communities of racial minority and low-income populations. As a result of the workgroup's final report and recommendations, the Office of Environmental Equity was established; this office was later renamed the Office of Environmental Justice (USEPA, 2004).

Environmental justice requires the fair treatment and meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. No group of people (including racial, ethnic, or socioeconomic groups) should experience a disproportionate share of negative environmental impacts from any private, state, or federal action, program, or policy (USEPA, 2004). In order to prevent such a situation, potentially affected communities should have every opportunity to participate in decisions about a proposed activity that will affect their environment and/or health. The potentially affected community should also be afforded the opportunity to influence the final decision of the regulatory agency involved through the consideration of that community's concerns (USEPA, 2004).

The NYSDEC identifies "Potential Environmental Justice Areas (PEJAs)" as census block groups meeting one or more of the following NYSDEC criteria in the 2000 U.S. Census (NYSDEC, 2016):

- 51.1% or more of the population are members of minority groups in an urban area;
- 33.8% or more of the population are members of minority groups in a rural area; or
- 23.59% or more of the population in an urban or rural area have incomes below the federal poverty level.

The NYSDEC publishes county maps identifying PEJAs, including Kings, Queens, and Nassau counties (NYSDEC, 2016). Upon review, the community of East New York was identified as a PEJA with a population that is 97% minority with over half the population living below the poverty line. Comments were received from the community during the public comment period and as such were addressed in this report and forwarded to the appropriate parties. Additional public comment periods will occur during permitting and/or if design changes take place. The District is committed receiving input from the community of East New York and will continue to update the stakeholders during Construction Phase. The adjacent community of Howard Beach was not identified as a PEJA.

3.8. CULTURAL RESOURCES

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the Advisory Council on Historic Preservation's Guidelines for the Protection of Cultural and Historic Properties (36 CFR Part 800), a Phase IA Cultural Resources Documentary Study was conducted in connection with the Spring Creek Ecosystem Restoration Project to determine whether there was a potential for significant archaeological sites or other cultural resources to exist within the project area (Appendix C). Cultural Resources deemed significant are any material remains of human activity that are listed on, or eligible for inclusion in, the National Register of Historic Places (NRHP). The study involved background documentary research and a field inspection. Research was conducted at the offices of the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP), the New York City Landmarks Preservation Commission (NYCLPC) and the NYC Parks, and a review was undertaken of previous archaeological work from the area and HTRW Testing.

3.8.1. Prehistoric

Native American occupation of Long Island is believed to have been relatively limited during the Paleo-Indian (circa 10,000-8,000 BC) and Archaic (circa 8,000-2,000 BC) periods. They are believed to have lived as migratory bands that moved from place to place based upon the availability of resources such as game, fish, plants and lithic materials. From the Middle Woodland period (circa 1,000 BC- 1,000 AD) to the time of European contact the population grew steadily on the Island and its occupants settlement patterns grew increasingly sedentary, practicing agriculture in addition to hunting and fishing. At the time of European contact, the Spring Creek project area was utilized by the Canarsie and Rockaway Native Americans for fishing and hunting but these groups were quickly displaced by Dutch and English settlers.

There are no previously documented prehistoric archaeological sites located within the current project area. Typically, Native American sites identified on Long Island have been located on terraces or knolls above low-lying land and there are no natural areas of high ground within the project area that would have been suitable for occupation. Therefore, based on environmental factors and the archaeological record of Long Island, sensitivity for prehistoric archaeological resources in the project area is considered low.

3.8.2. Historic

First settled by the English and Dutch in the mid-1600s, Queens County was originally organized into three towns: Jamaica, Flushing, and Newton. Physical barriers such as tidal marsh and estuaries separated the towns and the main form of transportation was through water travel. The majority of Queens County was agrarian for much of the eighteenth and nineteenth centuries. The Van Wicklen mill was built in the mid-nineteenth century along Spring Creek and along with it other industries sprung up around Jamaica Bay where goods were grown or produced for sale in Manhattan. In 1880, when the New York, Woodhaven, and Rockaway Railroad built a wooden trestle five miles long across Jamaica Bay, connecting the Rockaways to the rest of Queens, industry and settlement began to really take hold in the area. Around this time the population of New York City was growing exponentially and many people began to move into the outer boroughs. The City of New York planned to establish many areas including the project area for residential living. Landfill was brought in and placed throughout the area to begin this process. Around the turn of the twentieth century Patrick Flynn built a causeway that extended through the Spring Creek Project area that connected the waterfront to the planned community north of the current project area. The remains of the Flynn Causeway are still present in the Spring Creek project area today (Pickman, 2002).

In the early part of the twentieth century industry continued to expand along the shores of Jamaica Bay which soon led to deposition of waste and sewage disposal. In 1916, the Board of Health banned fishing and swimming in the bay, and all the summer resorts and hotels that had been built along the bay closed down (Panamerican, 2003). During the prohibition period there is an indication that the area was used by bootleggers and Speakeasies were rumored to exist along the Flynn piers in the late 1920s (Brooklyn College Archaeological Research Center, 2000). The only standing historic structures within the project area are several wooden piers and a footbridge that may have been part of the Flynn Causeway. No other historic properties were identified within the project area and no physical evidence of the rumored speakeasy establishments has been recovered.

3.9. COASTAL ZONE MANAGEMENT

The project site is located within the Coastal Zone Boundary of New York City, as indicated on the 1982 sectional maps delineating the boundaries of New York City's coastal zone.

As a federally-funded project located within the New York City coastal zone, the project must be reviewed by the New York State Department of State (NYSDOS) for consistency with the policies of the New York State Coastal Management Plan (NYSCMP) and the applicable local New York City Waterfront Revitalization Program. All information related to the coastal consistency application is presented in Appendix B.

New York State Coastal Management Program

The New York State *Waterfront Revitalization and Coastal Resource Act* of 1981 was established under the coastal management program. The Act states that "… actions undertaken by State agencies within the coastal area… shall be consistent with the coastal area policies of this Article (Section 919 (1))." The New York State Division of Coastal Resources provided its coastal consistency determination on December 01, 2017.
New York City Local Waterfront Revitalization Program

Under federal law, the waterfront revitalization plan (WRP) was first approved by New York State for inclusion in the NYSCMP and then was presented to the U.S. Secretary of Commerce for approval. The WRP was approved on September 30, 1982. The New York City Board of Estimates implemented the New York City WRP as part of the local plan and is in accordance with Section 197-a of the City Charter. In accordance with the WRP, any local discretionary actions, as well as activities subject to the Uniform Land Use Review Procedure (ULURP), City Environmental Quality Review (CEQR), variance procedures, and other 197-a plans are subject to review for consistency with the WRP policies. The Waterfront and Open Space Division, on behalf of the New York City Coastal Commission found the recommended plan consistent with the WRP policies and the local program November 15, 2017. All information related to the coastal consistency application is presented in Appendix B.

Coastal Boundary Zone

Adopted and mapped in 1982, the coastal zone boundary defines the geographic scope of the WRP. All land and waters directly bordering on or tributary to coastal waters are encompassed in the boundary. The coastal zone water boundaries extend to the Westchester and Nassau County and New Jersey boundaries and the three-mile territorial limit in the Atlantic Ocean. Spring Creek is located within a City park and therefore must follow all coastal boundary zone guidelines.

3.10. NAVIGATION

Navigation near the project site is limited to shallow draft vessels such as canoes, kayaks, or small Jon boats, as the waters of Spring and Ralph's Creeks are relatively shallow. The depth of Ralph's Creek at MHW is approximately 5.5 feet. The depth of Spring Creek at MHW is approximately 5.5 to 7.3 feet. Old Mill Basin is approximately 10 to 12 feet deep at the mouth of Spring Creek.

3.11. AESTHETICS AND SCENIC RESOURCES

The existing project site provides approximately 47 acres of open space within an urbanized setting; however it does not provide a quality viewshed for the surrounding environs. There is a significant amount of disturbed area within the project site due to fill activities and illegal dumping. The site is overgrown with invasive species such as tree-of-heaven, mugwort and common reed. These species grow to heights of 30 ft, 5 feet and 14 feet, respectively, and can block the line of sight. In addition, the invasive species are growing on several feet of fill, so the vegetation is elevated, further decreasing the viewshed.

3.12. RECREATION

Although the project area is owned by the New York City and under the jurisdiction of the NYC Parks, it provides limited opportunity for passive and active recreational uses. A desire path, approximately 800 feet in length, traverses the site in an east-west direction along the sanitary sewer line easement. This may provide some opportunity for walking and bird watching. The current state of the project site is susceptible to illegal use of all-terrain vehicles and illicit use of dirt bikes and access for dumping, which further degrade natural areas.

3.13. TRANSPORTATION

Vehicular access to the study area is provided via a system of collector and arterial roads. Truck routes include State Road 27 (Linden Boulevard) and North Conduit Avenue. Belt Parkway, which is limited to non-commercial traffic only, passes through the southern edges of Brooklyn and Queens, providing access to the Jamaica Bay area. Arterial roads into the site include Fountain Avenue, which forms the western site bound and Flatlands Avenue, which forms the site northern boundary. Please note that vehicular and pedestrian access to the site is limited to Flatlands Avenue. Subway access to the study area is via Metropolitan Transportation Authority - New York City Transit (MTA-NYCT) Subway Lines A, C and 3, which operate between Manhattan, Queens, and Brooklyn. MTA-NYCT provides bus service on Fountain and Flatlands Avenues via the B13, B84 and Q8 lines.

Air-based transportation is accessible at JFK International Airport, located approximately two miles east of the project site or LaGuardia International Airport; located about eight miles north of the site.

3.14. AIR QUALITY

The Clean Air Act (CAA), originally passed in 1970, had been the primary basis for regulating air pollutant emissions. The CAA allowed USEPA to delegate responsibility to state and local governing bodies. This allowed each State/local government the opportunity to prevent and control air pollution at the source. The 1970 CAA mandated that the USEPA establish ceilings for certain pollutants based on the identifiable effects each pollutant may have on public health and welfare. Subsequently, the EPA promulgated the regulations which set and in some cases revised National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), lead (Pb), sulfur dioxide (SO_2), total suspended particulates (TSP), inhalable particle matter smaller than 10 micrometers (PM-10), and inhalable particulate matter smaller than 2.5 micrometers (PM2.5). The ozone standards were revised in 1997 and 2008, and the PM2.5 standards, originally promulgated in 1997, were revised in 2006 and 2012.

Ambient air monitoring is used to designate areas as “attainment”, “non-attainment”, or “unclassifiable/attainment” with respect to the standards. States with designated non-attainment areas are required to develop State Implementation Plans (SIPs) to bring these areas into attainment of the NAAQS. For non-attainment areas that are re-designated as attainment areas, states are required to submit and implement maintenance plans to ensure the areas do not revert to non-attainment status.

Existing conditions information was obtained from USEPA’s Green Book. Spring Creek is located in an ozone non-attainment area and maintenance areas for PM2.5 and CO under the CAA with the ozone non-attainment being classified as “moderate.” In the project area, the General Conformity applicability trigger levels for ‘moderate’ ozone nonattainment areas are: 100 tons per year (any year of the project) for NOx and 50 tons per year for VOC (40 CFR§93.153(b)(1)). For areas designated as ‘maintenance’ for PM2.5, the applicability trigger levels are: 100 tons for direct PM2.5, SO2, and CO per year (40 CFR§93.153(b)(2)). According to Section 176(c) of the CAA, any project sited in a non-attainment area must satisfy the General Conformity Rule of the CAA. Conformity ensures that projects do not cause or contribute to a new air quality standard violation; increase the frequency or severity of an existing violation; or delay timely attainment of a standard or any required interim emission reduction milestone.

For additional context, Table 6 provides a summary of the USEPA Air Quality Index results for both Kings and Queens Counties, for the years 2002 and 2003.

3.15. NOISE

Noise is generally defined as unwanted sound. The primary sources of ambient noise in the project area include auto, truck and bus traffic along Flatlands Avenue, Fountain Avenue, 157th Avenue, and 77th Street; auto traffic on Belt Parkway; and air traffic to and from JFK Airport. Although noise levels for the project area have not been measured, they can be approximated based on existing land use, which is primarily residential and open space. Typical noise levels in residential areas range from 39 to 59 dBA (decibels on the A weighted scale) (USEPA, 1978). It can be assumed that these noise levels are within the low range of noise levels within this urbanized area.

Table 6. Summary of Air Quality Index (AQI) Data, Kings and Queens Counties

		Number of Days when Air Quality was[1]:				Number of Days when AQI pollutant was:					
County	**Year**	**Good**	**Moderate**	**Unhealthy for Sensitive Groups**	**Unhealthy**	**CO**	**NO_2**	**O_3**	**SO_2**	**PM2.5**	**PM10**
Kings	2015	289	76	0	0	0	0	0	0	365	0
	2016	325	41	0	0	0	0	0	0	366	0
Queens	2015	251	109	5	0	0	66	166	0	133	0
	2016	286	74	6	0	0	62	200	0	104	0

[1]Number of days having AQI of 151 or higher.

3.16. Post Hurricane Sandy

On October 29, 2012, Hurricane Sandy devastated the metropolitan area with high winds and extensive tidal flooding. Within the Jamaica Bay watershed damage was extensive to several coastal communities, due mainly to elevated water levels of up to 11.16 ft. NAVD88. Because of its sheltered location within the bay and its confined entrance under the Belt Parkway, impacts to Spring Creek area were confined mostly to elevated water levels that deposited considerable floating debris. Sediment redeposition and accumulation appeared to have been limited with little effect on existing topography. Updated surveys were therefore not deemed necessary, and were postponed to the D&I Phase in an effort to reduce costs and provide the pertinent information when it would be most useful to development of final design. It is expected that the excavation volumes may increase but that habitat values will do so as well. Remaining debris left on the marsh after the storm would reduce its functional value, and any action to remove that debris as part of the final plan would restore values of the remaining functional portions of the marsh while resulting in increased value to the now even more degraded portions designated for restoration.

Part 4 – Problem and Opportunity Identification

4.1. Problem Identification

As has been highlighted above, the Spring Creek area has been degraded by past activities including the placement of fill material on the site, the construction and operation of the 26 Ward WWTP, including the construction of the sewer pipe which transects the area. These disturbed areas are presently dominated by upland invasive species. These degraded areas have been identified as potential restoration sites.

Within the project area, and adjacent to the degraded areas, there remains a rather large tract of undisturbed wetland which serve as a restoration benchmark, and are integrated into the project formulation. In addition, the improvements and upgrades made to the WWTP (outlined in Section 4.2) have improved water quality at the site adequately in order to advance the restoration of the degraded habitat.

4.2. Future Without Project Condition

The future without project condition was determined by projecting conditions in the study area over a 50-year period of analysis (2019-2069). A multi-tier assessment of New York City salt marshes was recently performed by NYC Parks Natural Areas Conservancy (NYC Parks, Natural Resources Group, 2016). As part of this study, recent salt marsh loss trends were assessed through comparison of 1974 NYSDEC aerial photo mapping and 2012 (post Sandy) field assessments and aerial photos. Findings have determined Spring Creek to be a complex with both a large amount and percentage (~50%) of waterward marsh loss. (Sea levels are estimated to rise at a rate of 3.97 mm/yr in the Sandy Hook, NJ region and 2.92 mm/yr in the area of the Battery, NY.) Additionally, a condition index was developed with respect to vulnerability to sea level rise and marsh loss impact. Preliminary results indicate Spring Creek ranks among the top 3 worst condition complexes out of the 25 surveyed. In the absence of federal action, it is anticipated that the degraded conditions recorded within the Spring Creek ecosystem (e.g., increasing abundance of invasive species, increasing fragmentation of and encroachment upon healthy wetland ecosystems, and continuing erosion within certain areas of the salt marsh) will continue and likely worsen in the future. Present and future illegal dumping activities are also anticipated to continue.

The Spring Creek Park Composting Facility, built in 2001, has in the past operated on up to 20 acres of property within the project site. The majority of the composting site consists of paved lots with gravel in some places; the lots are fenced in and surrounded by berms. Current NYSDEC permitting requirements for use of this property as part of the proposed restoration, specify that these lots must be included in the maritime upland habitat. In the absence of this project, it would be more costly and less cost effective for NYC Parks to restore these lots to a natural state in the near future. Subsequent to a January 2014 judgment, the City is precluded from operating a compost facility at Spring Creek Park without authorization from New York State in the form of legislation enacted by the New York State Legislature and approved by the Governor. New York City intends on restoring and managing the former composting facility site as upland marine habitat consistent with this Feasibility Study and other marine habitat owned and managed by NYC Parks. Therefore, the disposal of material excavated as part of the proposed restoration at the site of the composting facility is currently available and is a permissible and cost-effective measure.

The proposed restoration is being coordinated with grant funding awarded to NYC Parks from New York Rising- Howard Beach Community Reconstruction Plan and the National Fish and Wildlife Foundation's (NFWF) Hurricane Sandy Coastal Resiliency Program. This grant has been provided to improve the resiliency and coastal storm risk management benefits at the site through the construction of adjacent berms, installation of storm water detention basins along the northern perimeter of sites and management of invasive vegetation and planting native species in adjacent areas to the project area. These grant funded activities would continue, even in the absence of the proposed project.

As described in Section 1.3, the improvements made to the 26th Ward WWTP and Spring Creek AWWTP have improved water quality since the Clean Water Act. 26th Ward WWTP was recently upgraded for Biological Nitrogen Removal and typically removes approximately 70% of the influent nitrogen entering the treatment plant prior to the effluent being discharged into Hendrix Creek. The plant is currently undergoing some upgrades on its head works to improve wet weather capture throughout the collection system during rain events. The Spring Creek AWWTP Facility was also upgraded around 2007 that refurbished much of the structures and equipment along with slightly increasing its CSO storage capacity to operate as a flow-through retention facility for tributary drainage areas in Brooklyn and Queens within the 26th Ward and Jamaica WWTP drainage areas. On average the Spring Creek AWWTP reduces annual volume of CSO discharges into Spring Creek by about 50% to 70% and reduces the number of CSO events by about 70% to 90%.

4.3. GOALS AND OBJECTIVES

This report is an integrated feasibility study and environmental document. This document describes the environmental effects of the recommended plan and summarizes compliance with federal statutes and regulations in a manner consistent with USACE Environmental Operating Principles (EOPs). These principles are consistent with NEPA, the Army's Environmental Strategy with its four pillars (prevention, compliance, restoration, and conservation), and other environmental statutes that govern USACE activities. All formulated plans strive to avoid any adverse impacts on significant resources to the extent fully practicable. The implementation framework proposed as part of this study seeks to work collaboratively by fully engaging individuals, agencies, and local groups in identifying, planning, and implementing solutions that maximize sustainable habitat within the area of Spring Creek North.

The goal of this project is to contribute to National Ecosystem Restoration by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded more natural condition. The primary project objectives are to maximize restored intertidal salt marsh and increase/maximize wetland functions and values. These will be quantified in the Evaluation of Planned Wetlands (EPW) over the period of analysis. Emphasis is placed on the following:

- Increasing wildlife habitat, which includes restoring functional transitional habitats (maritime scrub and forest), adding vertical and horizontal habitat structure/diversity, and adding species specific habitat elements.
- De-fragmenting former intertidal salt marsh by creating a greater contiguous area of salt marsh.

A secondary objective, in the wake of Hurricane Sandy and findings of the North Atlantic Coast Comprehensive Study (NAACS), is to investigate the potential of storm resilient features into the restoration techniques recommended without sacrificing ecological value or substantially increasing costs. Natural and nature-based features (NNBFs) refer to the integration of natural systems and processes, or engineered systems that mimic natural systems and processes. These features can provide coastal storm risk management measures in addition to valuable ecosystem services. For example, excavated material could be beneficially re-used, on-site to create a vegetated berm; this option could provide both storm risk management features and habitat benefits while reducing costs of off-site disposal.
The restoration will also provide secondary benefits of water quality treatment function of the site at large, which will lead to an increase in water quality in the Spring Creek system that will improve the overall success and value of any proposed restoration, as well improve the value of the remaining functioning wetlands while providing some additional water quality improvement to Jamaica Bay as a whole.

As was discussed previously, the predevelopment condition in Spring Creek was intertidal salt marsh and mud flat. There is a significant opportunity to restore filled and degraded salt marsh system, enhance adjacent maritime upland areas and healthy salt marsh and increase water quality treatment in Spring Creek. It is possible to create more ecologically valuable conditions by removing fill material and restoring intertidal inundation and intertidal vegetation to establish the historic ecological functions associated with the site.

4.4. PLANNING CONSTRAINTS AND CONSIDERATIONS

The formulation and evaluation of alternative plans for the Spring Creek ecosystem restoration project incorporated a variety of planning constraints and considerations. Constraints are significant barriers or restrictions that limit the extent of the planning process. Constraints are designed to avoid undesirable changes between without and with-plan conditions. Constraints unique to the study were considered during plan formulation including:

1. Physical Constraints of the 26 Ward Water Pollution Control Plan and Spring Creek North Composting Facility to the west/north-west; Flatlands Avenue to the north; and a residential development (77th Street and 157th Avenue) and Belt Parkway to the east;
2. Compliance with federal, state and local laws and policies; and
3. Maintenance of the project site as a park.

Considerations are those issues or matters that should be taken into account during the planning process, but do not necessarily limit the extent of the process as do constraints. A number of considerations unique to the study were considered including:

1. Consistency with existing management plans, especially those of NYC Parks, NYCDEP, and the adjacent Gateway National Recreation Area;
2. Consistency with regional plans considered such as New York Rising to improve coastal resiliency and sustainability from future storms;
3. Restoration of the upland habitat restoration of the composting facility pursuant to Part 360 of the New York State Environmental Conservation Law from NYSDEC, as written in the permit for the operation of a solid waste management facility obtained by the City; and
4. View-shed of the surrounding community.

Part 5 – Plan Formulation, Evaluation and Selection

A small fringe of healthy salt marsh exists along the northern portion of Spring Creek (north of the culvert), while larger areas of healthy salt marsh occur along Ralph's Creek and the southern portion of Spring Creek. This indicates that the site possesses adequate physical, chemical, and biological conditions to support tidal wetland habitat. Therefore, the formerly filled tidal wetlands located within the project site can be restored to their previous level of functionality with a high probability of success provided the proper elevations are restored by removal of fill.

The site investigations lead to the discovery of three distinct tidal and bio-benchmark ranges across the proposed restoration site (see Section 3.3 above). The initial array of alternatives were evaluated against the ability of the project to be sustainable over the project life, cost-effectiveness, and technical feasibility. A description of the final array of alternatives, along with initial alternatives that did not meet the screening criteria are discussed in this section. The site was divided into four distinct restoration areas (See Figure 16), in consideration of the bio-benchmark differentials and in order to facilitate plan formulation, as follows:

- Area A is a 2.3 acre area located within the southwestern portion of the project site, bound by Spring Creek to the east, Spring Creek AWWTP and Old Mill Creek to the west, and the existing access road to the north.

- Area B is a 6.43 acre area located in the southeastern portion of the site, bound by the sewer easement to the north, Spring Creek to the west and Ralph's Creek to the east.

- Area C is a 0.856 acre area bound by the access road to the south, Spring Creek to the north and the upland area to the east.

- Area D is a 3.4 acre area bound by Flatlands Avenue to the north, Spring Creek to the east, and the 26th Ward WWTP to the west.

Area A and the western side of Area B demonstrated similar biological benchmark elevations and thus possess similar requirements for the establishment of salt marsh vegetation. Area A and the western half of Area B are influenced by tidal inundation from the southern portion of Spring Creek. The eastern half of Area B is influenced by the tide range of Ralph's Creek and possesses slightly different elevational requirements for the establishment of salt marsh vegetation. Areas C and D share the same elevational requirements for the establishment of salt marsh vegetation as they are influenced by the tide range in the northern portion of Spring Creek.

5.1. MEASURES CONSIDERED FOR ECOSYSTEM RESTORATION

The following ecosystem restoration measures were evaluated and combined as appropriate to form site-wide alternatives:

1. Existing pavement removal: restore ground permeability and allow for planting of native vegetation;
2. Excavating material: excavation of historic fill to achieve proper elevations for tidal wetland plantings, and for construction of tidal creek;
3. Grading: re-grading elevations on site to restore low and high marsh and upland habitats (note: upland habitat achieved as cost-effective soil placement; increased acreage of upland habitat is paid 100% non-federal sponsor funds);
4. Clean fill: placement of clean fill in over-excavated areas unsuitable for planting to achieve proper elevations for tidal wetland plantings, and for construction of tidal creek;
5. On-Site Disposal: excavated material will be placed on-site, capped, and planted. This action provides both a cost savings and ecological benefit;
6. Removal of invasive vegetation species;
7. Planting of native vegetation;
8. Channel modification; and
9. Turtle mounds: created with clean and graded sand and surrounded by high marsh and graded to an elevation above MHW to protect them from inundation.

5.2. ALTERNATIVE RESTORATION PLANS

Eight alternatives restoration scenarios were formulated. As discussed below, the best buy plan of these eight alternatives was selected and then optimized to arrive at the recommended plan. These restoration alternatives were developed based on site constraints (physical as well as the regulatory and land use constraints listed among site-specific constraints above), considerations, standard biological and physical parameters for salt marsh restoration and other design guidelines (i.e. maximizing low marsh) developed at a series of planning/design team meetings. The eight alternatives were developed in consideration of several design factors, most predominantly: 1) variations in the percentage and type of habitat restored (low marsh, high marsh, upland); 2) options for relocating the existing sewer pipe that bisects the site; and 3) off-site versus on-site material disposal requirements. Varying these three predominant factors was used to create alternatives, including variations in what percentage of, if any, material was disposed off-site. The preliminary alternatives were then analyzed based on how each met the project's objectives and cost limitations.

The specific measures and combinations of the three factors (low marsh/high marsh/upland, sewer pipe relocation, and off-site/on-site disposal), associated with each restoration alternative as well as the No Action Alternative are discussed below. The basic alternative layouts were developed in accordance with the overall project goal of restoring as much salt marsh as possible. The alternatives were developed using the basic guiding ecological principals for salt marsh restoration which are subject to a set of chemical, physical, and biological design requirements. The primary requirement for successful marsh restoration is connected to the physiological limitations and environmental requirement for smooth cordgrass establishment and growth, predominantly focusing on achieving the proper target elevations relative to the tide.

5.2.1. Alternative 0 - No Action Alternative

The No Action Alternative would result in continued degradation from the present environmental conditions in the study area. Approximately 15± acres of fill will remain in place over former tidal salt marsh. An additional 28-acre area of disturbed herbaceous and woody upland will remain degraded. Present and future illegal dumping activities would continue. Invasive/exotic vegetation will continue to overtake existing healthy, functioning upland and wetland systems. Based on losses of vegetated marsh over the last 40 years, NYC Parks predicts there would be future vegetated marsh loss (see section 3.4). Moreover, with sea level rise and the lack of area for marsh to migrate, the no action alternative would result in diminished marsh area and few marsh functions in the future. The No Action Alternative serves as the basis against which the other alternatives are evaluated.

5.2.2. Alternative 1

Alternative 1 maximizes low marsh habitat by restoring degraded areas to low marsh only. Approximately 12.25 acres of smooth cordgrass dominated low marsh would be restored under this alternative. Also included is approximately 2.52 acres of scrub/shrub habitat planted as a transition area between marsh and upland communities. The transition area would be designed with a 1:3 slope, and would consist of species such as marsh elder, hackberry and northern bayberry. The design for Alternative 1 does not include constructed tidal creeks; however, creeks would be added if hydrologic modeling indicates a need for additional sources of inundation.

All excavated material (~ 190,750 cy) would be transported off site to an authorized disposal facility. A maritime upland community would be developed adjacent to the restored wetland area. The upland community would encompass approximately 7.34 acres. Establishment of the maritime upland community would require the placement and grading of a minimum of 18 inches of clean planting medium specific to the targeted vegetation requirements (e.g., clean sand, amended sand, etc.).

Alternative 1 includes off-site disposal of excavated material. During early plan formulation, off-site disposal was a potential method that required consideration due to the uncertainty of the availability of on-site placement (within the Composting Facility area). Currently, acreage for on-site placement within the study area provided by the local sponsor/landowner (Composting Facility) is available as a disposal option. Therefore, Alternative 1 will only be considered for implementation if the construction schedule surpasses the local sponsor's ability to use the area of the Composting Facility for the enhancement action (on-site placement in Areas G and F).

The distribution of design elements included in Alternative 1 is summarized below in Table 7 and presented in Figure 16 (for Area references see the illustration above):

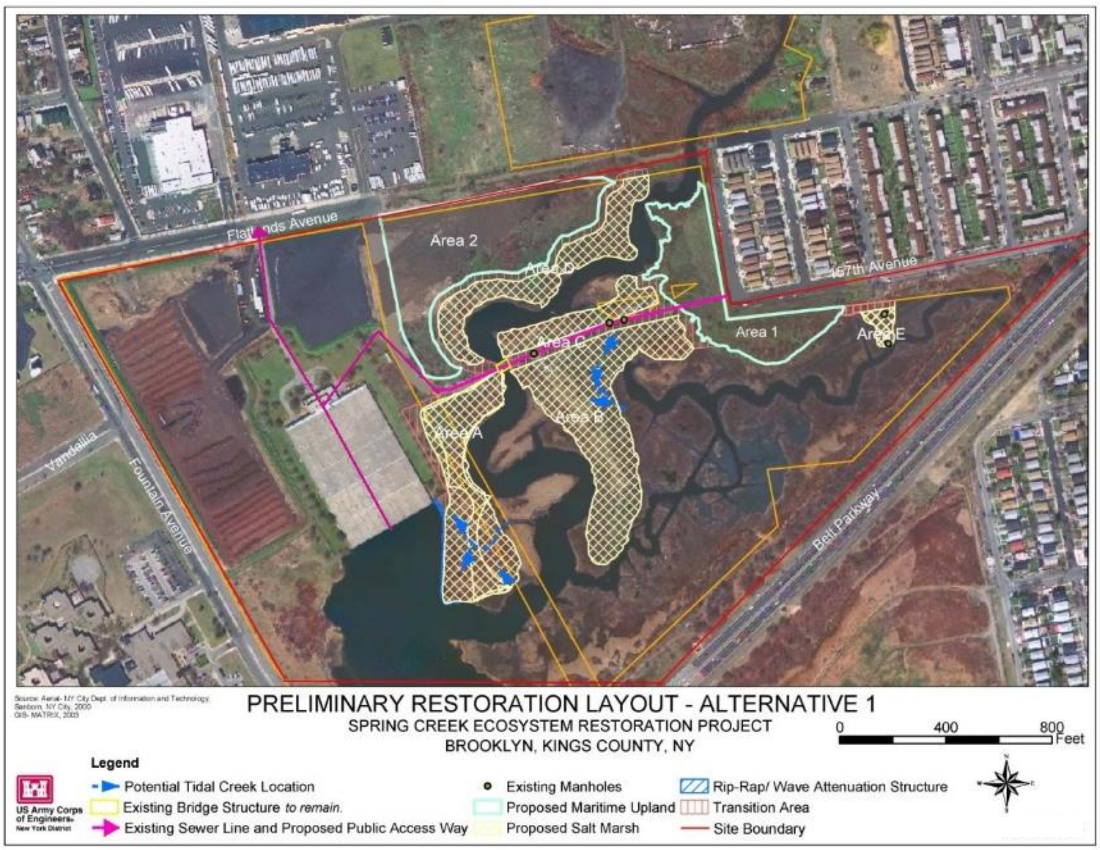


Figure 16: Alternative 1

Table 7. Alternative 1 Design Element Area (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On Site Disposal
A	3.63	--	0.49	--	-	-
B	5.05	--	0.62	--	-	-
C	1.18	--	0.41	-	-	-
D	2.39	--	1.00	-	-	-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	-
Total	12.25	-	2.52	-	7.34	--

5.2.3. Alternative 2

Alternative 2 maximizes low marsh acreage to a greater extent than Alternative 1. This is achieved through the removal and relocation of the sewer line that bisects the site (a variation in factor #2 relative to Alternative 1). The sewer line footprint would be backfilled and included in the restoration area. Approximately 13.34 acres of smooth cordgrass dominated low marsh would be established as part of this alternative. The plan would include an additional 1.84 acres of scrub/shrub transition area planted between the marsh and upland habitats. A 1:3 design slope would be established for the transition area plantings. Transition areas would be planted with species such as marsh elder, hackberry and northern bayberry. Tidal creeks would be included in the restoration design only if models indicate the necessity. Constructed tidal creeks would provide inundation to the interior of the restored wetlands.

All excavated material (~ 213,500 cy) would be removed and transported to an approved, off-site disposal location. Maritime upland areas would be developed adjacent to the constructed wetlands through the placement and grading of a minimum of 18 inches of clean planting medium appropriate for the target vegetation (e.g., clean or amended sand). The maritime upland area would account for approximately 7.34 acres of the project site.

Alternative 2 includes off-site disposal of excavated material. During early plan formulation, off-site disposal was a potential method that required consideration due to the uncertainty of the availability of on-site placement (within the Composting Facility area). Currently, acreage for on-site placement within the study area provided by the local sponsor/landowner (Composting Facility) is available as a disposal option. Therefore, Alternative 2 will only be considered for implementation if the construction schedule surpasses the local sponsor's ability to use the area of the Composting Facility for the enhancement action (on-site placement in Areas G and F).

Design elements included in Alternative 2 are summarized below in Table 8 and presented in Figure 17:

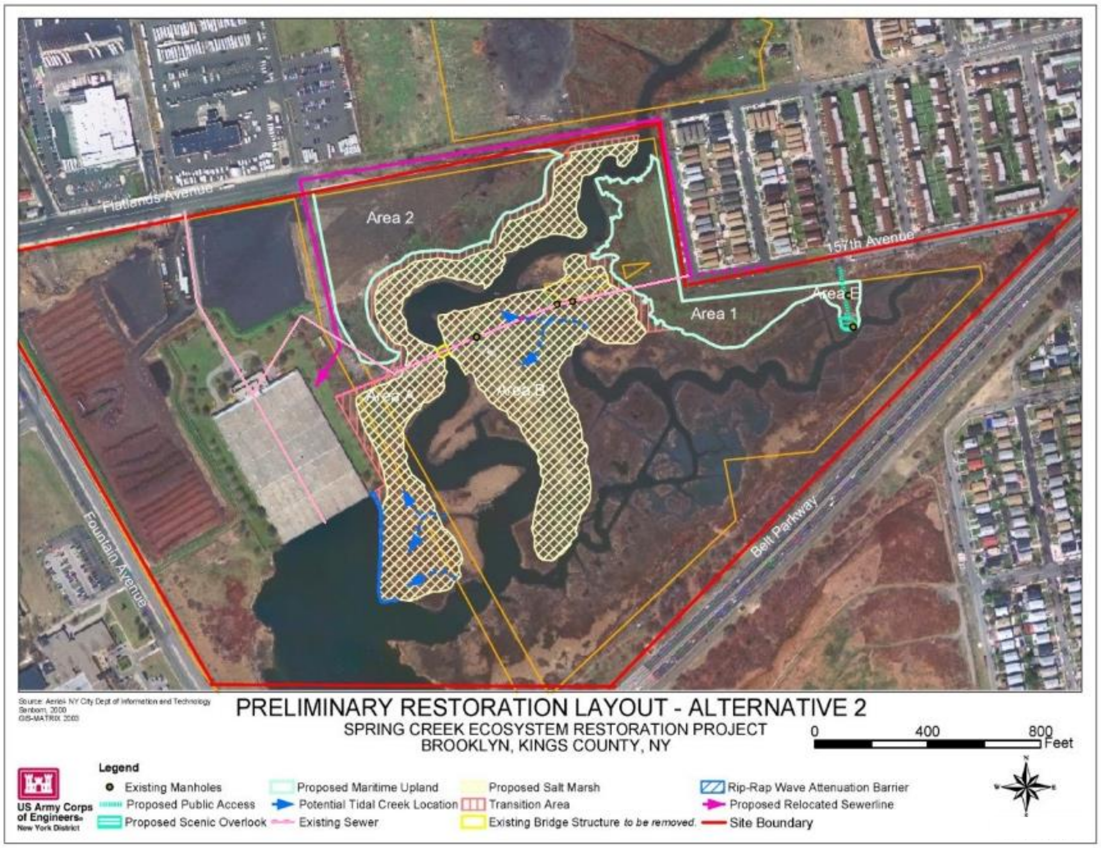


Figure 17: Alternative 2

Table 8. Alternative 2 Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal
A	3.99	--	0.49	--		-
B	5.78	--	0.19	--		-
C	1.18	--	0.19	-		-
D	2.39	--	0.97	-		-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	-
Total	13.34	-	1.84	-	7.34	-

5.2.4. Alternative 3A

Alternative 3A, as well as 3B and 3C, differs relative to Alternatives 1 and 2 in that a percentage or all of the excavated material is disposed of on-site (a variation in factor #3). Alternative 3A is similar to Alternatives 1 and 2 in that restored low marsh acreage is maximized. In this alternative, approximately 12.4 acres of low marsh habitat would be restored. Transition area acreage would amount to approximately 2.60 acres. If needed, tidal creeks would be added to the design to facilitate tidal inundation of the created marshes.

In this alternative approximately 191,500 cy of material would be excavated: about 56% of the excavated material (107,240 cy) would be disposed of off-site, while the remaining 44% (84,260 cy) would be placed and graded on-site in the maritime upland/compost areas. The cost savings from reducing off-site transportation of a portion of the fill would more than cover the work needed to cap and plant the upland buffer habitat, while adding diversity to the maritime complex. Excavated material would be placed and graded to a depth of three feet in Area 1. In Area 2, the material would be placed and graded from a depth of ten feet on the west side to a depth of three feet on the east side. These depths take into consideration the viewsheds of the surrounding communities. A minimum of 18 inches of clean planting medium specific to the target vegetation would be placed and graded over the excavated material areas targeted for maritime upland (approximately 7.34 acres).

Alternative 3A includes off-site disposal of excavated material. During early plan formulation, off-site disposal was a potential method that required consideration due to the uncertainty of the availability of on-site placement (within the Composting Facility area). Currently, acreage for on-site placement within the study area provided by the local sponsor/landowner (Composting Facility) is available as a disposal option. Therefore, Alternative 3A will only be considered for implementation if the construction schedule surpasses the local sponsor’s ability to use the area of the Composting Facility for the enhancement action (on-site placement in Areas G and F).

Design elements of Alternative 3A are summarized below in Table 9 and presented in Figure 18:

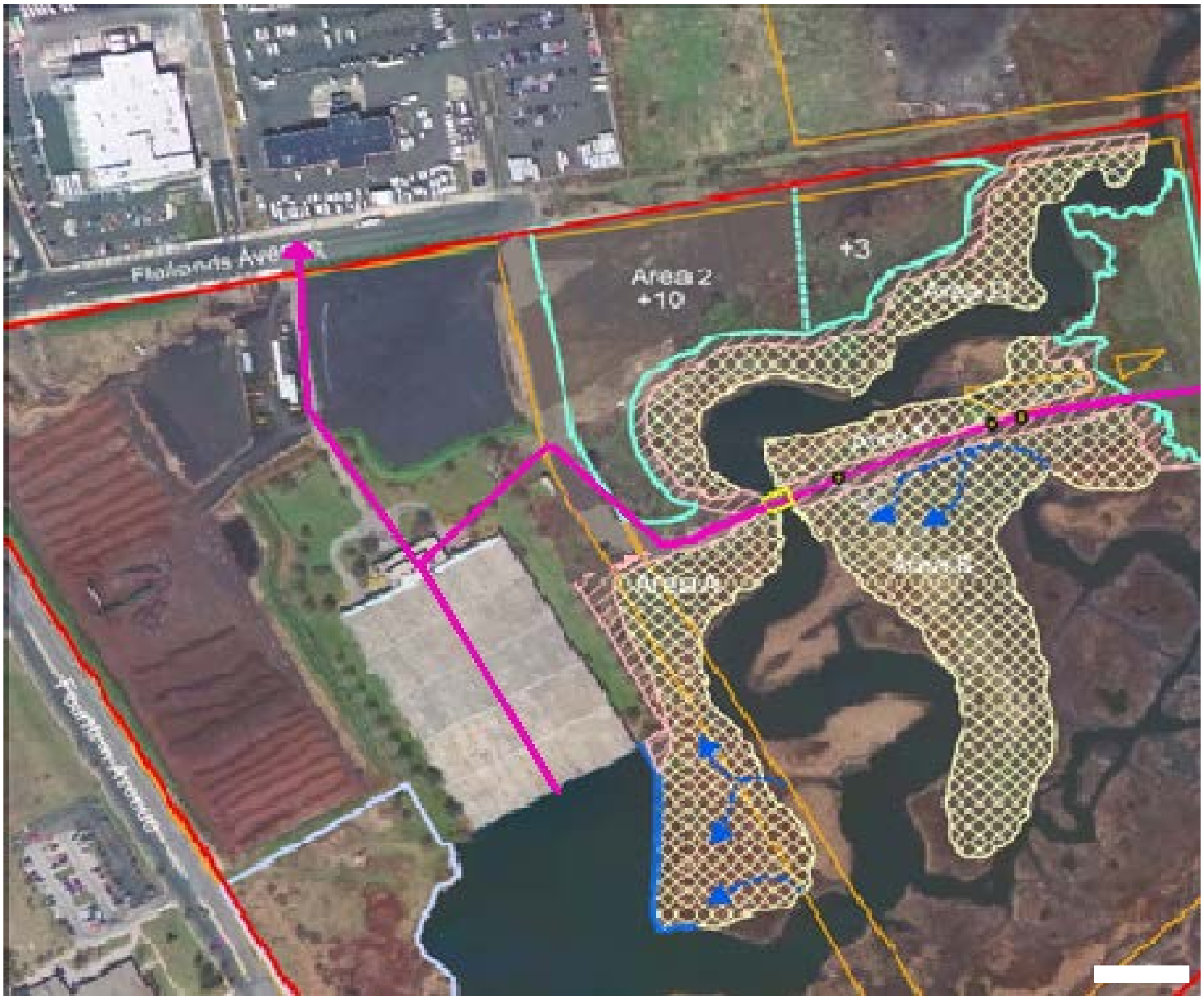


Figure 18: Alternative 3A

Table 9. Alternative 3A Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal/ Composting
A	3.63	-	0.49	-	-	-
B	5.05	-	0.62	-	-	-
C	1.18	-	0.41	-	-	-
D	2.55	-	1.08	-	-	-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	2.92
Total	12.41	-	2.60	-	7.34	2.92

5.2.5. Alternative 3B

Alternative 3B introduces additional elements to the restoration designs of Alternatives 1, 2, and 3A in the form of high marsh habitat and turtle mounds. This alternative looks to maximize intertidal marsh; however both low and high marsh communities are proposed. In this alternative, approximately 10.28 acres of smooth cordgrass dominated low marsh and approximately 2.27 acres of salt meadow hay/spikegrass dominated high marsh are restored for a total of 12.55 acres. Turtle mounds would be created with clean sand placed and graded to about 3 feet in depth. These mounds would be surrounded by high marsh and graded to an elevation above MHW to protect them from inundation. Turtle mounds account for 0.22 acres of the restoration area in this alternative. Scrub/shrub transition areas would be planted between the marsh and upland habitat at a design slope of 1:3; these areas would account for 2.43 acres of the restoration area.

Similar to Alternative 3A, a total of 189,375 cy of material would be excavated, where approximately 56% of the excavated material (106,050 cy) would be disposed of off-site at a licensed facility, while the remaining 44% (83,325 cy) would be disposed of on site. The excavated material would be placed and graded to depth of 3 feet in Area 1. In area 2 the excavated material would be gradually graded from a depth of ten feet to a depth of three feet, from west to east. These design depths are sensitive to the viewsheds of the surrounding communities. In areas to be planted with maritime upland vegetation (approximately 7.34 acres), clean planting medium (e.g., clean or amended sand) would be placed and graded atop the excavated material to a depth of at least 18 inches. As with alternative 3A, there would be a cost savings from reducing off-site transportation of a portion of the fill, while adding diversity to the maritime complex.

Alternative 3B includes off-site disposal of excavated material. During early plan formulation, off-site disposal was a potential method that required consideration due to the uncertainty of the availability of on-site placement (within the Composting Facility area). Currently, acreage for on-site placement within the study area provided by the local sponsor/landowner (Composting Facility) is available as a disposal option. Therefore, Alternative 3B will only be considered for implementation if the construction schedule surpasses the local sponsor's ability to use the area of the Composting Facility for the enhancement action (on-site placement in Areas G and F).

Design elements of Alternative 3B are summarized below in Table 10 and presented in Figure 19:

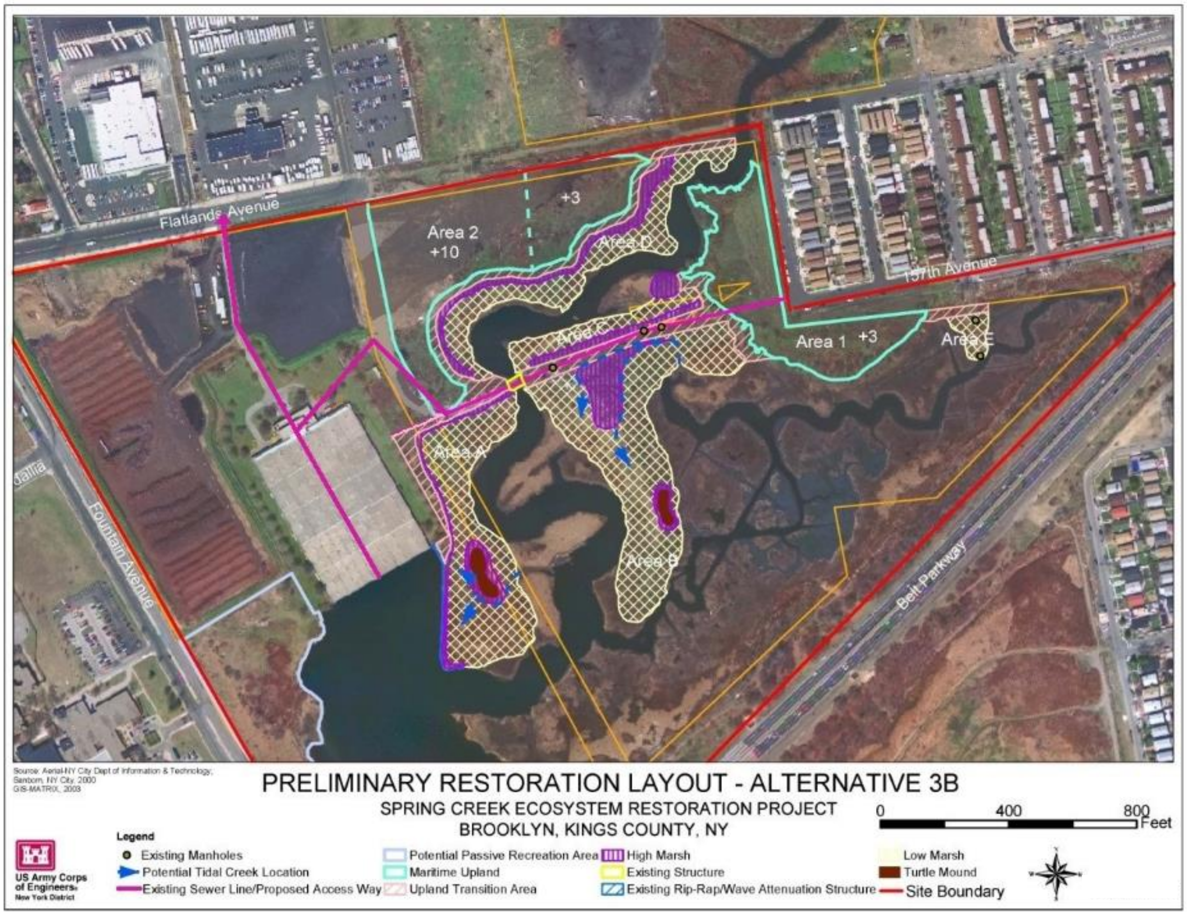


Figure 19: Alternative 3B

Table 10. Preliminary Alternative 3B Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal
A	3.15	0.49	0.44	0.14	-	-
B	4.33	0.68	0.58	0.08	-	-
C	0.79	0.44	0.38	-	-	-
D	2.01	0.66	1.03	-	-	-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	2.92
Total	10.28	2.27	2.43	0.22	7.34	2.92

5.2.6. Alternative 3C

Alternative 3C includes the restoration of approximately 10.23 acres of smooth cord grass dominated low marsh, and approximately 2.17 acres of salt meadow hay/spikegrass dominated high marsh. A transition area with a 1:3 design slope would be included between wetland and upland features, and would be planted with scrub/shrub species such as marsh elder and/or northern bayberry. Turtle mounds are also featured in this alternative's design. Turtle mounds would be constructed of clean sand to a depth of at least 3 feet. They would be situated at elevations that would prevent daily tidal inundation, and would be surrounded by high marsh habitat. Tidal creeks would be constructed, if needed, in Areas A and B to ensure tidal inundation of the interior portions of the created wetlands.

All excavated material would be retained on site. Approximately 191,800 cy would be excavated from the restoration areas, placed upland to create buffer habitat. Approximately 7.34 acres would be developed into maritime upland habitat. As with alternatives 3A and 3B, the cost savings from reducing off-site transportation of fill would more than cover the work needed to cap and plant the upland buffer habitat, while adding diversity to the maritime complex. Maritime upland habitat development would require the placement of 18” of clean planting medium specific to the requirements of the target maritime upland community (e.g. clean sand, amended sand, etc.). The remaining 101,920 cy of excavated material would be placed and graded on Areas 3 and 5 (Area 4 was not considered for disposal in this or any of the following alternatives). Areas 3 and 5 would then be restored and maintained as upland maritime habitat by NYC Parks.

The design elements included in Alternative 3C are summarized in Table 11 below and presented in Figure 20:

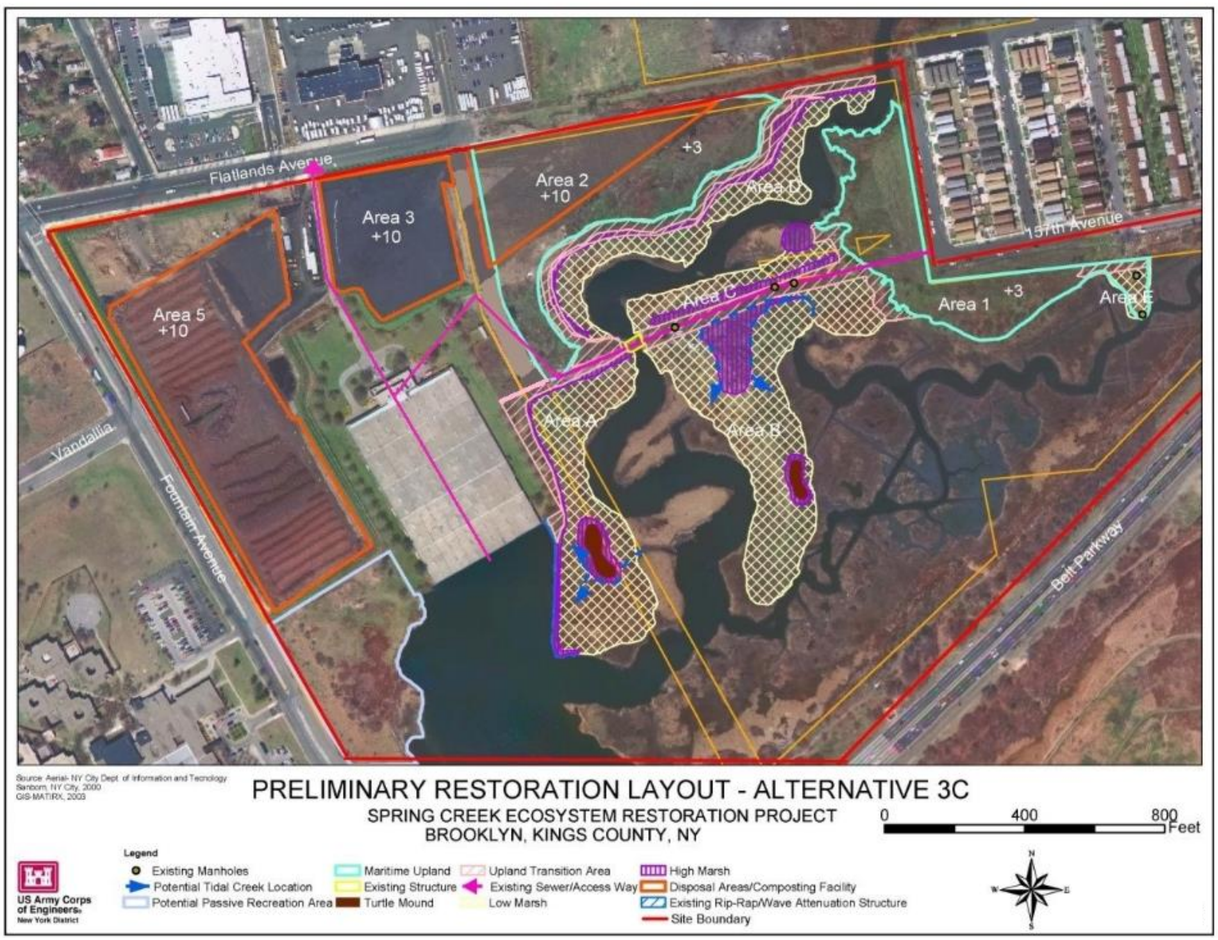


Figure 20: Alternative 3C

Table 11. Preliminary Alternative 3C Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal
A	3.17	0.45	0.44	0.14	-	-
B	4.33	0.67	0.58	0.08	-	-
C	0.79	0.44	0.38	-	-	-
D	1.95	0.61	1.03	-	-	-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	2.92
3	-	-	-	-	-	3.13
5	-	-	-	-	-	8.40
Total	10.24	2.17	2.43	0.22	7.34	14.45

5.2.7. Alternative 4A

Alternative 4A as well as 4B and 4C maximizes low marsh habitat through the removal and relocation of the existing sewer line. The sewer line's footprint would be backfilled and included in the restoration area, just as in Alternative 2. Approximately 13.34 acres of smooth cordgrass dominated habitat is restored in this alternative. Scrub/shrub habitat, planted as a transition area between marsh and maritime upland habitats, accounts for 1.84 acres of the total restoration area. Transition area species would include marsh elder and/or northern bayberry. Tidal creeks would be incorporated into the design if modeling results indicate the need.

In Alternative 4A, approximately 213,600 cy of material would be excavated, where 56% of the excavated material, just as in Alternative 3A, (119,616 cy) is disposed of off-site, while the remaining 44% (93,984 cy) would be placed on site in Areas 1 and 2. The excavated material would be placed and graded to a depth of three feet in area 1. In Area 2, the material would be placed and gradually graded from a depth of ten feet to a depth of three feet, from west to east. These depths take into consideration the viewsheds of the surrounding communities. In those areas to be developed into Maritime Upland habitat (approx. 7.34 acres), a minimum of 18 inches of clean planting medium (e.g., sand or amended sand) would be placed and graded on top of the excavated material before planting. As with Alternatives 3A, 3B, and 3C, costs for the capping and planting of the upland buffer would be covered by the reduced off-site transport of materials, while also providing added ecological benefits from increased diversity within the coastal system.

Alternative 4A includes off-site disposal of excavated material. During early plan formulation, off-site disposal was a potential method that required consideration due to the uncertainty of the availability of on-site placement (within the Composting Facility area). Currently, acreage for on-site placement within the study area provided by the local sponsor/landowner (Composting Facility) is available as a disposal option. Therefore, Alternative 4A will only be considered for implementation if the construction schedule surpasses the local sponsor's ability to use the area of the Composting Facility for the enhancement action (on-site placement in Areas G and F).

Design elements of Alternative 4A are summarized below in Table 12 and presented in Figure 21:

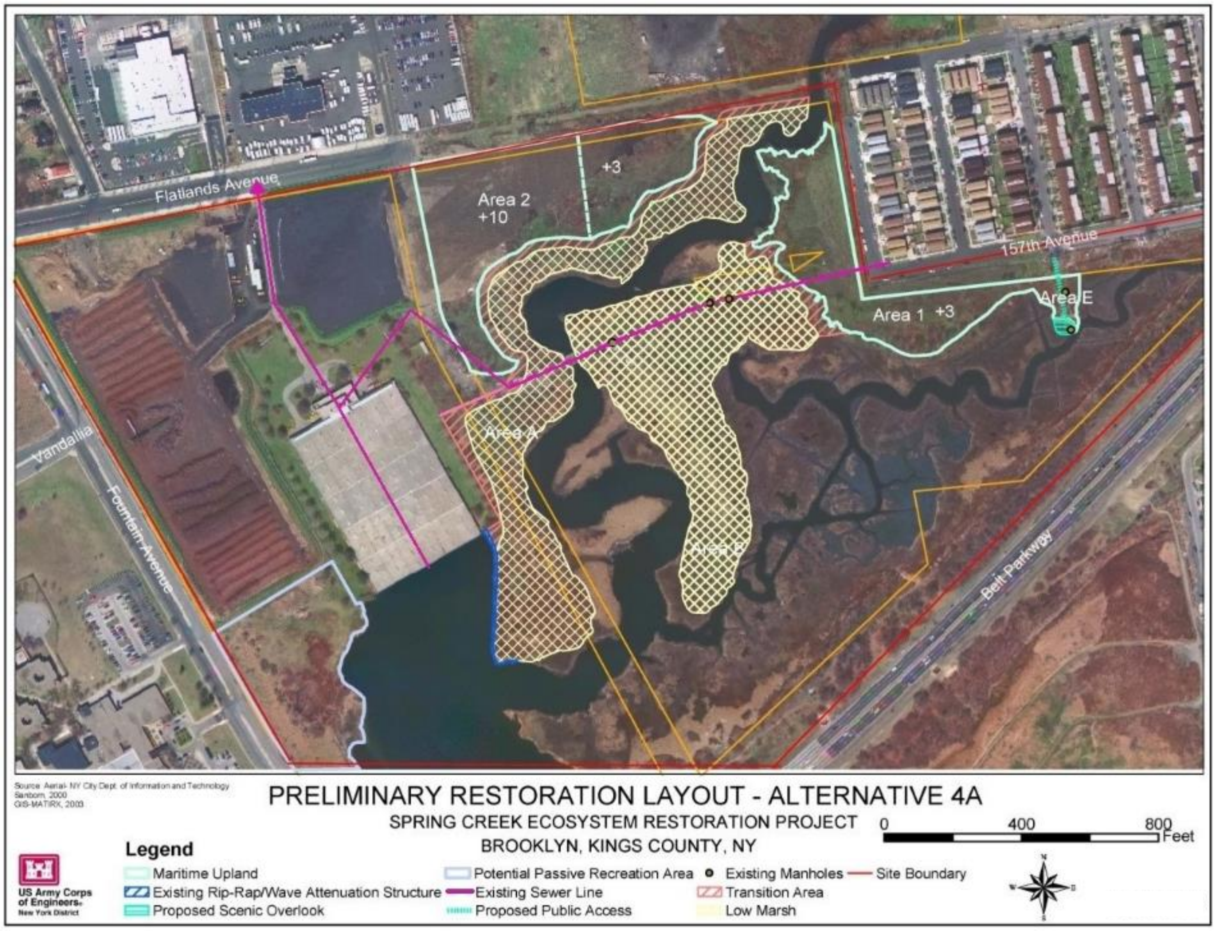


Figure 21: Alternative 4A

Table 12. Alternative 4A Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal
A	3.99	-	0.49	-		-
B	5.78	-	0.19	-		-
C	1.18	-	0.19	-		-
D	2.39	-	0.97	-		-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	2.92
Total	13.34	-	1.84	-	7.34	2.92

5.2.8. Alternative 4B

Alternative 4B introduces additional design elements to Alternative 4A. In this alternative, high marsh and turtle mounds are included in the restoration design, much like in Alternative 3B. Marsh acreage is maximized in the alternative through the removal and relocation of the existing sewer line easement. The sewer line's footprint would be backfilled and included in the restoration area. A total of 9.39 acres of low marsh, and 2.57 acres of high marsh would be restored under this alternative. Approximately 1.84 acres of scrub/shrub transition area would be planted between the marsh and upland areas. The design slope of this area would be 1:3. Turtle mounds would be created with clean sand placed and graded to about 2 feet in depth. These mounds would be surrounded by high marsh to protect them from daily inundation. Turtle mounds account for 0.22 acres of the restoration area.

Similar to Alternative 4A (as well as 3B), approximately 56% of the excavated material (130,681 cy) would be disposed of off-site, while the remaining 44% (102,879 cy) would be disposed of on site for a total of 233,360 cy. The excavated material retained on site would provide savings in reduced off-site transport of materials, a portion of which would be used to cover costs to cap and plant the upland buffer. The materials would be placed and graded in Areas 1 and 2. In Area 1, the material would be placed and graded to a depth of three feet. In Area 2, the material would be placed and gradually graded from a depth of ten feet on the west side to a depth of three feet on the east side. In those areas to be developed into Maritime Upland habitat (approx. 7.34 acres), a minimum of 18 inches of clean planting medium specific to the requirements of the target maritime upland community would be placed and graded over the excavated material.

Alternative 4B includes off-site disposal of excavated material. During early plan formulation, off-site disposal was a potential method that required consideration due to the uncertainty of the availability of on-site placement (within the Composting Facility area). Currently, acreage for on-site placement within the study area provided by the local sponsor/landowner (Composting Facility) is available as a disposal option. Therefore, Alternative 4B will only be considered for implementation if the construction schedule surpasses the local sponsor's ability to use the area of the Composting Facility for the enhancement action (on-site placement in Areas G and F).

Design elements of Alternative 4B are summarized below in Table 13 and presented in Figure 22Figure 22: Alternative 4B:

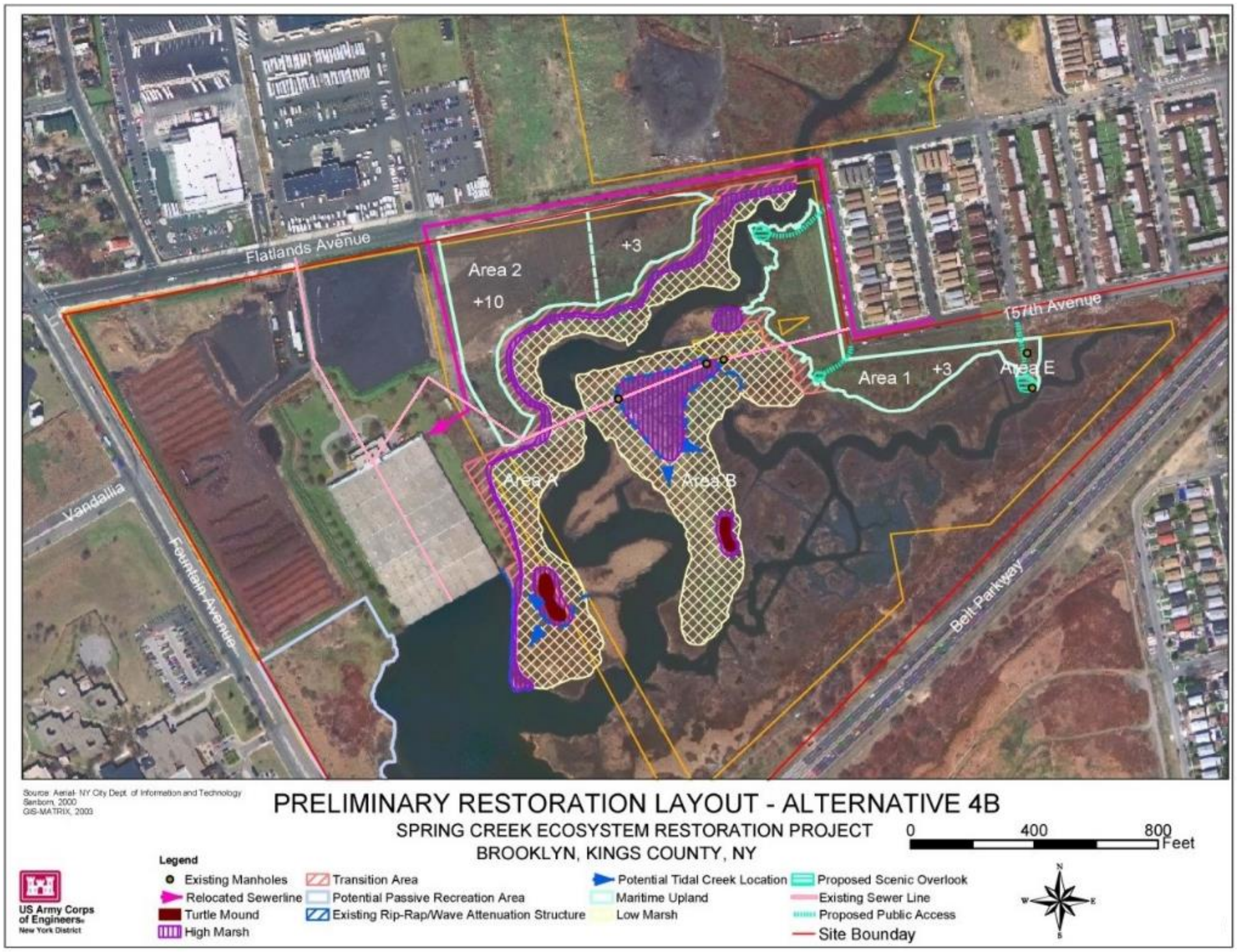


Figure 22: Alternative 4B

Table 13. Preliminary Alternative 4B Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal/ Composting
A	3.26	0.59	0.49	0.14	-	-
B	4.42	1.28	0.19	0.08	-	-
C	0.85	0.14	0.19	-	-	-
D	0.86	0.56	0.97	-	-	-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	2.92
Total	9.69	2.57	1.84	0.22	7.34	2.92

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5.2.9. Alternative 4C

Alternative 4C includes the restoration of approximately 9.39 acres of smooth cordgrass dominated low marsh and 2.57 acres of salt meadow hay/spikegrass dominated high marsh. In this alternative, the existing sewer line and its associated structure would be removed. The sewer line footprint would be backfilled and the resulting area incorporated into the marsh design elements.

A 1.84 acre transition area would be created with a 1:3 design slope. The transition area would be planted with scrub/shrub species such as marsh elder and northern bayberry. Alternative 4C also includes turtle mounds. Tidal creeks would be incorporated into the design, if necessary, to facilitate inundation of the interior portions of the created wetlands.

Disposal of excavated material would be handled in the same manner as in Alternative 3C, with all excavated material retained on site. Approximately 233,360 cy would be excavated from the restoration areas, placed and graded in Areas 1 and 2. A large portion of these areas (7.34 acres) would be developed into maritime upland habitat. The excavated material retained on site would provide savings in reduced off-site transport of materials, a portion of which would be used to cover costs to cap and plant the maritime upland buffer. Maritime upland habitat development would require the placement of 18" of clean planting medium specific to the requirements of the target community (e.g. clean sand, amended sand, etc.). The balance (2.92 acres) of Area 2 would remain unchanged.

Design elements included in Alternative 4C are summarized below in Table 14 and presented in Figure 23:

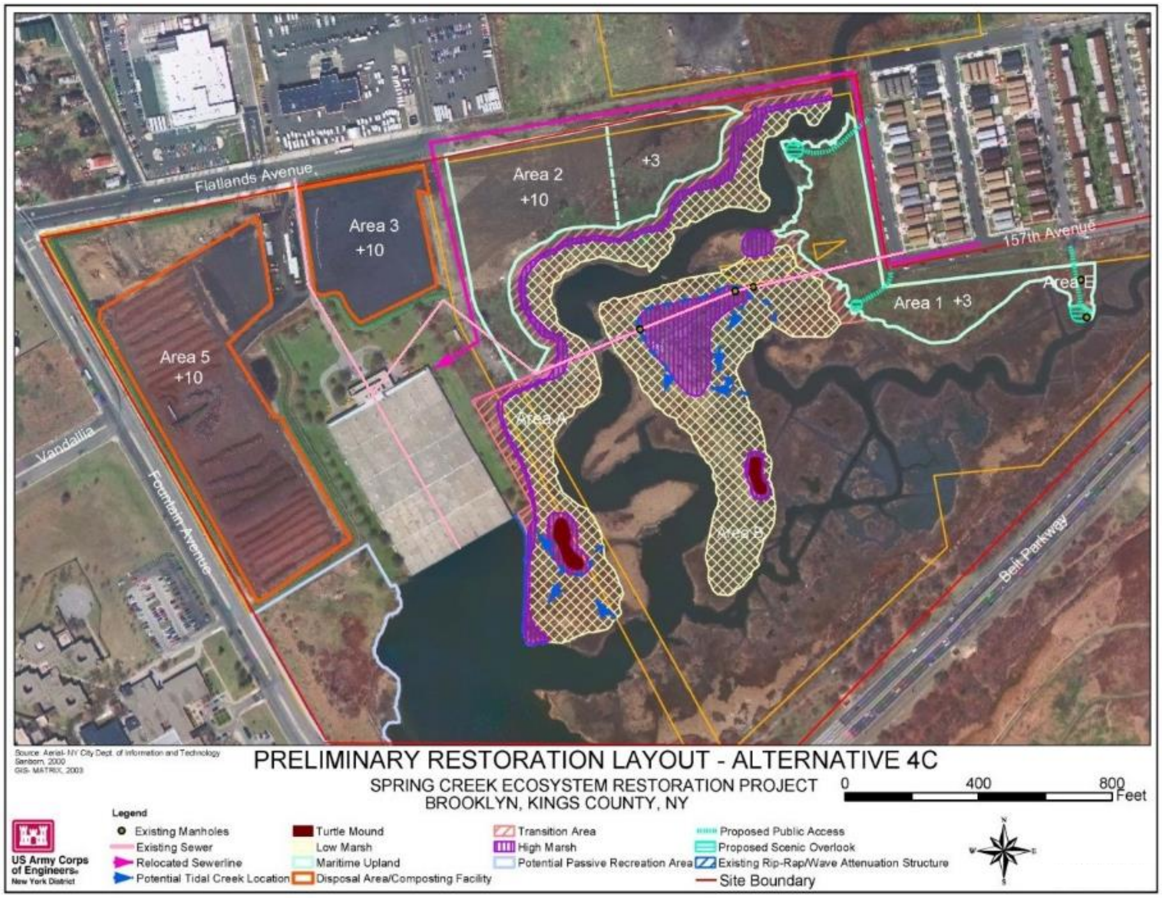

Figure 23: Alternative 4C

Table 14. Preliminary Alternative 4C Design Element Areas (Acres)

Location	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On-Site Disposal
A	3.26	0.59	0.49	0.14	-	-
B	4.42	1.28	0.19	0.08	-	-
C	0.85	0.14	0.19	-	-	-
D	0.86	0.56	0.97	-	-	-
1	-	-	-	-	4.03	-
2	-	-	-	-	3.31	2.92
3	-	-	-	-	-	3.13
5	-	-	-	-	-	8.40
Total	10.55	2.57	1.84	0.22	7.34	14.45

5.2.10. Summary of Alternatives Restoration Plans

The Spring Creek FR/EA lays out 9 Alternative Restoration Plans, 6 which require off site placement of excavated material. At this time, Alternatives 1, 2, 3A, 3B, 4A, and 4B will not be considered for implementation because there is an opportunity to place the material on-site at the Composting Facility (Areas G and F).

5.3. SCREENING OF ALTERNATIVES

The final array of alternatives considered for implementation were evaluated for their success in meeting the Planning Objective, including Purpose and Need; and the Planning Constraints, including technical feasibility, environmental acceptability, habitat analysis, and economic feasibility. The evaluation criteria considered the alternatives according to their overall acceptability. As stipulated under the CAP 1135 Authority, Cost Effectiveness/Incremental Cost Analysis (CE/ICA) should focus on alternative solutions. The four criteria in the Principles and Requirements of March 2013: completeness, effectiveness, efficiency, and acceptability. These are defined as:

- Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective.
- Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
- Efficiency is the extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
- Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

All alternatives are complete and are anticipated to be acceptable to State and local entities and the public and compatible with existing laws, regulations, and public policies. Effectiveness and efficiency will next be determined for all alternatives and will lead to the identification of the NER Plan.

To facilitate the selection of a preferred alternative and to ensure that the federal government is investing funds in the most cost-effective plans, USACE requires that the benefits be quantified so that relative levels of habitat benefit (output) can be compared to the costs. Each habitat restoration measure was analyzed using EPW. EPW can provide numeric scores (element scores) for existing conditions at a project site, potential future without-project conditions, and various action alternatives for a wetland habitat in a particular geographic area. A set of variables that represent the habitat requirements were combined into a mathematical model. The variables were then measured and their corresponding index values were inserted into the model to produce a score that describes existing habitat suitability. The value is an index score between 0 and 1, though a perfect score of 1.0 was not found to exist within the project area and is considered unlikely to be found within an urban setting.

Although approval of planning models under EC 1105-2-412 is not required for CAP projects (Civil Works Policy Memorandum #1 [January 19, 2011]), the principles to ensure quality continue to be necessary. Models and analysis must be compliant with USACE policy, theoretically sound, computationally accurate, and transparent. However, Evaluation Planned Wetland (EPW) has been certified for regional use within the Hudson-Raritan Estuary by USACE's Ecosystem Restoration Planning Center of Expertise in June 2016.

A set of factors were screened in each of the alternatives in order to select the NER plan, the one which is most effective and efficient, with an overall goal of restoring significantly degraded ecosystem function, structure, and dynamic coastal process to approximate the sites former, natural condition. The factors evaluated during the screening process included: total project cost; disposal volumes and options (off-site versus on-site); total acreage of intertidal salt marsh; and the anticipated increase in restored wetland functionality through a comparison of EPW scores for each alternative. EPW provides a technique for determining the capacity of a wetland to perform six major wetland functions, although only five were evaluated for the project site (see Table 15 and Table 16). Table 15 below presents a comparison of restoration element areas and disposal volumes for each of the eight preliminary alternatives.

Table 15. Design Element Areas and Disposal Volumes; Eight preliminary Alternatives

Alt.	Low Marsh	High Marsh	Transition	Turtle Mound	Pipe	Disposal Vol. (cy)	
						On-site	Off-site
0	---	---	---	---	---	---	---
1	12.25	---	2.52	---	N	---	190,750
2	13.34	---	1.84	---	Y	---	213,500
3A	12.41	---	2.60	---	N	84,260	107,240
3B	10.28	2.27	2.43	0.22	N	83,325	106,050
3C	10.24	2.17	2.43	0.22	N	191,800	---
4A	13.34	---	1.84	---	Y	93,984	119,616
4B	9.69	2.57	1.84	0.22	Y	102,879	130,681
4C	10.55	2.57	1.84	0.22	Y	233,360	---

5.3.1. EPW – Existing Conditions

The assessment results serve as a baseline reference for estimating current resource value and the potential ecological lift (increase in resource value) of the restoration project. Within each function, numerous elements (i.e., physical, chemical, and biological characteristics) are evaluated in order to identify a wetland's capacity to perform a given function.

Element scores (unitless numbers ranging from 0.0 to 1.0, where 1.0 represents the optimal score) were assessed for each of two reference sites. The scores were combined to produce a Functional Capacity Index (FCI) value from 0.0 to 1.0, which provides a relative index of a reference site's capacity to perform a given function. Size *(i.e.,* acreage) of the reference site is then multiplied by the FCI value to produce a wetland functional capacity unit (FCU), which represents the reference site's capacity to perform each wetland function (Bartoldus *et al.,* 1994).

The wetland functions assessed during this evaluation included sediment stabilization (SS), water quality (WQ), wildlife (WL), fish-tidal (FT), and Uniqueness/Heritage (UH). Appendix F provides a description of EPW methods, results of field surveys and future with project conditions for each of the alternatives. These functions were chosen based upon the conditions of the site. The specific functions evaluated for each assessment site at Spring Creek included the following.

Table 16. EPW Functional Capacity Index Categories

Function	Abbreviation	Definition
Sediment Stabilization	SS	Capacity to stabilize and retain previously deposited sediments
Water Quality	WQ	Capacity to retain and process dissolved or particulate materials to the benefit of downstream surface water quality
Wildlife	WL	Degree to which a wetland functions as habitat for wildlife as described by habitat complexity
Fish (tidal)	FT	Degree to which a wetland habitat meets the food/cover, reproductive, and water quality requirements for fish
Uniqueness/ Heritage	UH	Presence of characteristics that distinguish a wetland as unique, rare, or valuable

Based on these general site characteristics, the site in its existing state was scored using the EPW as summarized below.

Sediment Stabilization: Existing conditions at Reference Site 1 and Reference Site 2 scored a 1.0 for this function, which represents the highest FCI value for a function.

Water Quality: The reference sites received high FCI values for this function, scoring 0.86 and 0.97 for Site 1 and Site 2, respectively.

Wildlife: Both reference sites received moderate FCI values for this function, receiving a score of only 0.35 out of 1.0.

Fish-tidal: Both reference sites received only a moderate score for this function, 0.48 out of 1.

Uniqueness/Heritage: The UH functional capacity for the existing reference sites are low, both sites scored only 0.25 out of 1.0. It should be noted that the uniqueness/heritage function is based primarily on the presence of elements such as threatened species or historically significant features, and is not calculated based on size. The reference wetlands at the Spring Creek site received a low score for Uniqueness/Heritage because none of the relevant elements/features were present.

In summary, the reference wetlands function very well with regard to sediment stabilization and water quality, while they function moderately with regard to wildlife and fish-tidal functions. This indicates that these wetlands are healthy considering existing conditions on the site, and that it is likely that the disturbed areas within the project site can be restored to functional wetlands. The full EPW report is available as a separately bound document.

5.3.2. Analysis of the EPW Scores

The EPW scores indicated that the two wetland restoration reference sites, representing existing high marsh and low marsh respectively, possess moderate to high functions and values. The reference sites scored high for sediment stabilization and water quality functions and values. Moderate functions and values were calculated for wildlife and fish-tidal categories. The reference sites possess low functions and values related to uniqueness/heritage, as there are few characteristics present that distinguish the reference sites as unique or rare. However, elements for this function are based on background data collection, not field observations.

An EPW score was determined for each of the eight restoration alternatives (see Table 17 below). The existing conditions for wildlife habitat functions (expressed in FCI) for the proposed restoration areas scored relatively low with values of 0.17 and 0.20, for restoration areas 1 and 2, respectively. This was also the case for the uniqueness/heritage function, for which both restoration sites received scores of 0.25 out of 1.0. Because the EPW model does not account for upland habitat, the FCI values for the proposed wildlife habitat function were augmented from 0.35 in the reference site to 0.50 for the proposed condition, using best professional judgment. This FCI value was changed due to EPW methodologies oversight of a healthy intertidal salt marshes ability to provide wildlife habitat, which is certainly increased when combined with a natural transition to coastal/maritime uplands. Furthermore, the existing and more importantly proposed tidal wetlands are even more important from a local and regional standpoint as they represent a scarce resource in the New York Metropolitan area.

The EPW assessment method was not designed to evaluate the functionality of upland habitats. Furthermore, there is no good on-site reference for upland maritime habitat. Consequently, FCI's and FCU's could not be developed for reference upland habitats. Using best professional judgment, the team adjusted EPW scores to augment wildlife function for the coastal maritime habitat to account for this limitation in the overall assessment of ecological values to the system.

5.3.3. EPW Comparison Summary

The existing site conditions FCI's and FCU's were calculated for the former tidal wetland areas targeted for wetland restoration. FCI's and FCU's were also calculated for the eight restoration alternatives. The eight alternatives ranged in total FCU values from a low of 37.91 for Alternatives 4B and 4C to a high of 41.94 for Alternatives 2 and 4A (Table 17). Baseline conditions of areas surveyed for EPW analysis and slated for excavation/ wetland creation are primarily disturbed upland habitat comprised of *Phragmites australis*, *Artemesia vulgaris* (mugwort), and concrete rubble (See Figure 13), therefore, each of the eight alternatives provides significant ecological lift (increase in value) between the existing and proposed conditions. The largest lift in each of the alternatives results from an increase in sediment stability and water quality functions. Each of the alternatives also presents ecological lift resulting from increases to the wildlife habitat and fisheries habitat functions. Ecological lift does not apply to the uniqueness and heritage value. This function is based on background data, such as presence of historic sites or threatened and endangered species, therefore this function cannot be increased as the result of restoration. Summary tables for each alternative are presented in a separately bound EPW report (appendix F).

Table 17. Total FCU Comparison by Alternative

Alternative	Baseline FCUs	Total FCUs	Net FCUs
No Action			
1	5.12	39.23	34.11
2	5.12	41.94	36.82
3A	5.12	39.72	34.60
3B	5.12	39.89	34.77
3C	5.12	39.50	34.38
4A	5.12	41.94	36.82
4B	5.12	37.91	32.79
4C	5.12	37.91	32.79

In accordance with planning guidance, the outputs, expressed in Functional Capacity Units (FCU), were computed on an average annual basis, taking into consideration that the outputs achieved may vary over time (Table 18).[1] For example, a maritime forest environment may take 30 years to reach maturity and function at maximum capacity, compared to low marsh that will mature and be functional within 5 years of construction. In the case of Spring Creek North, upland benefits were not counted through the EPW analysis, so that example does not directly apply. The net benefit for the with-project condition under each alternative scenario is shown in Table 17 and represents the difference between the maximum (or total) FCU and the baseline.

Average annual benefits were determined by utilizing habitat growth pattern values developed for a similar site (Bayswater Point State Park) in the Jamaica Bay Ecosystem Feasibility Study (which is now included in the HRE Feasibility Study; USACE, 2017). The team settled on using a marsh growth pattern since the area of Maritime Upland was constant amongst all the alternatives. The average annual benefit values determined for Bayswater Point State Park in Jamaica Bay (USACE, 2017) of a marsh over the 50 year period of analysis is about 92% of the net function (see Appendix F for details).

Table 18. Average Annual Functional Capacity Units (AAFCU) for each Alternative

Alternative	Net Restoration Output (Functional Capacity Units [FCUs])[1]	Average Annual Functional Capacity Unit Output (AAFCU)
1	34.11	31.38
2	36.82	33.87
3A	34.60	31.83
3B	34.77	31.99
3C	34.38	31.63
4A	36.82	33.87
4B	32.79	30.17
4C	32.79	30.17

[1]This value represents the restoration Total FCUs minus the baseline condition FCUs

[1] ER 1105-2-100, paragraph E-36c.(1)

5.3.4. Screening-level Costs

Screening level costs for the alternatives 1 through 4C were developed in 2004 (inflated in 2010) using a set of assumptions, some of which were derived from real world experiences during construction of the completed restoration projects in Jamaica Bay (Appendix D). These include but are not limited to the following:

- All costs were developed by obtaining bids and conducting detailed conversations with local NYC contractors with significant experience in constructing whatever elements they were asked to bid on;
- A homogeneous cost per cubic yard for excavation and on-site placement of excavated material;
- A homogeneous cost per cubic yard for excavation, transport and disposal offsite of excavated material;
- Excavation would be conducted during periods of low tide to promote a dry work environment;
- The culvert/bridge over spring creek is structurally capable of supporting construction vehicles;
- The low marsh would be planted with 2" plugs of *Spartina alterniflora,* 2 foot centers and not seeded;
- Transition areas would be planted with 2-3' high containerized material on 6 – 10 foot centers for shrubs and trees respectively and seeded with an appropriate native seed mix;
- Turf reinforcement mats and bio-logs would only be used to stabilize the proposed tidal channels;
- All costs were based on New York City prevailing labor rates; and
- All excavated material was considered contaminated but non-hazardous.

The total average annual costs of the Spring Creek alternative plans are presented in Table 19. These costs are based on average annual implementation costs and annualized O&M costs. Average annual implementation costs include capital costs, real estate costs, and interest during construction. Interest during construction was calculated assuming 10-month construction periods for Plans 1, 3A, 3B, and 3C, and 12-month construction periods for Plans 2, 4A, 4B, and 4C. O&M costs were estimated assuming: (1) fence replacement and interpretive path (see section 5.5 below for further description) maintenance every five years and (2) biological monitoring conducted in the post-construction period. The prevailing federal discount rate at the time that the screening was initially conducted of 5 5/8 percent or .05625 was used to estimate interest during construction and to discount future O&M expenditures.

Since ecosystem restoration outputs are not monetary, they were not discounted. Restoration costs were calculated in terms of present worth using the current rate of 4 7/8% and annualized. Annualized costs and average annual restoration outputs were input into IWR-PLAN.

Table 19. Implementation Costs (2010 Inflated) for each Alternative Restoration Plan

Alternative	Construction Cost	Interest During Construction	Average Annual Equivalent Cost*	O&M Costs	Total Average Annual Costs
1	$11,369,456	$219,352	$697,048	$5,362	$702,410
2	$14,431,382	$402,168	$892,215	$5,362	$897,576
3A	$9,527,824	$183,822	$584,140	$5,362	$589,502
3B	$9,201,039	$177,517	$564,105	$5,362	$569,467
3C	$6,521,093	$125,812	$399,801	$5,362	$405,163
4A	$12,140,381	$338,323	$750,574	$5,362	$755,936
4B	$12,829,777	$357,535	$793,196	$5,362	$798,558
4C	$9,498,812	$264,709	$587,260	$5,362	$592,622

5.4. COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS

The USACE ecosystem restoration policies (including EC 1105-2-210, Ecosystem Restoration in the Civil Works Program, 1 June 1995 and ER 1105-2-100 Appendix H) require that restoration projects include a Cost Effectiveness and Incremental Cost Analysis (CE/ICA). The purpose of CE/ICA is to explicitly compare the incremental costs and the incremental outputs associated with moving to each successively larger restoration plan. The Institute for Water Resources has developed a computer model, *IWR-PLAN*, to facilitate incorporation of CE/ICA into the planning process.

The first step is to identify which plans are cost effective. For each plan identified as cost effective, no other plan provides the same output for less cost. The set of cost effective plans is referred to as “best buy plans.” The best buy plans then undergo an Incremental Cost Analysis, starting from the smallest best buy plan. An ICA reveals changes in costs as output levels increase, and allows an assessment of whether the increase in output is worth the additional cost.

The results of the CE/ICA conducted for Spring Creek are discussed below and presented in Table 20 (Appendix D). IWR-PLAN Version 3.30 software was used for this analysis. Costs of the alternative plans include implementation costs (including construction costs, real estate costs, and interest during construction) and operation and maintenance (O&M) costs. Anticipated outputs of the Spring Creek restoration alternatives were estimated using the Evaluation of Planned Wetlands (EPW) assessment method, and restoration outputs are expressed in Functional Capacity Units (FCUs) (see Section 5.3.3.). The average costs and outputs of all restoration plans are presented in Table 20. The Cost Effective plan (labeled with blue triangle) and the Best Buy plans (labeled with red squares) are marked in Figure 24.

Table 20. Average Costs of Alternative Restoration Plans*

Alternative Restoration Plans*[1]	Net Outputs (FCUs)[1]	Average Annual Output (AAFCU)	Costs ($1000)	Average Cost ($1000)/AAFCU
1	34.11	31.38	702	22.37
2	36.82	33.87	898	26.51
3A	34.60	31.38	590	18.80

Alternative Restoration Plans*[1]	Net Outputs (FCUs)[1]	Average Annual Output (AAFCU)	Costs ($1000)	Average Cost ($1000)/AAFCU
3B	34.77	31.99	569	17.79
3C	34.38	31.63	405	12.80
4A	36.82	33.87	756	22.32
4B	32.79	30.17	799	26.48
4C	32.79	30.17	593	19.66

Entries in grey were not cost effective

[1]This value represents the restoration FCU's minus the baseline condition FCUs

For each plan identified as cost effective, no other plan provides the same output for less cost. Alternatives 3C, 3B, and 4A were identified as cost effective and were carried forward to the Incremental Cost Analysis (ICA) (Figure 24).

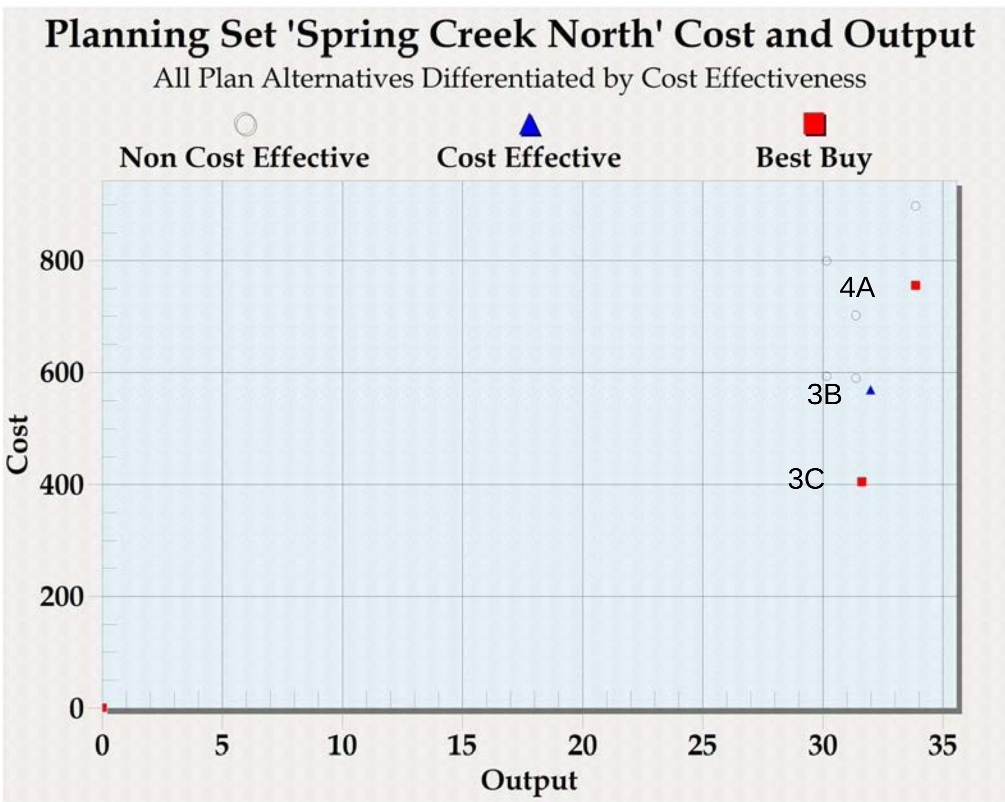

Figure 24: Cost Effective Restoration Alternatives at Spring Creek North

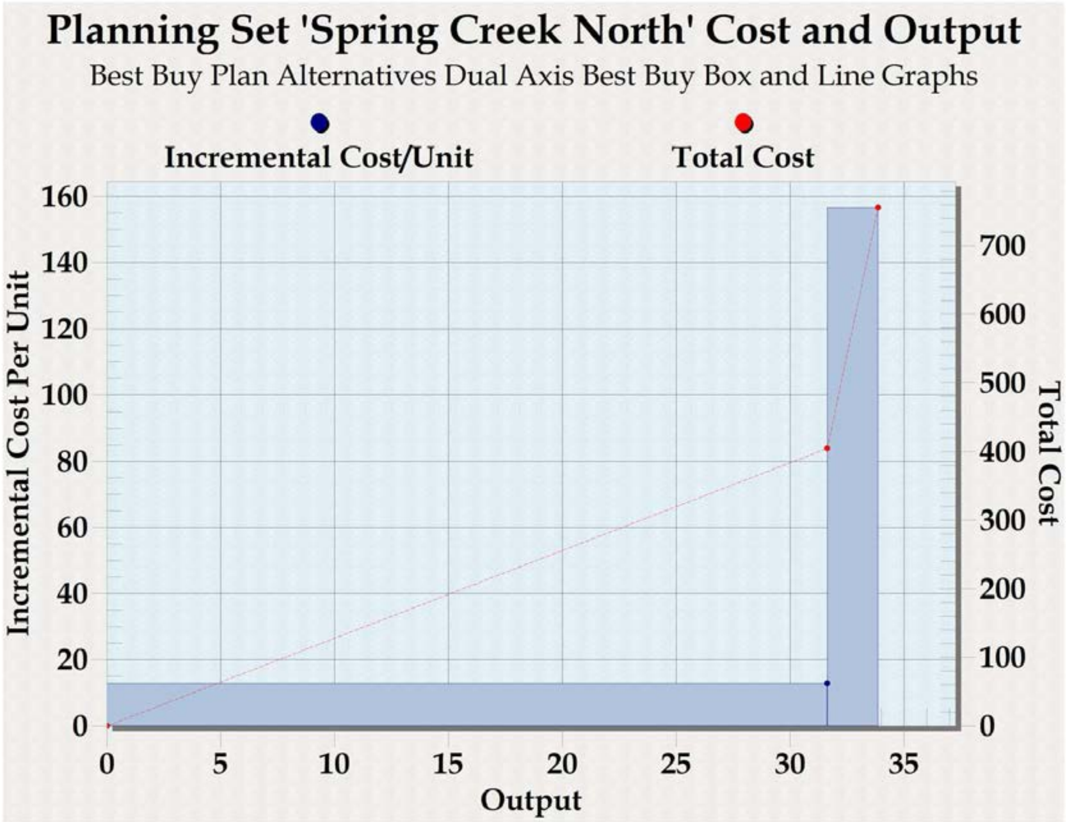

Figure 25: Spring Creek North Ecosystem Restoration Best Buy Plans

Of the 3 Cost Effective Plans, IWR-Plan identified 2 Best Buy Plans through an ICA; Alternative 3C and Alternative 4A. An ICA reveals changes in cost as output levels increase, and allows an assessment of whether the increase in output is worth the additional cost.

Table 21. Best Buy Restoration Plans for Spring Creek

Alternative Restoration Plans	Outputs (AAFCUs)	Average Annual Costs ($)	Average Cost ($/AAFCU)	Incremental Costs ($)	Incremental Output (AAFCUs)	Incremental Cost per Output ($/AAFCU)
3C	31.63	$405,000	$12,804	$405,000	31.63	$12,804
4A	33.87	$756,000	$22,321	$351,000	2.24	$156,696

The 2 Best Buy plans are presented graphically in Figure 24, Figure 25, and in Table 21, along with their respective average cost and incremental cost per additional output. The CE/ICA analysis identifies 2 breakpoints. The first breakpoint is at Best Buy plan 3C for a total habitat output of 31.63 AAFCU's with an average annual cost of $405,000. The second breakpoint is at Best Buy plan 4A for a total habitat output of 33.87 AAFCU's with an average annual cost of $756,000. Including an additional 2.24 AAFCU's by implementing Best Buy plan 4A would increase the cost per unit ($/FCU) $12,804 to $156,696.

The selection of the recommended restoration plan for a given site can be a complex undertaking. The comparison of incremental costs and incremental outputs provides a way to evaluate alternative levels of ecosystem restoration. CE/ICA shows what additional costs would be incurred and what additional outputs would be gained if successively larger plans were implemented. The analyses do not specify whether one Best Buy plan is preferable to another. However, in this case, the identification of the tentatively selected plan is based on selecting the most cost effective alternative which would be Alternative 3C.

5.5. SELECTION OF THE RECOMMENDED PLAN

Based on the CE/ICA results, the study team recommends Alternative 3C as the recommended plan and NER plan. The additional FCUs obtained for the additional cost, and incremental cost per FCU, for Alternative 4A was decided to be too high. It was then determined that this plan required further optimization with regard to engineering and ecological constraints (see Section 4.4), relating to constructability, non-federal sponsor requirements and current permitting policies. In addition, the alternative could be further optimized with regard to cost effectiveness. As a result, the Alternative 3C optimized was further refined. The optimization includes areas not previously considered and due to constructability issues, sets asides areas that were in the original array of alternatives (Area C in the alternative). The optimized plan also sought to enhance the design of the restored wetland with regard to better adapting to sea level change. High marsh acreages have been increased and the transitions between low and high marsh have been graded to allow for the migration plant species in step with sea level rise. The labeling scheme for the optimized plan has therefore changed; please refer to Figure 24 to view new area labeling scheme. Specific changes to the area nomenclature include:

- Modifications to specific locations of Areas C and D;
- Area 2 changed to Area E;
- Area 3 changed to Area F; and
- Area 5 changed to Area G

The recommended plan (Optimized Plan 3C) provides approximately 7.6 acres of low marsh, 5.4 acres of high marsh, 1.0 acre of scrub-shrub habitat, 2.1 acres of upland, and 19.0 acres of maritime upland (a portion included in Park's Enhancement Area), for a total of 35.1 acres (Table 22 and Figure 25). NYC Parks plans to advance an additional 2.4 acres of maritime forest in the north eastern portion of the site. Turtle mounds have been removed from Alternative 3C to minimize risk of common reed re-establishment. This plan also recommends channel realignment to reintroduce sinuosity back into the creek and address ongoing erosion that has occurred on the eastern portion of the project area.

These design changes resulting in the Optimized Plan 3C include reduced slopes rising from high marsh to scrub-shrub and upland in both Areas B and E. The slope rising from high marsh to upland in Area B begins at 1V:3H and then decreases to 1V:5H while approaching maritime forest. The slope rising from high marsh to upland in Area E begins at 1V: 5H and then decreases to 1V:10H while approaching the maritime forest elevations. The elevated nature of maritime habitat does afford some reduction in risk of storm damage from elevated tidal flooding to the adjacent properties. A secondary benefit in providing additional protection from tidal flooding is noted here but not quantified or included in the benefits analysis for any of the alternatives. Although not quantified, the secondary coastal storm risk management benefits of the upland habitat was acknowledged given the needs identified by the regional partners to complement NY Rising efforts and NYC Parks NFWF grant activities (Section 1.3.1).

To achieve designed wetland elevation, approximately 99000 cubic yards of material excavated from onsite will be distributed to create the upland and maritime forest communities. It is anticipated that approximately 8,600 cubic yards of excavated material will be placed at Area F and approximately 21,700 cubic yards of excavated material will be placed at Area G. As per study coordination with NYSDEC, a layer of imported growing medium (clean soil) will be placed over all restored areas to ensure success. The maritime forests and upland habitats within Areas B, E, F and G are designed to have a 1.5-ft layer of growing medium; all other areas (i.e., wetlands) will have a 1-ft layer of growing medium. Capping the excavated materials with a clean medium and planting the areas specific to the targeted plant communities increases the diversity of the overall system.

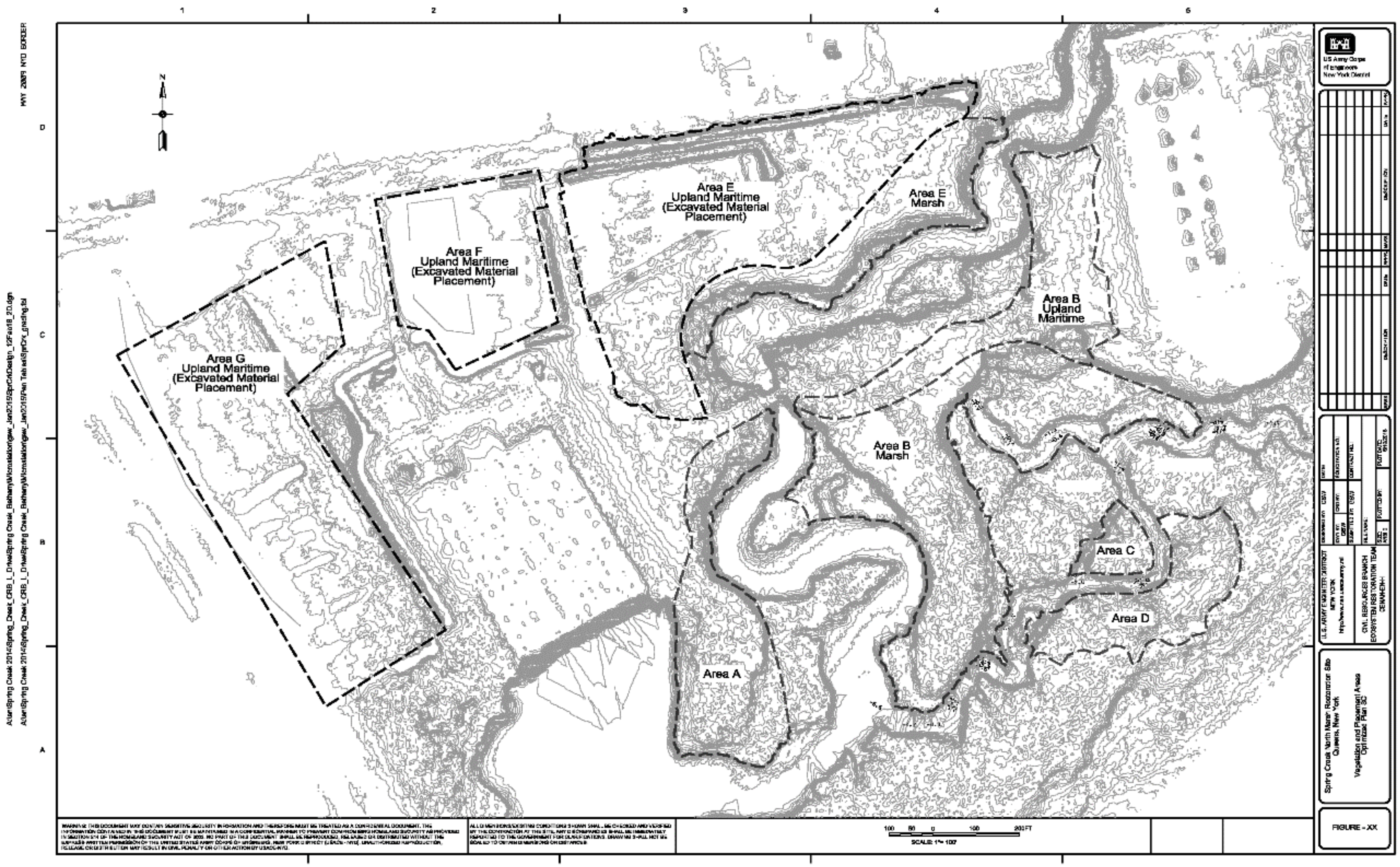

Figure 26: Revised labeling scheme for Optimized Plan 3C

Table 22. Recommended Plan Design Element Areas (Acres)

Area	Low Marsh (ac)	High Marsh (ac)	Maritime Upland (ac)	Excavated Material Volume (cy)	Excavated Material Placement Volume (cy)	Clean Cover (ft)	Clean Cover Volume (cy)
A	1.65	0.8	0.68	25,200	100	1	5,000
B (Marsh)	3.7	3	-	43,000	2,950	1	6,490
B (Maritime)	-	-	2.83	12,250	2,100	1.5	9,600
C	0.40	0.1	-	550	1,000	1	1,110
D	1.1	0.8	-	1,200	1,600	1	3,450
E (Marsh)	0.70	0.7	-	19,600	650	1	3,700
E (Maritime)	-	-	8.9	2,200	60,300	1.5	16,500
F (Maritime)	-	-	2.7		8600	1.5	6,410
G (Maritime)	-	-	6.9		21,700	1.5	16,270
Off-Site					5,000		
Totals	7.6	5.4	22.1	104,000	104,000		68,530
Additional NYC Parks Maritime Forest			2.4				

Approximately 9,300 square yards (1.92 acres) of pavement is required to be removed from portions of Areas F, G and E. A tremendous cost-savings is realized by reusing the excavated material on site. Additionally, excavated material placed in Areas E, F and G will enable the future conversion of the existing Composting Facility to upland habitat.

The placement of the soil in Areas F & G will provide an appropriate location of the excavated soils in order to achieve proper elevations (i.e., minimize the height of the soil placement if all material was placed in Area E [as originally planned]) and meet the requirements of the NYC Parks for their permit and future plans at the Composting Facility. The placement and grading of the excavated material is considered part of the project and cost shared accordingly. The purchase and placement of clean growing media and planting are considered non-federal sponsor enhancement activities.

The project site also lends itself to future opportunities for public access, walking trails and education that are not components of the Spring Creek North project, should additional non-federal funding be identified. For instance, interpretive signage could also be added to provide information explaining the development of the restoration project and site's ecology. Bollards and/or fences can be incorporated into the design to discourage both illegal dumping and the use of all-terrain vehicles on the site.

The proposed grading plan for Alternative 3C-Optimized is found in Appendix G. The excavation, re-grading, and re-contouring used to create the intertidal salt marsh system will establish an elevational gradient that gradually transitions from open water to wetland to upland. Vegetation will occupy a gentle slope of increasing elevation, beginning with low marsh and transitioning to high marsh, transition area and finally maritime upland and maritime forest. Whereas the area of transition zone in the original alternatives ranged from approximately 1.8 acres to 2.6 acres (see Table 15), the Optimized Plan 3C proposes 3.1 acres of transition zone (included in high marsh acreage), providing a more gentle transition between high and low marsh. At low tide, mudflat areas will be exposed along the edges of the interface of the salt marsh and the open water area; at high tide, the mudflat and salt marsh will be flooded at varying depths, depending on final elevations.

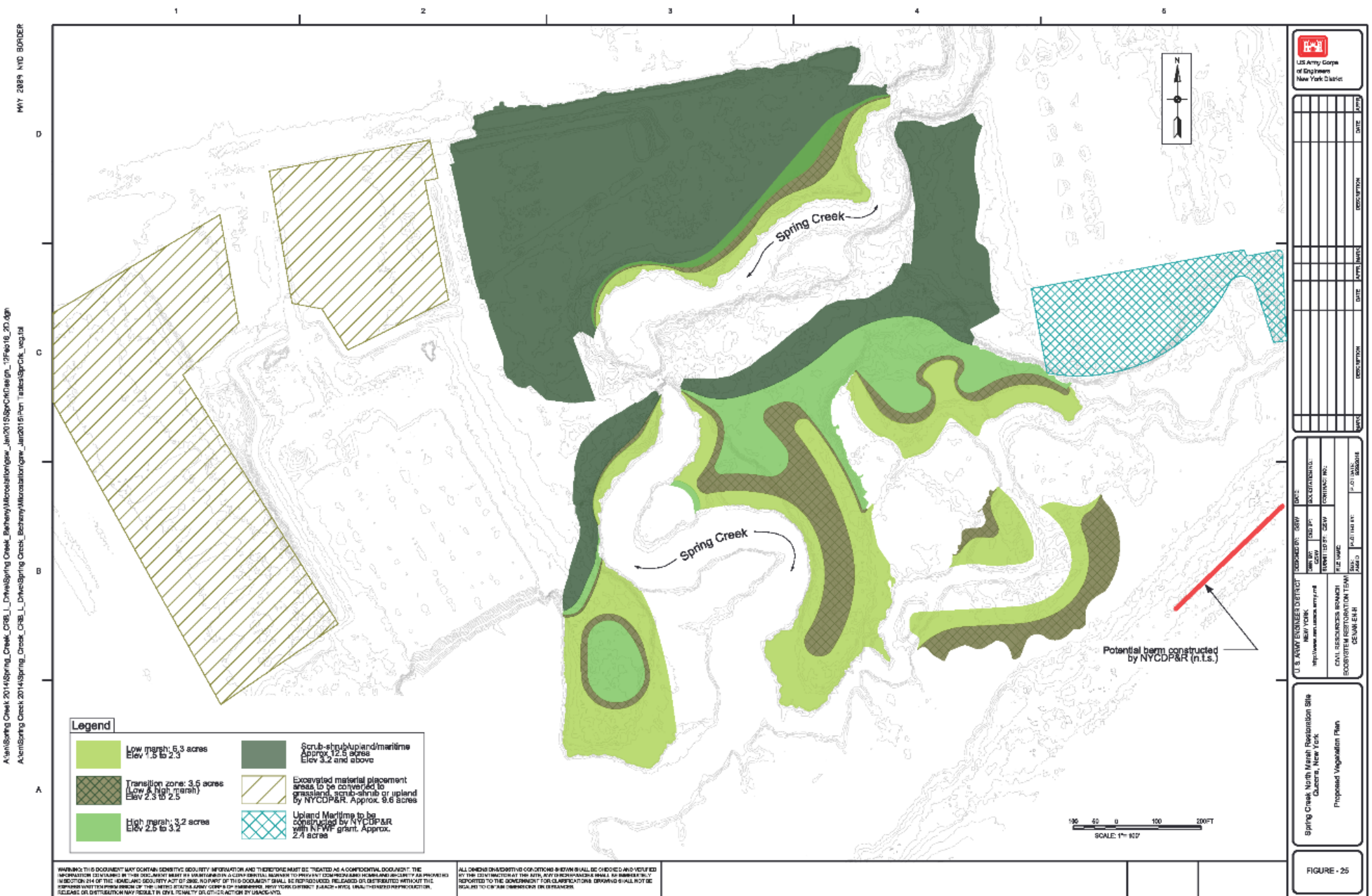

Figure 27: Optimized Plan 3C Proposed Vegetation

3As the existing tidal marsh is restored to a much wider and contiguous expanse of marshland, a system of tidal creeks will be added to achieve the required tidal flushing. Tidal creeks would be designed by using site-specific hydrologic, hydraulic, and sedimentary conditions to mimic a natural dendritic pattern of tidal channels, as was the case in the successful restoration of Gerritsen Creek, a nearby tributary into Jamaica bay that was restored in 2011 under the same section 1135 authority (and with the same non-federal sponsor; NYC Parks). Secondary and tertiary tidal channels will develop naturally over time. The goal for creek construction will be to allow for optimal inundation periods, which is typically defined for a planned tidal marsh with slopes of 1% to be no further than 200 feet from any channel or creek. In this way, salt marsh species like smooth cord grass growing in the uppermost portions of the restored wetland will receive the appropriate degree and magnitude of tidal flushing necessary for their establishment and long-term sustainability.

The successful expansion of the existing tidal marsh relies primarily on establishing, with a high degree of accuracy, the correct elevations for intertidal salt marsh. The necessary level of accuracy has been determined by carefully measuring the elevations of nearby marshes through bio-benchmarking techniques that established the range of elevations that target plant communities occupy. These elevations were presented in Section 3.4.3 and illustrated on Figure 10. This information was then compared and combined with the tide data to determine a base elevation for the distinct hydrologic areas of the site. This data will be reconfirmed through another site survey prior to the development of a final design. Adjusted accordingly during the D&I Phase, to account for any changes from local land use.

Unlike intertidal salt marsh, the creation of maritime upland habitat does not require achieving precise elevations. Instead, successful restoration requires specific physical and chemical characteristics of the soil or planting medium. Soils need to be predominately (greater than 80%) coarse to medium grained sands or gravels and contain low levels of nutrients (particularly nitrogen and phosphorus concentrations) (USACE, 1997). The surface substrate and sub-grade must be well drained to prevent wet depressions that would provide desirable conditions for common reed to re-establish.

The habitat value of native coastal maritime grassland, containing warm season grasses like dune grass (*Ammophila breviligulata*), switchgrass (*Panicum virgatum*), and little bluestem (*Andropogon scoparius*), is significantly higher to native animal species than the non-native herbaceous species adapted to disturbed soil conditions that currently dominate the site (USACE, 1997). Once the excavated material has been stabilized and capped, a diversity of native flowering herbaceous species will be added to the grassland seed mix since there are few local sources for natural recruitment. Although standard and successful techniques to establish warm season grassland habitat exist, most species have a small seeding window (approximately the month of May) and establish themselves relatively slowly, so maintenance activities are often necessary during the first two or three years after planting (Dickerson *et al*., 1989; Gaffney and Dickerson, 1987).

Other restoration design features of the recommended plan include lessons learned from the successful restoration projects in the bay and adjoining tributaries since 2006, and include:

- Initial invasive/exotic vegetation removal and control achieved through the application of a glyphosate based systemic herbicide like Rodeo or mechanical removal.
- A planting plan that considers the creation of a primary successional community like maritime grassland to set the stage for succession into scrub-shrub or forest by establishing strategic plantings.
- Use, including collection as necessary, of native seed stocks and propagation of native plant material, with a special focus on low marsh and high marsh species (smooth cordgrass (*Spartina alterniflora*), salt meadow hay (*S. patens*), saltworts (*Salicornia* spp.), spike grass (*Distichlis spicata*)). A planting plan should also include black grass (*Juncus gerardii*), salt meadow hay, and spike grass for high marsh planting. The planting plan should also consider collection and propagation of primary successional species for the high marsh and maritime uplands [(e.g., eastern cottonwood (*Populus deltoids*), water hemp (*Amaranthus cannibinus*), camphorweed (*Heterotheca subaxillaris*), and pigweed (*Amaranthus albus*), etc.].
- Implementation of a beneficial soil re-use plan to balance proposed cut and fill on-site to the greatest degree possible thus yielding a high degree of cost effectiveness.

5.5.1. Habitat Analysis for the Recommended Plan (Optimized Alternative 3C)

An updated EPW assessment was performed (Table 23) to reflect the changes discussed above. This analysis revealed that the Optimized Alternative 3C had increased ecosystem benefits compared to the original best buy plans and would continue to be considered the "Best Buy" and NER plans.

Table 23. Total FCU Comparison of optimized 3c Alternative

Alternative	Baseline FCUs	Total FCUs	Net FCUs
3C	5.12	39.50	34.38
Optimized 3C	5.12	46.86	41.74
4A	5.12	41.94	36.82

5.5.2. Micro-Computer Aided Cost Estimating System (MCACES) for the Recommended Plan (Optimized Alternative 3C)

The MCACES program uses detailed unit cost information, obtained from mean cost databases of large scale projects located throughout the United States, to create cost estimates and cost projections for particular projects. The mean cost databases are derived from various project types and locations throughout the United State and are typically developed by taking numbers from large scale projects that benefit from such economies of scale. MCACES program was not used to estimate all costs prior to the selection of the recommended NER Plan.

The estimated cost of constructing the recommended plan was developed using MCACES Second Generation (MII) version 4.2 for a 35% level of design (see Appendix I). The construction costs were developed using the appropriated Work Breakdown Structure (WBS) and based on quantities provided by Hydraulics & Hydrology. The cost estimate was developed from the quantities using cost resources such as RSMeans, historical data from similar construction features, and MII Cost Libraries. The contingencies were developed based on input to the Abbreviated Cost Schedule Risk Analysis (ARA). These contingencies were applied to the construction cost estimates to develop the Total Project First Cost which were then escalated to the midpoint of construction to develop the Fully Funded Project Costs (Table 24). Table 24 shows the breakdown of the first level costs between the recommended plan (cost shared activities) and the non-federal enhancement actions.

The non-federal enhancement actions include upland habitat restoration in Areas G and F where excavated soil/sediment would be placed at the Composting Facility paid for by NYC Parks at 100% non-federal cost. The non-federal sponsor costs include removal of asphalt, purchase and placement of 18-inch cover material and plantings (type TBD). The costs for restoration of Areas A, B, C, D and E, including placement of excavated material onto Areas G and F, would be cost shared and considered project costs.

Table 24. Summary of Initial Costs for Recommended Restoration Plan (First Level Costs)

Feature of Work/*Phase*	**First Cost**			**Fully Funded Cost**
	Contract Cost	**Contingency**	**Total**	**Total**
Cost Shared Project Activities (75% Fed / 25% Non-Fed) Design & Implementation Phase				
01 Lands & Damages	$12,595	$2,519	$15,114	$15,733
06 Fish & Wildlife Facilities	$500,000	$89,592	$589,592	$619,911
16 Bank Stabilization (Restoration of Areas A, B, C, D and E & Monitoring)	$7,631,765	$1,367,487	$8,999,253	$9,461,974
30 Planning, Engineering & Design	$780,649	$178,294	$958,944	$1,037,505
31 Construction Management	$650,541	$161,093	$811,634	$896,158
Total of Recommended Plan	$9,575,551	$1,798,986	$11,374,536	$12,031,000
Non-Federal Enhancement Actions- 100% Non-Fed Funding Only				
16 NYC Parks Activities #2 (Upland Maritime Restoration Areas G & F)	$3,733,766	$669,030	$4,402,796	$4,629,178
30 Planning, Engineering & Design	$358,442	$81,865	$440,307	$476,379
31 Construction Management	$298,701	$73,967	$372,668	$411,478
Total Non-Federal Enhancement Actions	$4,390,909	$824,862	$5,215,771	$5,517,000
Grand Total	**$13,966,460**	**$2,623,848**	**$16,590,307**	**$17,548,000**

Part 6 – Environmental Analysis of RECOMMENDED Action and Cumulative Impacts

The environmental impacts of the recommended plan on the physical, ecological, cultural, aesthetic, socioeconomic, and recreational conditions of the existing site are presented in the following sections. Impacts directly related to the recommended plan are separated into two categories: temporary and long-term. Also discussed are cumulative impacts.

Cumulative impacts result when the effects of an action (project) are added to or interact with the effects of other actions (projects) in a particular place and within a particular time. The geographic area for cumulative impacts analysis is defined as Jamaica Bay which is located at the southwestern tip of Long Island and is surrounded by the Rockaway Peninsula to the South, Brooklyn to the West, and Queens to the East. This Jamaica Bay represents a functional ecological zone linked by salinity, ecosystem type, and dredging history. Other projects in the vicinity of Spring Creek that interact with those of the recommended plan include:

<u>Recently Constructed (2006-2012)</u>

- Gerritsen Creek in 2012 restored 20 acres of wetlands and 20 acres of upland grassland habitat; and
- Six Marsh Islands including Elders East (40 acres wetlands), Elders West (43 acres wetlands), Yellow Bar (47 acres wetlands), Black Wall (20 acres wetlands), Rulers Bar (10 acres wetlands) and Big Egg (2 acres wetlands).

<u>Future Projects (outlined in Section 1.3.1)</u>

- Spring Creek South restoration directly adjacent and east of the study is planning for 22-51 acres of wetlands and 147 to 178 acres of maritime upland (including maritime forest, shrubland and grassland);
- Five new Marsh Islands may be recommended as part of the HRE Feasibility Study including Elders Center (16 acres), Duck Point (28 acres), Pumpkin Patch East (35 acres), Pumpkin Patch West (16 acres) and Stony Creek (52 acres);
- Six (6) Perimeter sites within Jamaica Bay to be recommended by the HRE Feasibility Study including Hawtree Point (east), Fresh Creek (west), Dead Horse Bay, Brant Point, Dubos Point, and Bayswater State Park;
- The Atlantic Coast of New York, East Rockaway to Rockaway Inlet and Jamaica Bay Reformulation Study, currently in feasibility phase, will recommend coastal storm risk management features along the perimeter of Jamaica Bay; and
- Maintenance dredging of the entrance channel of the Jamaica bay Federal Navigation Channel at Rockaway Inlet is scheduled to occur in the fall/winter 2019.

The Spring Creek South, Marsh Islands, and Jamaica Bay Perimeter habitat restoration projects may have short-term negative cumulative impacts from construction activities; however, it is not expected that these projects will reach construction phase at the same time and therefore will not act cumulatively with the recommended plan to negatively affect Jamaica Bay. Combined these projects will affect a positive long-term change through restoration and connection of fragmented habitat in the Jamaica Bay Region. Additional positive impacts that will act cumulatively with the recommended plan are attributable to: 1) the closure of Pennsylvania and Fountain Avenue landfills. The two landfills were planted with approximately 400 acres of natural habitat area and; 2) the NYCDEP's proposed improvements to the 46th Ward WWTP and Spring Creek Auxiliary Waste Water Treatment Plant, which would result in significant improvements to local water quality.

The Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study is currently analyzing the feasibility of providing discrete coastal storm risk management features to address high frequency flooding in the communities surrounding Jamaica Bay. The determination of feasibility will depend on which features are independently justified economically and can function separately to address high frequency flooding in densely populated low-lying areas. The current measures to address coastal flood risk under consideration are: flood walls, revetment, flood gates, and berms; the project delivery team is looking for opportunities to include natural and nature-based features and built-in mitigation for any environmental impacts caused by CSRM features wherever possible.

Maintenance dredging of the entrance channel of the Jamaica Bay Federal Navigation Channel at Rockaway Inlet occurs approximately every 2 years and is scheduled to occur in the fall/winter 2019. The channel was last dredged under the Operations and Maintenance Dredging Program in 2012, with the removal of approximately 271,250 cubic yards (CY) of sand, which was used in a beneficial manner as beach nourishment placed along the Rockaway Beach shoreline.

The future actions considered will modify their respective study areas through modification of the waterways and flood risk management measures such as the addition of hard structures, removal and placement of sediment along bay bottom, clearing of vegetation, and alteration of hydrology. Dredging of the Rockaway Inlet navigation channels may be act as sediment sinks and the increased wave energy and sediment flushing time caused by a deeper average depth may affect sediment accretion in Jamaica Bay overall. However, dredging of the interior channels nearer to the study area rarely occur, decreasing any cumulative effects when combined with the Spring Creek project. While these actions will result in both temporary and long term impacts to biological resources and water quality locally, it is not expected that they will act cumulatively with the recommended plan to negatively affect Jamaica Bay.

6.1. LAND USE AND ZONING

The project area is located within Spring Creek Park, part of which is zoned as residential and part of which has not been zoned by New York City. The site will continue to function as parkland, so there will be no impacts to zoning or land use. The fact that a portion of the site is zoned as residential has no impact to its present zoning designation or use.

Temporary Impacts

Access to the site will be temporarily restricted during construction and planting activities. Construction is likely to take place during winter months, while planting is likely to begin in the early spring and continue through the early summer. Spring Creek Park is not currently accessible to the public, therefore there will be no expected impacts to access.

Long-Term Impacts

The Spring Creek Ecosystem Restoration project will result in a beneficial change in land cover types primarily from disturbed upland habitat consisting of invasive plant species and paved surfaces, to natural coastal communities including intertidal salt marsh and upland maritime systems. The restored ecosystems will continue to provide the current land uses including open space, and passive recreation. However, the restoration will improve the function and quality of the landscape and thus enhance the quality of these uses. The restoration will also provide an improved aesthetic viewshed and safer and more readily usable trails to enjoy the open space and educational opportunities afforded by the restored area. No negative long term impacts to land uses from the implementation of the recommended plan are anticipated, rather a positive impact is projected.

Cumulative Impacts

None of the projects in the Spring Creek/Jamaica Bay area will result in negative cumulative impacts on zoning; in actuality, taken as a collective action, they will provide added value from synergetic interactions that will improve the ecosystem as a whole, as well as the functioning and success of each of the individual projects.

6.2. TOPOGRAPHY

Temporary Impacts and Long-term Impacts

Excavation and regrading at the project sites will result in a permanent change to local topography. Excavations will be done along the shorelines to allow for the influx of tidal waters to create the tidal marshes. These elevations more closely reflect the historical elevations of the project site, prior to fill activities and utilize bio-benchmarking to help establish elevations that currently support the desired habitat type.

The excavation and regrading of the sites will involve the displacement and the replacement of soils. Suitable materials excavated from the shorelines will be reused onsite to establish suitable maritime habitats that will support and add to the values of the recreated wetland/aquatic restorations, as well as buffer them from human intrusion. All soils to be removed are fill soils that have been placed along the shorelines in the past, burying salt marsh, mudflat and shallow water communities that occupied the areas before.

Ground elevations in areas A and B will be reduced from levels ranging from 11.9 to 25 feet at the top of fill to elevations appropriate for wetland development. These new elevations will range from 1.5 to 3.2 feet, depending on the target community (i.e., low marsh, high marsh or transition area). These elevations reflect the historical elevations of the salt marsh that originally occupied the site, previous to fill activities. Soil will be placed in areas C and D to restore the channel and prevent erosion.

In the upland and maritime forest areas E, F and G, local topography will be increased through the creation of habitat and the removal of portions of existing pavement. Elevations between 4.0 to 13 feet will be achieved in these areas through the placement of excavated material and clean planting medium (e.g. sand). These areas will be contoured to minimize any impact to the viewshed of neighboring residences or businesses. They will then be planted with native vegetation. The placement of excavated soil in the areas of the current composting facility will transform areas covered by macadam into restored areas of functioning habitat.

Cumulative Impacts

The majority of restoration projects in the vicinity of Spring Creek will result in the excavation of filled areas to elevations appropriate to wetland vegetation. These topographical changes do not represent an adverse impact to the Jamaica Bay area; rather they re-establish historic elevations that existed when the marsh areas of Jamaica Bay were intact. Operations at the Pennsylvania and Fountain Avenue Landfills have resulted in a substantial increase in elevation from historic levels; while these areas will not be returned to original elevations, they will be developed into passive recreation areas which may be considered ameliorative.

6.3. SOILS

6.3.1. Soil Complexes

Temporary Impacts and Long-Term Impacts

It should be noted that the majority of restoration projects in the Jamaica Bay area would result in the removal of anthropogenic fill material from naturally occurring soil complexes. Therefore, the overall effect is positive. Activities at landfills around the bay have resulted in the placement of large amounts of fill over naturally occurring soil complexes. Long term impacts to soil complexes will be localized. Areas A, B, C, and D, mapped as Big Apple Fine Sands and Ipswich-Pawcatuck-Matunuck mucky peat, are currently covered with fill material. This fill material will be either removed exposing the complex, or in the case of upland creation, covered with clean soil consistent with NYS DEC requirements and protective of future use scenarios. Therefore, the long term impact will be beneficial, as these soils are typical of salt marsh habitat. Impacts to the soil complex in areas E, F and G will result from the placement of the excavated material. Areas E, F and G are mapped as Ipswich-Pawcatuck-Matunuck mucky peat, but are currently covered by a layer of unmapped fill. As a result of the proposed project, 3 to 10 additional feet of material will be placed over these soils beneficially using excavated soil from the wetland restoration and placed in these areas to restore upland habitat. Areas E, F and G will receive 18 inches of planting medium that will serve as a cap to isolate any low-level contaminants present in the placed material and stabilize the site to improve long-term sustainability. Converting the area to maritime upland habitat will restore a greatly diminished historical habitat type and increase the overall diversity of the immediate Spring Creek watershed. In short, these disturbed areas will be converted to a more natural habitat.

Cumulative Impacts

The majority of restoration projects in the Jamaica Bay area will result in the excavation of anthropogenic fill material from naturally occurring soil complexes and the capping of existing fill material with clean soil for the purpose of providing a clean (invasive root-free) growing medium. Therefore the overall effect is positive. Activities at Pennsylvania and Fountain Avenue Landfills have resulted in the placement of large amounts of fill over naturally occurring soil complexes. However, these areas have been converted to a wooded prairie habitat and future recreation areas in an effort to compensate for the negative impact. The creation of wetland habitat through excavation of fill and placement of material and capping with clean growing media for the restoration of maritime upland forest habitat in the adjacent Spring Creek South Site together will provide and enhance these ecological benefits, connect adjacent habitat and provide a more comprehensive cumulative positive impact within the Spring Creek area.

6.3.2. Geotechnical- Soils

Temporary Construction Effects

A temporary increase in turbidity is expected during construction as a result of the earthwork. However, the work will be accomplished during low tidal periods and utilizing best management practices for erosion and sedimentation control, reducing the amount of sedimentation that could potentially enter the adjacent water bodies. Sedimentation and turbidity will be minimized, and if any does occur, it will likely settle out quickly or be dissipated by the tide. Thus, no lasting long- term adverse effects to the soils resulting from the earthwork are expected to occur.

Long-Term Impacts

In general, the excavation and regrading of the site will involve the displacement of the top 1 – 3 feet of soils located on site. Material excavated from the salt marsh restoration areas will be placed in the proposed upland areas. To complete the planting medium, enough sand to cover a maximum of twelve inches in the wetlands and 18-inches in the upland will be imported and incorporated with on-site sand. As excavated materials will consist primarily of historical sand and gravel fill material that came from historic dredging. As the only imported soil materials will be clean sand (including organic material for growing media), no adverse effects on the soils of the project site are anticipated due to implementation of the recommended plan.

6.3.3. HTRW

Soils will be managed pursuant to the provisions of 6 NYCRR Part 360-1.7(b)(9) based on discussions with NYSDEC regarding the management of contaminants on Spring Creek North and South, as well as other sites within Jamaica Bay. This provides a great deal of flexibility in managing soils on-site to reduce risk of exposure to wildlife and humans. Prior to more detailed HTRW sampling during the D&I Phase, the current plans call for placement of a twelve inch cover of growing media over excavated area at the cut line prior to the creation of wetlands. The areas proposed for excavation have been selected avoiding any high-level of contaminants at or above required excavation depth. The material that is retained on site and graded/planted as upland coastal habitat (maritime forest or grassland) will also be covered with eighteen (18) inches of growing media. The placement of this growing media over the excavated soils, as well as current surface conditions, will inherently improve the physical and chemical conditions for the future vegetative community onsite.

Temporary Impacts

Temporary impacts would include the excavation and disturbance of fill material containing low level metals contamination located in areas A, B, C and D of the project site. Areas of higher concentrations would not be excavated.

Long-Term Impacts

Long term positive impacts would include the excavation and subsequent relocation and capping of fill material containing low level metals contamination from areas A, B, C, and D, to areas E, F and G currently covered by similar fill or macadum. The macadam would be removed, relocated fill will be placed and then covered with planting medium in Areas E, F and G and planted with maritime upland vegetation. Therefore, the contaminated fill will be capped and isolated from exposure to the surrounding environs. The USFWS, in their Coordination Act Report, has expressed concern over the erosion potential of the newly placed growing medium and the possibility of exposing sections of Areas A-D that have elevated metal concentrations. The District expects that over the course of the five year monitoring period, the planted vegetation will mature to a place where it will provide stability to the placed sediment. The District notes that detailed designs of the growing medium/wetland cover will be conducted in the D&I Phase to ensure its stability. Further, at the request of USFWS, the District will incorporate a monitoring plan specific to the growing medium/wetland cover into the design level Monitoring and Adaptive Management Plan. It should be recognized that in general, lack of suitable habitat can have a greater adverse effect on healthy ecological communities than the presence of soil contamination. Any habitat restoration performed on this site is likely to improve the overall health of the ecosystem at the project area and within Jamaica Bay. Overall, the recommended project will result in a positive impact to HTRW issues in that it will effectively cap contaminated soils to reduce uptake and potential for lateral movement of contaminants by leaching.

Cumulative Impacts

Cumulative impacts resulting from the many restoration projects located in the Jamaica Bay area are in the form of isolation and/or removal of soils with low level contamination, with subsequent improvements to immediate and bay-wide water quality.

6.4. WATER RESOURCES

6.4.1. Regional Surface Watershed and Groundwater Resources

The Spring Creek site lies within the Southern Long Island watershed, contained within the Coastal Plain Physiographic region. Major land use types within this watershed include residential, urban, industrial, commercial, recreational, and open space (parkland).

Temporary Impacts

There will be no temporary impact resulting from the recommended restoration project.

Long-Term Impacts

There will be no long term impacts to regional surface watershed or groundwater resources as a result of the recommended project.

Cumulative Impacts

There are no cumulative impacts to regional surface watershed or groundwater resources as a result of the recommended project.

6.4.2. On-Site Surface Water

The project site is influenced by both tidal and freshwater inputs depending on the area in question. Currently, all of the restoration areas are influenced primarily by freshwater input via precipitation or overland flow.

Temporary Impacts

On-site surface water will be handled through use of best management practices to ensure no erosion and other adverse impacts occur during construction. It is expected that increased turbidity and sedimentation will result from channel filling activities. Sand will be used for the restoration, which is expected to settle quickly out of the water column, limiting these impacts only to the period of active in-water construction. The increase in turbidity is therefore expected to be relatively minor. Sedimentation will also be limited by completing construction at low tide and limiting the impact zone with the use of the geotubes.

Long-Term Impacts

Project related long-term impacts to on-site surface water would result from the excavation of areas A, B, C, and D. Currently, these areas are influenced only by direct precipitation and overland flow. These areas will be graded to plan elevations that will subject the areas to the tidal inundation necessary for salt marsh development. This change in surface water conditions would represent a return to historic conditions. There will be no negative long-term impact to the area.
Cumulative Impacts

The recommended and recently completed restoration projects in the Spring Creek/Jamaica Bay area will result in a change in the nature of on-site surface water to approximately 380 acres of land. These areas will be returned to elevations appropriate to the development of salt marsh habitat, subjecting the sites to tidal inundation. This would represent a positive impact in that the project areas will be restored to natural conditions. These projects would not result in a change in overall surface water resources to the bay.

6.4.3. Tidal Influences

Currently, only the existing marsh habitats are subject to tidal influence. As discussed above, the restoration areas are subject to freshwater input from precipitation and overland flow.

Temporary Impacts

There will be no temporary impacts to tidal influences as a result of the Spring Creek Ecosystem Restoration Project.

Long-Term Impacts

The excavation of area B may result in a change in the tidal influences of Ralph's Creek as more marsh habitat will be opened up to tidal inundation. Placement of excavated materials on some portions of the site would raise elevations and serve as a berm to protect adjacent properties from elevated tidal flooding during storm events. The elevations at the perimeter of the site and the creation of potential berms with excavated materials will be coordinated with NYC Parks and the NFWF grant the sponsor has received to coordinate complementary actions that would improve resiliency and provide coastal storm risk management benefits. This ecosystem restoration project and its coordination with NYC Parks activities would have a positive influence on the tidal inundation over the Belt Parkway reducing the risk of water flanking over the Belt and entering Spring Creek South site.

Cumulative Impacts

The projects proposed and completed restoration projects in the Spring Creek/Jamaica Bay area may result in localized changes to tidal influences in the immediate proximity of the project in a positive manner, but are unlikely to affect tidal influences on the bay as a whole. These improvements, in conjunction with other adjacent activities including Spring Creek South and New York Rising activities, would collectively provide CSRM benefits to the Howard Beach Community.

6.4.4. Coastal Processes

The coastal processes that characterize the Spring Creek project site include the interaction of waves, tidal currents, and coastal sediment transport.

Temporary Impacts

There will be no temporary impacts to waves or tidal currents as a result of the recommended project. Coastal sediment transport may be affected in that a temporary increase in sedimentation may result during the construction phase of the project. This will be minimized, however, through the implementation of best management practices such as the use of geotubes, hay bales, erosion control fabric, and/or other approved erosion control measures. Additionally, in water construction activities will be completed during low tide.

Long-term Impacts

The channel realignment and channel filling activities off of Ralph's Creek would have a long-term impact on the tidal flow, sedimentation, and erosion within Ralph's Creek. Tidal flows are the main erosional and depositional driver within creek systems. The plan will fill in two tributary segments with clean sand: (1) an approximately 360-ft length of linear channel (possibly a mosquito ditch), which will bridge the remaining segments of the small tributary, restoring its prior sinuosity and slowing the flows to address the current low marsh erosion problem, and (2) an approximately 435-ft length of a larger, dead end tributary will be filled to create more low marsh. This creek segment was cut off from the main channel of Spring Creek by historic filling activities. Current speed is a function of tidal volume and channel size. In this regard, two factors of the proposed restoration may impact long term current speed: (1) plans for the narrowing and filling of existing channels, which will decrease channel size; and (2) the creation of wetland from former upland, which will increase tidal volume.

Cumulative Impacts

The projects proposed for the Spring Creek/Jamaica Bay area may result in localized changes to coastal processes around the bay in proximity to the project site; but are unlikely to affect coastal influences in the bay as a whole.

6.4.5. Floodplains

The project area is located within the flood plain of Spring and Ralph's Creeks. However, the extent of the floodplain and associated salt marsh has been greatly reduced as a result of historic filling. The lower elevations along the shoreline fall within the 100-yr floodplain, while the higher elevations fall within the 500-yr floodplain.

Temporary Impacts

No temporary impacts to the local floodplain will occur as a result of the recommended project.

Long-Term Impacts

Long-term impacts will result from the recommended Spring Creek Ecosystem Restoration Project. These impacts will be the result of the excavation of fill material from the shoreline areas of the site. Excavation of areas A, B, C, and D will shift these areas into the 100-yr floodplain, while the scrub/shrub transition areas associated with the project will be subject to 500-yr flood conditions. The placement of excavated soil in Areas E, F and G will have a positive long-term impact providing CSRM benefits from flooding due to the higher elevations of the upland habitat that is restored on site.

Cumulative Impacts

The projects proposed for the Spring Creek/Jamaica Bay area may result in localized improvements to local floodplains within the Howard Beach Community; but are unlikely to have a significant effect on the floodplain of the bay as a whole.

6.4.6. Wetlands

Biological benchmarks were established in the summer of 2003, and then compared with the tidal analysis results described in Section 3.3.6 in order to determine the upper and lower elevations of each marsh habitat type at the Spring Creek project site.

Temporary Impacts

There will be no project related, temporary impacts to the elevations of the existing wetlands at the Spring Creek project site.

Long-Term Impacts

There will be no negative long-term impact to the elevations of the existing wetlands at the Spring Creek project site. As a result of the recommended plan, approximately 13 acres of restored wetlands will be added to the system at established biobenchmark elevations determined for the site.

Cumulative Impacts

An additional 13 acres of wetlands at the Spring Creek North site would be restored building upon the successful restoration of 20 acres of wetlands at Gerritsen Creek (in 2012) and ~160 acres of wetlands at five marsh islands (Elders East, Elders West, Yellow Bar, Black Wall and Rulers Bar) constructed from 2006 through 2012. The restoration of these wetlands will also complement and provide positive cumulative impacts with other planned adjacent projects at Spring Creek South where ~21 to 51 acres of wetlands may be proposed. In addition, approximately 147 acres of wetlands are proposed at 5 additional marsh islands which will be recommended as part of the HRE Feasibility Study.

All of these wetlands will be planted at elevations equivalent to the biobenchmarks of their related sites, and will not affect the elevations of the existing salt marsh habitat. Overall, there will be no cumulative impact on the bio-benchmark elevations of Jamaica Bay salt marsh habitat as a result of the many restoration projects occurring in the area.

6.5. VEGETATION

Temporary Impacts

Temporary impacts would include clearing and grubbing all of the vegetation located within restoration areas A, B, C, and D.

Long-Term Impacts

Implementation of the recommended plan will result in a permanent conversion of fill areas, presently covered with invasive plant species and macadam, to valuable salt marsh and maritime upland communities.
Cumulative Impacts

The recommended plan is compatible with the Jamaica Bay Watershed Management Plan, which recommends that existing wetland and grassland areas in Jamaica Bay be restored and protected, and invasive species like common reed (*Phragmites australis*) be removed.

6.5.1. Wetland Vegetation

Temporary Impacts

Temporary impacts to wetland vegetation include a potential for increased sedimentation and turbidity during excavation and grading of adjacent areas. However, Best Management Practices (BMPs), such as hay bales and/or erosion control fabric and floating turbidity barriers will be prior to and maintained throughout construction to prevent and/or minimize temporary impacts to water quality.

Long-Term Impacts

Implementation of the recommended plan will have a long-term beneficial effect on wetlands. The recommended plan will expand the area of existing relatively high quality salt marsh that borders the restoration area by converting the adjacent invasive-dominated habitat to a healthy intertidal marsh. The recommended plan will restore 13 acres of functioning wetland habitat.

Cumulative Impacts

There will be considerable positive impacts on Spring Creek/Jamaica Bay area wetlands as a result of the restoration projects planned for the area. Cumulatively, these projects will restore up to 211 acres (+ 6 perimeter sites) of the bay and tributaries. This in turn will have positive impacts on water quality, fish and wildlife habitat, aesthetics, and recreation in the Spring Creek/Jamaica Bay area as discussed below.

6.5.2. Upland Vegetation

Temporary Impacts

Temporary impacts to uplands include the removal of invasive vegetation and disruption of the ground surface during construction activities. Subsequent to completion of construction, disturbed areas will be planted and seeded as per the restoration planting plan.

Long-Term Impacts

The environmental quality of uplands at the project site will be improved with the implementation of the recommended plan. Of the 40 acres of invasives dominated habitat on-site, approximately 22.1 acres will be converted to maritime upland and an additional 2.4 acres will be converted to maritime forest by NYC Parks, greatly increasing the project site's biodiversity. The remaining 13 acres of these degraded and historically filled uplands will be converted to wetlands. This will result in the loss of upland areas. However, these impacts will be offset by the net increase in valuable wetland habitat, partially returning the area to its previously dominant habitat type before the area was filled, and thereby increasing the environmental quality of the system.

Cumulative Impacts

Approximately 24 acres of maritime upland habitat will be restored as a result of the Spring Creek North and 147 to 178 acres of maritime upland habitat at Spring Creek South restoration projects. This along with the nearly 400 acres of maritime upland/upland habitat to be restored at the Pennsylvania and Fountain Avenue landfills and 20 acres at Gerritsen Creek will result in a significant positive impact on the Spring Creek/Jamaica Bay area. These habitat improvements will provide increased wildlife habitat, recreational opportunities, and aesthetic resource value to the area.

6.6. FISH AND WILDLIFE

The implementation of the recommended plan will increase the availability of quality wetland habitat and provide an increase in habitat diversity through the planting of maritime scrub/shrub transition areas and maritime upland habitat.

6.6.1. Shellfish, Finfish and Benthic Resources

Temporary Impacts

The project may have temporary impacts including the loss of existing shellfish, finfish and benthic macroinvertebrate populations during construction, principally through an increase in sedimentation and turbidity and resultant physical disturbances to the site. However, sedimentation and turbidity will be minimized to the fullest extent possible through the implementation of BMP’s such as hay bales, erosion control fabric, and/or other approved methods. Finfish and other mobile species will be able to avoid impacts by relocating to adjacent open water wetlands during construction. Sessile, filter-feeding species, such as mussels, will be unable to avoid water quality disturbances and may experience a decrease in their ability to feed. However, the short-term nature of this impact will be limited to the immediate vicinity of the restoration activities and avoid the existing wetlands within the project area and is therefore not expected to result in a significant loss of species in any manner.

Long-Term Impacts

Permanent impacts include loss of benthic habitat in Area B as a result of channel filling activities. Although these open water channel segments will be permanently converted to low marsh habitat, many nearby areas have habitat similar to that which will be lost or made temporarily unusable due to construction. This project will have an overall beneficial effect on shellfish, macroinvertebrate and finfish that utilize the project area. Once construction is complete there will be an additional 13 acres of salt marsh habitat available for these species and resultant improvements in water and sediment quality.

Cumulative Impacts

In conjunction with the existing and future restoration projects, the recommended plan will result in the restoration of approximately 380 acres of intertidal wetland habitat. Many fish and shellfish species, such as Winter flounder, blue crab, and mussels, utilize wetland habitat for feeding, reproductive, and nursery functions so will experience an increase in availability of quality habitat. This will likely result in an increase in fish, shellfish and macroinvertebrate populations.

6.6.2. Birds

Temporary Impacts

Birds at, and within the vicinity of, the project site may be temporarily impacted during the eight to ten month construction and planting period. Increased noise levels, vegetation clearing (invasive trees), and earth moving activities may cause nesting failure and/or disruptions, as well as the displacement of individuals. The degraded/disturbed conditions currently on site make it unlikely to be of high value while the high mobility of avian species will allow them to relocate to adjacent areas of equal or perhaps even greater value until construction and planting activities are complete. Some birds may not return to the area until the plantings are established enough to support habitat functions (e.g., feeding and nesting).

Long-Term Impacts

The Spring Creek Restoration site has been reported to support a significant number of waterfowl, salt-marsh dependent heron, and migratory species. The recommended plan will restore approximately 22 acres of maritime upland and 13 acres of tidal wetland habitat. This will have a positive, long-term effect on avian populations as it will provide for an increase in the amount and quality of habitat and food sources for various bird species. In addition, the project meets the goals and objectives of the North American Waterfowl Management Plan, an international agreement signed in 1986 that seeks to increase waterfowl populations through increasing and restoring wetland habitat.

Cumulative Impacts

It has been reported that more than 300 species of birds currently utilize the Jamaica Bay area, including a variety of species of herons, ducks, geese, plovers and sand pipers (Corps 1994a). As a result of the restoration projects completed and planned for the Bay overall it will see a significant increase in habitat for these avian species. Over 600 acres (including Penn and Fountain, Spring Creek South and North) of maritime upland/grassland and up to 211 acres (New Marsh Islands, Spring Creek North and South) of salt marsh may be made available as new feeding and nesting habitat for these species through the implementation of these restoration projects.

6.6.3. Mammals, Reptiles and Amphibians

Increased noise levels, vegetation removal, and earthwork activities are likely to cause temporary impact to mammals, reptiles, and amphibians currently inhabiting the project site. The highly disturbed conditions currently on site, coupled with the mobile nature of the species currently inhabiting it, make relocation to areas of equal or even better value most likely. These species would be expected to return at project completion to improved site conditions that will have increased habitat functions (e.g., foraging and nesting habitat). Heavy machinery, vegetation clearing, and earth moving may result in the unavoidable loss of some smaller, less mobile animals. In addition, there may be increased mortality for some reptiles and amphibians during construction in the winter months for those animals that have already begun hibernation. However, losses are expected to be minor and the creation of higher value habitats will support species more characteristic of the historical wetland complexes that inhabited the area before it was degraded by being filled and otherwise altered.

Long-Term Impacts

Implementation of the recommended plan will benefit mammals, reptiles, and amphibians at the project site. The recommended plan will increase habitat diversity through the increase in the amount and quality of upland and wetlands habitat and food sources. In addition, newly created salt marsh areas will provide additional nesting and foraging habitat for reptiles and amphibians more characteristic of historic populations before the area was disturbed. Specifically, the diamondback terrapin will benefit from the increased transition shoreline and added nesting area. If construction takes place during winter months it will avoid the breeding and nesting season for many species. However, Diamondback Terrapins overwinter in the bottom of estuaries, creeks, and salt marsh channels. At the recommendation of USFWS, the Corps will work with the Service and the NYSDEC to develop a diamondback terrapin removal and relocation plan in order to reduce mortality during construction.

Cumulative Impacts

The restoration of over 211 acres of wetland habitat and 600 acres of maritime upland/grassland habitat in the Spring Creek/Jamaica Bay area will increase habitat diversity for mammals, reptiles, and amphibians that utilize the restoration sites. Habitat diversity will provide new opportunities for nesting and foraging and may result in an increase in populations of species such as diamondback terrapin.

6.6.4. Rare, Threatened, Endangered and Special Concern Species

This section details the project's impacts on any documented rare, threatened, and endangered species and species of special concern within the project site and adjacent areas. NMFS stated that there may be an occurrence of sea turtles in the project area. Excavation, the only construction activity with the potential to negatively impact these animals, will occur outside those months when sea turtles may be present. In addition, excavation will take place on upland habitat that does not possess the characteristics of sea turtle nesting habitat (i.e., sandy soil). Therefore no project related impact on sea turtles is expected. The recently listed Rufa Red Knot utilizes coastal habitat in Jamaica Bay during migration. Recent hotspots identified on the ebird website include the Jamaica Bay Wildlife Refuge as well as Big Egg Marsh, both located in interior portions of the Jamaica Bay and characterized by a variety of rare and native habitats including large areas of exposed intertidal sediment and expanses of sandy beaches. According to USFWS preferred Red Knot microhabitats are muddy or sandy coastal areas, specifically, the mouths of bays and estuaries, tidal flats, and unimproved tidal inlets. Along the U.S. Atlantic coast, dynamic and ephemeral features are important red knot habitats, including sand spits, islets, shoals, and sandbars, features often associated with inlets. Roseate terns are known to nest on Great Gull Island which is located east of the project area. During the breeding season, birds typically forage over shallow coastal waters around the breeding colony. Spring Creek North is located in an interior tributary of the Bay, mudflats lead to degraded marsh habitat with steep slopes leading to a degraded upland backed up against a highly urbanized/residential area. It is possible that these two species may be present in the project area; as such the District will conduct surveys for these species prior to, during construction, and post construction.

Temporary Impacts

Northern harrier and common tern, both listed as threatened in the State of New York, may use the site for foraging (see Section 3.5.4). These two avian species may be temporarily impacted through the increase in noise level, vegetation clearing, and earth moving activities. However, both are highly mobile species and would be displaced until construction and planting were completed. Once the restored vegetation has become established, the restored habitat would likely be more suitable for foraging activities.

Long-Term Impacts

The project will have a positive long-term impact on northern harrier and common tern. The restoration of marsh habitat will provide additional foraging and nesting habitat for northern harrier. Constructed tidal creeks may provide additional foraging habitat for common tern.

Cumulative Impacts

The restoration of over 211 acres of wetland habitat and over 600 acres of maritime upland/grassland habitat will provide new foraging and nesting habitat for northern harrier, and the potential to raise the population of this species in the Spring Creek/Jamaica Bay area. Constructed tidal creeks included in the various restoration plans will provide new foraging habitat for common terns, possibly increasing number of this species in the area.

6.6.5. Essential Fish Habitat

This section details the project's impacts on Essential Fish Habitat (EFH) within the project site. The full EFH assessment is found in Appendix B.

Temporary Impacts

Direct impacts could include smothering related to channel filling activities, as well as gill abrasion, suffocation, and decreased predation efficiency of sight feeding fish due to increased sedimentation and turbidity (Uncles et al., 1998). However, sand will be used for the restoration, which is expected to settle quickly out of the water column. The increase in turbidity is therefore expected to be relatively minor. Sedimentation will also be limited by completing construction at low tide and limiting the impact zone with the use of the geotubes. The segments of channel designated for fill are in the range of -2.5 - 2.0, thus potentially eliminating impacts to a number of species that would not typically occur at those depths. Additionally, juvenile and adult life stages of fish will be able to avoid impacts by relocating to adjacent wetlands during construction. There are few fish species that use the creek as a nursery, therefore impacts on egg and/or larval life stages are not expected to be significant.

Indirect negative impacts are expected to be minor; although the recommended project calls for a loss of open water habitat and the temporary loss of forage species at the site due to the proposed channel filling in Area B. Many nearby areas have similar habitat to that which will be lost or temporarily unusable due to construction. Recolonization of temporarily disturbed areas is expected to occur soon after construction.

Long-Term Impacts

Positive long-term benefits are expected from the restoration of marsh habitat, as many forage species are expected to benefit from the vegetation and increased detritus of the marsh system. Due to the legacy contaminants on site NMFS has requested continued coordination following the update of the HTRW analysis. The District will continue to coordinate with NMFS through more detailed HTRW analysis in the D&I Phase to ensure that the project does not pose an increased risk of contaminants exposure to aquatic organisms during construction and post- construction due to restoration of tidal flow.

Cumulative Impacts

The restoration of over 211 acres of wetland habitat (with its associated open water creeks) in the Spring Creek/Jamaica Bay area will provide a significant increase in habitat and habitat function for EFH species. As a result, these commercially and recreationally important species may see an increase in number, which in turn would benefit those species which depend on them for food. Likewise it would benefit those individuals that utilize the Bay for fishing opportunities.

6.7. SOCIO-ECONOMICS

6.7.1. Population

Temporary Impacts

There will be a small increase in the local working population as a result of the Spring Creek Restoration Project. The construction work will require the employment of approximately 50-70 workers for an eight to ten month construction period. Some of the workers may be from the local community, and would not increase the local population, while others may commute.

Long-Term Impacts

There will be no permanent jobs created as a result of this project. Therefore, at project completion the local working population will decrease by the number of laborers commuting to the site. There will be no project related permanent changes to the local population and thus no long-term impacts.

Cumulative Impacts

Cumulatively, the many restoration projects in the Spring Creek/Jamaica Bay area will provide increased employment. However, this will most likely be on a temporary basis as no new positions will be created by the restoration of these habitats.

6.7.2. Economy and Income

Temporary Impacts

Positive impacts will result from an increase in the local working population during the construction phase of the restoration project. The construction work will require the employment of approximately 50-70 workers for a time period of about eight to ten months. These workers will provide a temporary boost to the local economy through increased purchases of supplies and food and potentially overnight accommodations.

Long-Term Impacts

Since no permanent jobs will be created, there will be no permanent or long-term effects to the local economy or income.

As discussed in section 6.7.4 the adjacent community of East New York, which is a potential environmental justice area, will benefit from the planned conversion of the NYC Composting Facility into a recreational area as well as improved landscape, access, and recreational opportunities.

Cumulative Impacts

Cumulative impacts related to the many restoration projects located in the Spring Creek/Jamaica Bay environs would take the form of a temporary increase in the economy. This would primarily be through increased purchases of food and supplies from local businesses.

6.7.3. Housing

Temporary Impacts

There may be a temporary demand for short-term overnight accommodations as a result of the additional 50-70 construction workers on site. However, given the relatively short time-frame of the construction phase (eight to ten months) it is unlikely there will be any effect on local housing resources or the local tax base.

Long-Term Impacts

There will be no long-term effect on the number of local housing units as a result of the project. There will be no permanent jobs created, so there will be no increase in housing demands.

Cumulative Impacts

Although the many restoration projects taking place in the Spring Creek/Jamaica Bay area may create a temporary demand for short-term overnight accommodations, it is unlikely that the projects will create the demand for an increase in permanent housing.

6.7.4. Environmental Justice

Executive Order 12898, Environmental Justice directs federal agencies to determine whether the recommended action would have a disproportionate adverse impact on minority or low-income population groups within the project area. Based on a demographic analysis of the study area and the environmental justice review, the recommended plan would not have a disproportionately high and adverse impact on any low-income or minority population. USACE has determined that the recommended plan will have no negative impact on the Environmental Justice of the surrounding communities and will .provide short- and long-term benefits to the existing population by protecting the area from the detrimental effects of winds, waves, currents, and sea-level storms. Overall, the project poses no negative impact that could be interpreted as contrary to Environmental Justice policies. The project (including conversion of the Former NYC Composting Facility), will in fact improve a degraded area that currently depreciates the character of the surrounding area and provide the community with improved landscape and potential for access and recreational opportunities.

6.8. CULTURAL RESOURCES

The Spring Creek Ecosystem Restoration Project is not expected to have an adverse effect on significant Cultural Resources. A Phase 1A Cultural Resource Documentary Study was performed for the Spring Creek project site in 2003 (Appendix C). The study involved background documentary research and a pedestrian survey. Research was conducted at the offices of the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP), the New York City Landmarks Preservation Commission (NYCLPC) and the NYC Parks. A review of previous archaeological work from the area was conducted and information was gathered from HTRW testing. Based on the Phase IA study, there is limited potential for significant Cultural Resources to exist on the site. The proposed undertaking involves removal of layers of fill that were placed at the site in the past. Any material will be excavated as part of the proposed undertaking is likely to be refuse and dredged material. Although impacts are not anticipated based on the Corps' assessment, in order to ensure that deeply buried, undocumented, archeological sites are not impacted by the project the Corps has recommended archaeological monitoring during construction.

Pursuant to the National Historic Preservation Act and its implementing regulations, in 2003 the NYSOPRHP reviewed the Phase 1A Report and concurred with the Corps' findings of no effect and recommendation for monitoring during construction. In the time following that correspondence, the project plans have been further developed. The Corps has reviewed the current plans in conjunction with the 2003 Cultural Resources Phase IA report and has determined that the vertical and horizontal boundaries of the project have not changed from those in the 2003 report and therefore the project will have no effect upon cultural resources. A Programmatic Agreement has been developed to ensure that procedures are established to carry out monitoring activities as the project moves into the D&I Phase. In 2016 and 2017, the Corps carried out additional consultation with the NYSOPRHP, and the NYCLPC, and initiated consultation with the Delaware Tribe, the Delaware Nation, the Stockbridge-Munsee Band of Mohicans, and the Shinnecock Tribe to allow these agencies and Tribes with an interest in the cultural heritage of the study area the opportunity to review the updated plans and the PA. The NYSOPRHP, the NYCLPC, the Delaware Tribe and the Stockbridge-Munsee concurred with the Corps' determination of no effect and recommendation for monitoring during construction. A copy of the consultation letters and the executed Programmatic Agreement are presented in Appendix C.

6.9. COASTAL ZONE MANAGEMENT

To determine the recommended plan's consistency with the policies of the NYS Coastal Management Plan (NYSCMP, as well as New York City's The New Waterfront Revitalization Program, a Federal Consistency Assessment was completed (Appendix B). As indicated on the assessment form and supporting documentation, the recommended restoration plan is consistent with federal, state, and local coastal zone management policies. NYSDOS agreed with the determination in a letter dated December 1, 2017.

Temporary Impacts

During construction there will be temporary impacts to the coastal zone that are not consistent with the Policies of the New York State Coastal Zone Management Plan or New York City's waterfront revitalization program. However, after construction and planting are complete the adverse impacts will be over and the restored project area will fulfill the objectives of these two programs.

Long-term Impacts

As a result of implementation of the recommended plan, and area that has become degraded due to illegal filling activities will be returned to conditions consistent with New York State and New York City coastal zone management programs.

Cumulative Impacts

As a result of the restoration projects located taking place in the Spring Creek/Jamaica Bay area, approximately 600 acres could be restored to conditions consistent with the New York State and New York City coastal zone management programs.

6.10. NAVIGATION

Navigation near the project site is limited to shallow draft vessels such as canoes, kayaks, or small John boats, as the waters of Spring and Ralph's Creek are relatively shallow.

Temporary Impacts

The recommended plan will have no temporary impact on navigation near the project site, as construction and planting activities do not involve the neighboring waterways.

Long-term Impacts

The recommended plan does not include any additional points of access into the salt marsh or the creek system by canoe or kayak, though tidal creeks that are included as part of the design would provide some limited new areas to explore by paddlers accessing the system from outside the restored area. Otherwise, there will be no long-term impact on navigation due to the recommended plan.

Cumulative Impacts

Depending on the individual project design, shallow-water boating opportunities may be increased throughout the Spring Creek/Jamaica Bay area through an increase in tidal creeks.

6.11. AESTHETICS AND SCENIC RESOURCES

The existing project site does not provide a quality viewshed for the surrounding environs. There is a significant amount of disturbed area within the project site due to fill activities and illegal dumping. The site is overgrown with invasive species such as common reed and common mugwort. The recommended restoration project will replace these invasives with approximately 22 acres of maritime upland vegetation as well as 13 acres of healthy marsh. This will provide increased aesthetic and scenic resources for area residences.

Temporary Impacts

During construction, there will be temporary impacts to the aesthetic and scenic resources on site due to the presence of construction equipment, vegetation clearing and the earthwork. However, the aesthetic and scenic resources will be restored and enhanced as a result of project implementation.

Long-Term Impacts

Implementation of the recommended plan will have long-term positive effects on aesthetic and scenic resources. Invasive vegetation will be removed and replaced with more diverse vegetation. Diverse vegetation will provide the opportunity for an increase in the number of bird species utilizing the site, which will also enhance aesthetic and scenic resources. Finally, fences and/or bollards will be installed at the entrances of scenic overlook trails to prevent dumping and access by all-terrain vehicles, which will assist in maintaining the aesthetics of the site.

Cumulative Impacts

The many restoration projects located around the Spring Creek/Jamaica Bay environs will provide an overall positive effect on aesthetic and scenic resources. Many of these areas have been the site of illegal dumping and have been subject to overgrowth by invasive plants. As a result of the restoration projects planned for the Spring Creek/Jamaica Bay area, surrounding neighborhoods will benefit from seasonally changing landscapes, and the improvement of neighborhood open spaces.

6.12. RECREATION

Although Spring Creek is owned by New York City Department of Parks and Recreation, it provides limited opportunity for passive and active recreational uses. A desire path, approximately 1000 feet in length, provides some opportunity for walking and bird watching. The current state of the project area is susceptible to illegal use of all-terrain vehicles and illicit use of dirt bikes and access for dumping, which further degrade the natural area.

Temporary Impacts

During construction, there will be minor adverse impacts to recreation in the area due to the closing of the foot path. However, construction will be phased to occur during the colder, winter months when the path is not as heavily utilized.

Long-Term Impacts

After the recommended plan is implemented, there will be significant positive impacts to the recreational and educational features of the site. The sewer line easement will be developed into an improved walking trail with scenic overlooks and enhanced wildlife habitat and viewing opportunities. The project will not affect any recreational activity that occurs on the water either during construction or after the project is implemented as there are no “put-in” sites are planned for the restoration area.

Cumulative Impacts

Outdoor enthusiasts who use the Spring Creek/Jamaica Bay will benefit from the results of the implementation of the many restoration projects taking place in and around the Jamaica Bay area. The restoration of up to 280 acres (total restoration at Spring Creek North and South Sites) of habitat will increase the opportunity for walking, birdwatching, and other passive activities. The restored marshes will offer additional paddling opportunities within the constructed creeks. Should the number of recreationally important fish species increase (as discussed above), fishing enthusiasts will experience an increase in catches of these species.

6.13. TRANSPORTATION

Vehicular access to the site is provided via a system of collector and arterial roads. Truck routes include State Road 27 (Linden Boulevard) and North Conduit Avenue. The Belt Parkway, which is limited to non-commercial traffic only, passes through the southern edges of Brooklyn and Queens providing access to the Jamaica Bay area. Arterial roads into the site include Fountain Avenue, which forms the sites western boundary and Flatlands Avenue, which forms the sites northern boundary.

Temporary Impacts

The primary impact to transportation will be in the form of an increase in local traffic in the vicinity of the project, including trucks delivering supplies and clean growing media; as well as potentially hauling out debris and sediment. This impact will be limited to the eight to ten month construction and planting period. Off-site parking may also be impacted as current parking at the project site will not accommodate the entire construction crew. A temporary parking area may be established in an upland staging area to alleviate this potential problem.

Long-Term Impacts

There will be no long-term impacts to the transportation system at the Project Site or surrounding areas. Once construction is complete, there will be no additional employees or service vehicles accessing the site. There will be no additional need for subway or bus service in the area. Therefore, neither local nor regional transportation will be permanently affected by the recommended restoration.

Cumulative Impacts

While the many restoration projects planned for the Spring Creek/Jamaica Bay area will result in a temporary increase in local traffic, there will be no resulting long term, cumulative impact. Upon completion of the projects, there may be an increase in a demand for parking near those sites offering passive recreational opportunities; however this will be on a local basis and will not impact the Jamaica Bay area as a whole.

6.14. AIR QUALITY

According to the EPA Green Book,[2] Spring Creek is located in an ozone non-attainment area classified as “moderate” non-attainment under the Clean Air Act. As a land-based construction activity using traditional equipment in standard manner such actions as are being proposed for Spring Creek would have already been assessed in developing the State Implementation Plan (SIP).

Temporary Impacts

Heavy equipment and off-road vehicles used during construction may contribute minor amounts of oxides of nitrogen, carbon monoxide, or other criteria pollutants in the immediate vicinity of the project site. However, this would be limited to a 6-8 month period during construction activities, much of which will occur outside the peak ozone season (summer).

Long-Term Impacts

A more detailed analysis of air emissions and impacts was performed upon selection of the final plan. Based on the SIP, this type of activity will be in compliance with the Clean Air Act (CAA) providing its NO_x levels remain at or under the General Conformity *deminimus* level of 100 tons. The total direct and indirect NOx emissions from this project was estimated at 14.7 tons, and are therefore below the conformity threshold value. A general Conformity Determination in the form of a Record of Non-Applicability was prepared and is found in Appendix B.

Cumulative Impacts

Implementation of the many projects planned for the Spring Creek/Jamaica Bay area may result in temporary air quality impacts. However, there will be no negative cumulative impacts as a result of these projects, which occur on separate schedules with minimal overlapping timeframes. Long term beneficial impacts would be related to increased carbon dioxide uptake from planted vegetation.

[2] https://www.epa.gov/green-book

6.15. NOISE

Noise criteria and the descriptors used to evaluate project noise are dependent on the type of land use in the vicinity of the recommended project. In general, land uses near the project site include residences, institutional uses (schools, places of worship, libraries), and businesses. Receptors within the immediate vicinity of the site include the residential areas, the U.S. Postal Service Center, the 26th Ward Water Pollution Control Plant and the Spring Creek Auxiliary Waste Water Treatment. Two schools are in the area but lie ¼ to ½ mile away, these are PS 232 and PS 224. There are no highly sensitive receptors (i.e., hospitals) located within the immediate vicinity of the site.

Temporary Impacts

There will be a temporary increase in noise levels in the immediate project area during construction due to the increase in traffic, and the operation of construction equipment. However, these impacts are expected to be short-term (eight to ten months). The temporary impacts to ambient noise levels from construction equipment will occur during normal working hours, in compliance with local noise ordinances.

Long-Term Impacts

There will be no long-term impacts to ambient noise levels as a result of the recommended plan.

Cumulative Impacts

While each of the restoration projects will result in a temporary increase in noise in their local areas, there will be no cumulative impact to noise in the Spring Creek/Jamaica Bay area arising from these projects.

In summary, the recommended plan will have several temporary impacts (e.g., wildlife displacement and increased noise) on the local environment mainly stemming from construction and planting activities. These temporary impacts will ultimately lead to positive long term impacts related to the improvement of the currently degraded environment. Project related positive impacts/improvements include increased fish and wildlife habitat, improved aesthetic viewsheds, and increased opportunities for passive recreation. The recommended plan will have an overall positive cumulative impact; project related improvements will act additively with those of restoration projects taking place around Jamaica Bay.

Part 7 – Recommended Plan

7.1. ENVIRONMENTAL COMPLIANCE

Preparation of this Integrated Ecosystem Restoration Report and Environmental Assessment has included coordination with appropriate federal and state resource agencies and assessment of compliance will all relevant environmental statutes. Compliance had been met for all environmental quality statutes and environmental review. Following is a list of federal and state environmental quality statutes to which this planning process and recommended plan have to be in compliance:

Table 25. Relationship of Recommended Plan to Environmental Statutes

Federal Environmental Laws and Executive Orders	COMPLIANCE
Clean Air Act, as amended	In compliance
Clean Air Act	In compliance
Coastal Zone Management Act of 1972, as amended	In compliance
Endangered Species Act of 1973, as amended	In compliance
Migratory Bird Treaty Act of 1918, as amended	In compliance
Fish and Wildlife Coordination Act of 1934, as amended	In compliance
Marine Mammals Protection Act of 1972 Marine Protection, research, and Sanctuaries Act of 1972, as amended	In compliance
Magnuson-Stevens Fishery Conservation and Management act, as amended by the Sustainable Fisheries Act of 1996 (PL 104-267)	In compliance
National Environmental Policy Act of 1969, as amended	In compliance
National Historic Preservation Act of 1966, as amended	In compliance
Executive Order 11988, Floodplain Management	In compliance
Executive Order 11990, Protection of Wetlands	In compliance
Executive Order 12114, Environmental Effects of Major Federal Actions	In compliance
Executive Order 12898, Environmental Justice	In compliance
APPLICABLE STATE LAWS OF NEW YORK	COMPLIANCE
Coastal Zone Consistency	In compliance
Coastal Zone Management Act	In compliance
Article 25 and Article 15 of the Environmental Conservation Law, as amended	In compliance
Environmental Quality Review Law (1976)	In compliance
Fish and Wildlife Code (Title Six)	In compliance
New York State Environmental Laws (Local Admin)	In compliance
APPLICABLE LAWS OF THE CITY OF NEW YORK	COMPLIANCE
Uniform Land Use Review Procedure (ULURP)	In compliance
Local Waterfront Revitalization Program and Coastal Resources Act	In compliance

Copies of the application forms, Coastal Consistency Assessments, the Section 404(b)(1) analysis, and the Essential Fish Habitat assessment for the Spring Creek Restoration project are provided in Appendix B.

7.2. PROJECT IMPLEMENTATION

A Project Partnership Agreement (PPA), which outlines the project costs (see Table 24), tasks, and expectations for the completion of the project (see Table 26), will be completed and signed by the USACE and the non-federal sponsor, NYC Parks.

The D&I Phase will be coordinated with additional activities that would be advanced by NYC Parks. As outlined in Section 1.3.1, NYC Parks has received funding from NFWF in order to coordinate and implement berm construction (along the Belt Parkway) and maritime forest along 157th Street. In addition, the Non-Federal Enhancement Actions that NYC Parks will perform in Areas F and G fulfil responsibly set forth in a permit issued by the New York State Department of Environmental Conservation to the NYC Department of Sanitation that requires restoration of the Composting Area. The additional costs associated with restoration in these upland areas will be paid 100% by the non-federal sponsor and includes the removal of portions of asphalt, purchase and placement of 18-inches of cover, and planting. These costs (estimated at $5,517,000) are NOT considered part of the project costs and are included in Tables 24 and Table 26 to demonstrate the costs of the restoration of the area through a coordinated effort among additional programs and funding streams.

As previously stated, WRDDA of 2014 (f), further amended Section 1135(d) of WRDA 1986 (33 U.S.C. 2309a (d)) increasing the maximum federal expenditure to *$10,000,000* for all phases of the project. The cost shared aspects of the project (Table 26) including Feasibility Study (50 fed/50 non-fed), Design & Implementation Phase (75% fed/25% non-fed) of the Area and the associated Design and Construction Oversight of restoration of upland habitat in Areas G &F (100% non-federally funded) is $9,547,591 federally funded and $9,049,591 non-federally funded.

Table 26. Cost Apportionment of Recommended Plan (Fully Funded Costs*)

Feature of Work/*Phase*	**Federal**	**Non-Federal**	**Total**
Feasibility Study (FCSA estimate)	524,591	524,591	1,049,183
Cost Shared Project Activities (*Design & Implementation Phase)*			
01 Lands & Damages	$11,799	$3,933	$15,733
06 Fish & Wildlife Facilities	$464,933	$154,978	$619,911
16 Bank Stabilization (Restoration of Areas A, B, C, D and E)	$7,096,480	$2,365,493	$9,461,974
30 Planning, Engineering & Design	$778,128	$259,376	$1,037,505
31 Construction Management	$672,119	$224,040	$896,158
Total of Recommended Plan	$9,023,000	$3,008,000	$12,031,000
Non-Federal Enhancement Actions- 100% Non-Fed Funding Only			
16 NYC Parks Activities #2 (Upland Maritime Restoration Areas G & F)	$0	$4,629,178	$4,629,178
30 Planning, Engineering & Design	$0	$476,379	$476,379
31 Construction Management	$0	$411,478	$411,478
Total Non-Federal Enhancement Actions	**$0**	**$5,517,000**	**$5,517,000**
Total Fed/Non-Fed Cost Share	**$9,023,000**	**$8,525,000**	**$17,548,000**
Grand Total (with Feasibility Phase)	**$9,547,591**	**9,049,591**	**$18,597,000**

*Fully Funded Costs are Initial Costs escalated to the mid-point of construction.

The PPA outlines the terms and conditions of the relationship between the federal government and the non-federal sponsor for construction, operation, and maintenance of the project and will include costs for the design phase, as well as for construction (see

Table 24 and 26). The Feasibility Phase costs are also presented in the table above in order to ensure the total $10,000,000 federal expenditure was not exceeded.

Consistent with USACE NEPA regulations and guidance, a Notice of Availability of the draft EA/FONSI was issued on September 6, 2017 to the public for review and comment. Comments received have been incorporated into the final report (see the following section regarding the public involvement). Additionally, the New York District attended a pre-application meeting with the NYSDEC, and has compiled and will be submitting all of the necessary permits required for the implementation of the project. Following approval of all permits and funding, the project will proceed to the implementation phase, and finally to construction, monitoring and maintenance.

Table 27. Anticipated Construction Schedule

	Item	Completion date
1	Final FR/EA Submitted to NAD	19 January 2018
2	NAD Approval of Final FR/EA	13 March 2018
3	Execution of Project Partnership Agreement	29 June 2018
4	Preparation and approval of Plans & Specifications	December 2019
5	Obtain Real-estate Easements	December 2019
6	Advertise, Open, Evaluate and Review Bids	January-March 2020
7	Construct Restoration Project	April 2020 -– February 2021
8	Project Monitoring	March 2021 – March 2026

7.3. MONITORING AND MANAGEMENT

All monitoring and management conducted for the restoration project will be performed in accordance with federal and state regulations and standards. The goal of the monitoring and management program will be to ascertain compliance with contract specs and to assess the success of the restoration efforts relative to anticipated performance standards, quickly identify any problems requiring remedial action, and implement those remedial actions through adaptive management on a timely basis.

Post-construction monitoring and management will be performed over a period of five years. An initial monitoring event will immediately follow completion of site restoration. Long-term monitoring activities will be conducted in the first, third, and fifth year following completion of site restoration. The success of the restoration efforts will be measured by performance standards developed in the *New York State Salt Marsh Restoration and Monitoring Guidelines* (NYSDEC, 2000) and as defined in a monitoring work plan to be developed along the guidelines depicted below. In particular, ecological success will be evaluated based on the following performance criteria:

Successful establishment of each habitat type (low marsh, high marsh, maritime upland) relative to similar habitats in the region.

- Vegetation should occur in proper zones (e.g., hydric species in wet sites) in all layers (tree, shrub, herbaceous) and have adequate characteristics compared to similar habitats in the region.

- General landscape, sinuosity, and water depth should be similar to natural tidal creeks occurring in the region.

7.3.1. Responsible Parties

In order to determine whether or not the project has achieved its ecological success in meeting the restoration objectives, the monitoring and adaptive management plan (Appendix J) would be implemented following project construction. This plan lays out the strategy for assessing project success based on defined objectives and metrics, and potential adaptive management actions that could be implemented if the project fails to meet these objectives. In the event that the management action fails to achieve the stated objective, subsequent actions may be necessary to ensure that this project is successful. For example, in years 1- 4 of monitoring, removal of non-native plant species from the restored area may be warranted. Methods may need to be altered in order to address invasive plant communities that continue to survive. The Corps will be responsible for conducting monitoring and adaptive management for the first five years following implementation. The Corps has budgeted $620,000 towards monitoring and adaptive management as part of the total project cost.

7.3.2. Purpose

The purpose of monitoring is to assess the progress towards, and the success or failure of, the restoration of the salt marsh habitat and maritime upland habitat at Spring Creek. Monitoring also assesses the achievement of acceptable standards of salt marsh and maritime upland character and function. At a minimum, this will include an assessment of the vegetation development, soil profiles, colonization by benthic invertebrates, and habitat usage by macrofauna, as described below.

7.3.3. Monitoring Protocol Design

A work plan for all monitoring activities shall be written by NYC Parks, with input from USACE. The recommendations outlined in Sections 7.3.3 through 7.3.6 below were based on the *New York State Salt Marsh Restoration and Monitoring Guidelines* (NYSDEC, 2000). Where necessary and appropriate, the plan shall include site-specific modifications to the recommended monitoring protocol. Monitoring parameters and activities shall be clearly articulated and documented in the work plan. The monitoring protocol shall include the following study methods:

Control Transects – restored/enhanced and reference areas;
Quadrats – at least three per control transect;
Permanent Fixed-point Photo Stations – located at both ends of each of the transects;

Monitoring at the project site shall be conducted in the restored salt marsh and coastal grassland areas and at a minimum of two reference areas. At least one of the reference areas shall be located within the 17 acres of existing low marsh, while another shall be located within the existing high marsh area. A control transect will be set at each monitoring area, along which three quadrats shall be placed. The permanent fixed-point photo stations shall be located at the ends of the control transects. In addition, an overview photo station should be selected that includes a panoramic view of the entire project site.

The location code, view direction, time, date, and site conditions shall be documented for all photographs.

The purpose of monitoring reference areas is to distinguish background environmental effects from project related effects. For example, vegetation parameters within the restored salt marsh areas could be compared with the same parameters at the marsh reference areas to determine whether an observed loss of vegetation is a restoration failure or due to a natural event, such as a winter storm that has similarly affected all marsh communities in the area.

7.3.4. Pre-Restoration Monitoring Activities

For the reference areas, all parameters described below under Section 7.3.5 Post Construction Monitoring shall be monitored at least once prior to construction, preferably during August/September prior to commencement of construction. The work plan may call for May and December parameters to be included for these areas in pre-construction monitoring activities during the year prior to construction.

For the restored/enhanced areas (areas that will be planted post-construction), photographs shall be taken at the permanent fixed-point photo station locations prior to any construction activities. Photographs shall also be taken at the fixed point photo station locations of the selected reference areas, as well as the project site overview location.

7.3.5. Post-Construction Assessment (Immediately following Construction)

Immediately following construction and prior to planting, the project site shall be walked by NYC Parks, the USACE, and the NYSDEC to assess compliance with submitted work plans. Design elevations shall be verified prior to planting. Photographs shall be taken at all of the permanent fixed-point photo station locations. Based on the assessment immediately following construction, NYC Parks shall determine whether any additional work is required to achieve work plan compliance.

7.3.6. Post-Construction Establishment Period

After planting, it will be the contractor's responsibility to monitor plant survival as part of a two-year, 85% survival guarantee period. The contractor will be responsible for replacement and re-seeding costs during that period. The contractor will also be responsible for control of invasive species during the post-construction establishment period. Following the two-year guarantee period, an additional 3 years of monitoring will be conducted as part of Post-Construction Monitoring (Section 7.3.7).

7.3.7. Post-Construction Monitoring (Long-Term)

The following parameters should be monitored over a period of five years. Monitoring activities should take place during the first, third and fifth years following completion of restoration activities at all control transects specified in the work plan. All monitoring activities shall occur at appropriate tides. The August/September monitoring shall include documentation with color photographs at all fixed-point photo stations, as well as the project site overview location.

Subject to revisions and final agreements, it is anticipated that the following parameters will be monitored once during the last week of August or the first three weeks in September.

Tidal Wetland Monitoring

1. Wetland Vegetation – monitor at each quadrat:
    - Plant species occurring;
    - Stem density;
    - Plant height;
    - Signs of disease, predation or other disturbance;
    - Vegetation zones; and
    - Number of flowering stems.

2. Soil Properties – composite of at least two samples for each quadrat:
    - Hydric soil (texture, color, and structure); and
    - Soil salinity.

3. Wetland Hydrology
    - Inundation regime via visual hydrologic surveys;
    - Water Quality via portable meter

Given the project reserved $500,000 with contingency applied $619,991 for monitoring and adaptive management, we would still like to reserve this funding in the project heading into Design phase. The monitoring and adaptive management plan will be modified and more detailed (refining costs) and would prefer to modify at that point rather than in feasibility.

7.3.8. Monitoring Reporting Requirements

Monitoring reports will be written and submitted to NYSDEC by December 1 of each of the three monitoring years and will begin after the first post-construction growing season. Included in each report shall be the monitoring data, photographs, and a brief summary of the collected data. At the end of the five-year monitoring commitment, a summary report of the entire monitoring efforts and results shall be compiled.

7.3.9. Post Construction Maintenance

To ensure the success of the NER Plan, corrective action that would be accomplished during O&M activities will be taken if performance criteria are not met. Potential corrective action may include:

- Replanting vegetation in areas where plantings do not meet pre-determined criteria;
- Enhancing survival of planted vegetation (by applying a fertilizer such as Osmocote);
- Improving tidal flushing;
- Installing erosion control devices (stabilizing banks):
- Suppressing encroachment by *Phragmites* through mechanical landscaping techniques, physical removal and/or replanting of desirable species; or

- Preventing herbivory (by installing fencing).

Maintenance Activities –
Maintenance of the restoration area will be the responsibility of NYC Parks for the 50-year project life. A qualified wetland biologist/restoration specialist shall conduct/provide maintenance services to ensure that the performance standards are attained. Care will be taken during maintenance activities to minimize disturbance to the habitats within the mitigation area. The following maintenance activities will be conducted to facilitate the establishment of the target habitats.

Weed Control –
An aggressive weed control program will be implemented to discourage nonnative invasive species from colonizing the site. The goal of the weed control program is to minimize the colonization of non-native plant populations in the restoration area and to promote the development of target habitats that are self-sustaining and do not require continued human intervention. The weed control program will address the presence of non-native invasive species in the wetland restoration area and any additional areas that are disturbed as a result of construction (i.e., areas disturbed for construction access, etc.). Weed control will be implemented using hand removal techniques unless the weed infestation is so severe that herbicide application is necessary. Weed control activities will be timed to occur just prior to the flowering period of the target species to prevent seed development and dispersal.

If herbicide application is necessary, it will be accomplished in accordance with the following standards:

- Only the use of EPA-labeled herbicides suitable for aquatic settings (e.g., Rodeo or other herbicide(s) approved for use in aquatic settings) will be permitted;
- Herbicide application will be subject to the approval of the state and federal regulatory agencies and will be applied by a licensed applicator;
- Wetland biologist/restoration specialist will provide a pre-application training to sprayers to identify target species and prevent impacts to non-target vegetation that will be retained;
- No spraying will be permitted if wind speed exceeds 3 miles per hour;
- Application equipment will be limited to hand-held sprayers, backpack sprayers, and/or wick applicators;
- Once non-native species are determined to be under control, hand-removal techniques will be the primary method of control; and
- All non-native plant material removed from the restoration area will be disposed of at an appropriate off-site location.

Condition Survey –
Wetlands are generally driven by site topography. Condition surveys will be conducted to monitor change and to determine the necessary extent of remedial measures.

Regrading –
Regrading activities will be conducted, as needed, to restore site elevations to those that support desired plant communities.

Supplemental Planting-
In order to ensure the native vegetation remains, supplemental plantings will be installed to replace dead or dying plants and/or augment existing planting densities where necessary, as determined by the wetland biologist/restoration specialist.

Trash Removal –
Trash removal will take place periodically throughout the year by NYC Department of Parks and Recreation. Undesirable litter such as wood, Styrofoam, or other materials that can smother establishing plants will be removed annually as necessary and disposed of at an appropriate off-site location.

7.4. REAL ESTATE

The project shall be conducted on land owned by NYC Parks. Currently, NYC Parks owns 45 acres of the project area and four privately owned Lots are located in Block 4585 including Lots 165 and 167 (1.93 acres owned by EZER LCC) and Lots 205 and 225 (0.1 acres owned by Julian Utevsky). The privately owned lots are wetlands and restricted from most development. The NYC Parks intends to acquire the parcels for parkland so that all required lands for the project will be owned in fee by New York City before construction. See Real Estate Plan in Appendix H.

Part 8 – Public and Agency Involvement

Public and agency involvement and coordination in USACE projects are an integral part of the planning process and are required in accordance with NEPA, USACE and New York State Environmental Quality Review Act regulations. Involving the public and agencies at an early phase in the planning process can greatly improve the overall chances of project success by eliciting and addressing comments and input throughout the process, and revising the design at an early stage to reflect these comments and concerns.

The USACE has solicited input from NYC Parks, NYCDEP, NYC Department of City Planning, New York State Department of State, NYSDEC, Gateway, USFWS and NMFS since the inception of the planning for this restoration. Venues for agency input included electronic mails, telephone conversations, letters, PDT and interagency meetings.

Early development and review of alternatives were discussed at meetings of the Jamaica Bay taskforce that were advertised in advance through the Jamaica Bay list serve. The Draft Integrated FR/EA was made available to all interested agencies and the general public for review and comment on September 8, 2017. Public comments received on the Draft FR/EA are included in Appendix K.

Part 9 – Recommendations

9.1. PREFACTORY STATEMENT

In making the following recommendations, I have given consideration to all significant aspects of this study as well as the overall public interest in ecosystem restoration for the Spring Creek Ecosystem Restoration site in the Boroughs of Brooklyn and Queens, New York City. The aspects considered include engineering feasibility, economic effects, environmental impacts, social concerns and compatibility of the project with the policies, desires, and capabilities of the local government, state, federal, and other interested parties.

9.2. RECOMMENDATIONS

The USACE has completed this Integrated FR/EA in accordance with the requirements of the NEPA and the Planning Guidance Notebook, to assess the need for modifying the existing degraded habitat, evaluate the effects of the restoration activities, and determine a solution that maximizes the environmental benefits while minimizing the costs for the Spring Creek Ecosystem Restoration Project.

The purpose of the project is to ameliorate the adverse impacts associated with the past filling, widening and deepening activities on the project site, with the overall purpose being to improve the environmental quality of the area. This area was altered in the past due to dredging and filling activities associated with the creation and maintenance of the Jamaica Bay Federal Navigation Channel. As a result, the area is less productive than the pre-existing ecosystem.

The Spring Creek ecosystem restoration is being conducted under Section 1135 of the Water Resources Development Act of 1986, as amended. Under Section 1135, the Corps is authorized to review the need for modifications of existing projects to improve environmental quality.

The Spring Creek project site targeted for ecosystem restoration is an approximately 47-acre site that straddles the boundaries between the Boroughs of Brooklyn and Queens in Kings and Queens Counties, respectively, New York City, NY. Field observations of the site in its existing state indicate that the ecology of the area has been degraded, primarily due to past activities that included dredging and filling. These activities resulted in the loss of tidal wetlands and created a dominance of invasive species such as common reed and mugwort.

Based on the preliminary investigations, it is evident that a fringe of healthy tidal wetlands exists on site. Therefore, it is likely that the disturbed areas within the project site that received fill in the past can be restored to healthy tidal wetland ecosystems. In addition, upland areas that have been the site of filling can be restored to more productive and natural maritime upland areas.

The recommended project is the result of an analysis of eight (8) initial alternatives for restoring the disturbed areas on site to healthy tidal marshes and maritime uplands. After the initial screening, it was determined by the design team that Alternative 3C provided features closest to the requirements of the NER Plan and was considered the “best buy plan" from the CE/ICA. It was also determined that the plan needed to be further optimized with regard to engineering considerations, ecological opportunities and constraints, and cost effectiveness. This resulted in the development of the Recommendation.

The environmental effects of the recommended plan on the physical, ecological, cultural, aesthetic, socioeconomic, and recreational conditions of the existing site were evaluated and a determination has been made that no long-term, adverse impacts are anticipated as a result of implementing the recommended plan and the implementation will have a significant, cumulative and long term positive impact on the quality of the environment at Spring Creek and the surrounding environs.

It is recommend that the plan selected herein be constructed as authorized by Section 1135(b) of the Water Resources and Development Act of 1986, as amended. I make this recommendation based on findings that the selected plan constitutes a justified increment of construction within the limits of federal participation. These recommendations are made with such further modifications thereof, as in the discretion of the Chief of Engineers may be advisable, at a cost of **$12,031,000** (FY17 price levels), provided that non-federal interests comply with all the requirements substantially in accordance with the draft Project Partnership Agreement which will be prepared upon approval of this report.

9.3. CONCLUSION

The Spring Creek recommended plan includes the restoration of approximately 35 acres of habitat, including approximately 13 acres of intertidal salt marsh and approximately 22 acres of maritime upland habitat (Approximately ½ of the 22 acres of maritime upland associated with the Composting Facility considered non-federal enhancement actions). This recommendation compliments the additional 2.4 acres of maritime forest that NYC Parks will have constructed in the north eastern portion of the site. The recommended alternative is an incrementally justified and cost effective alternative that also meets the sponsor and public needs. This alternative provides important fish and wildlife benefits at a reasonable construction and O&M cost. The plan does not increase flood surface elevations. The plan is consistent with national policy, statutes and administrative directives. The plan has been reviewed in light of overall public interest, which includes the views of the non-federal sponsor and interested agencies. The District has concluded that the NYC Parks is capable of meeting their financial obligations and that the total public interest would be served by implementation of the recommended plan.

9.4. DISCLAIMER

The recommendations contained herein reflect the information available at this time and current Department policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority for authorization and/or implementation funding.

Date: 20180423

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