Chapter 4.1: Project Description for the New Creek Drainage Plan

A. WATERSHED DESCRIPTION

The New Creek watershed is located northeast and adjacent to the Oakwood Beach Watershed. It is generally bounded by Miller Field and New Dorp Lane to the west, the northern boundary extends through and incorporates portions of the Richmond County Country Club, parallels Ocean Terrace, and extends eastward across Reeds Basket Willow Swamp Park. Seaview and Burgher Avenues generally form the eastern boundary and the Lower Bay is the southern boundary (see **Figure 4.1-1**). This watershed occupies about 2,249 acres of which about 94 acres are Bluebelt properties (including lands that have been acquired or to be acquired). The upper watershed's higher elevations, rolling topography, steep slopes, woodlands and freshwater ponds contrast sharply with the flat relief and common-reed-dominated marshes of the lower watershed (below Hylan Boulevard) which are just above sea level.

New Creek is a mostly urbanized watershed, although the upper watershed is less developed than the lower watershed. The predominant land use and zoning is residential with commercial uses and districts along the major thoroughfares, such as Hylan Boulevard and Richmond Avenue. The upper watershed is also partially within the Staten Island Special Natural Area District (SNAD) special zoning overlay district. There is also substantial open space in the upper watershed including NYSDEC's Richmond County Country Club and St. Francis Woodlands and DPR's Reeds Basket Willow Swamp Park which are part of the Staten Island Greenbelt. DPR parklands in the central watershed include Last Chance Pond and the Boundary Avenue wetlands and the lower watershed has FDR Boardwalk and Beach Park along the Lower Bay shoreline. Overall, between the developed areas and the open space the watershed development pattern has resulted in about 36 percent impervious surfaces (i.e., rooftops and streets).

The upper watershed is characterized by the steep topography of the Staten Island terminal moraine. Thus, it does not suffer as much from street or property flooding, but the steep-sloped hillsides do create high stream velocities and erosion. Streams in the upper watershed extend as open water courses across and out from open spaces such as St. Francis Seminary and Reeds Basket Willow Swamp Park, but become piped once they enter the lower watershed (generally at either Richmond Road or Hylan Boulevard).

Approximately 750 acres of the lower watershed drain directly into the three streams channels: the Main Channel which originates at Last Chance Pond; the West Branch which originates at the Boundary Avenue wetlands; and the East Branch which originates at the southern end of Dongan Hills Avenue. There are several miles of stream channels that meander between streets and homes, which is one cause of local flooding due to undersized and sediment laden channels. The balance of the lower watershed is served by storm sewers that drain to the main trunk sewers and ultimately to the Lower Bay via tide-gate controlled outfalls (see **Figure 4.1-1**).

B. PROPOSED AMENDED DRAINAGE PLAN

STORMWATER MANAGEMENT PLAN

PROPOSED STORM WATER MANAGEMENT PLAN BUILD-OUT

The proposed amended drainage plan includes storm sewers to collect runoff with 19 BMPs at the points of discharge, with one new outfall to the Lower Bay from NC-10 while the existing outfall at Seaview Avenue would have an added barrel (see **Figure 4.1-2**). Total length of the proposed new stormwater collection sewers is approximately 302,700 linear feet (about 57.3 miles) which would be in addition to the continued operation of approximately 74,100 linear feet (about 14 miles) of existing storm sewers, including four existing trunk sewers and outfalls that extend from Greeley Avenue, Midland Avenue, Naughton Avenue, and Seaview Avenue. One-way-flap tide gates in these sewers allow discharge from the trunks to the Lower Bay when the water surface elevation in the sewers is above the tide. However, to prevent tidal inflow to the sewers, these flap gates also close shut during high tide events.

In addition to amending the drainage plan for the proposed BMPs and sewer infrastructure, a number of easements would need to be acquired in order to install certain lengths of proposed storm sewers.

STORMWATER DRAINAGE PLAN OBJECTIVES

As described in greater detail in Chapter 1.1, 'Project Description of the Overall Program," there are a number of objectives to the proposed project including: to provide a comprehensive stormwater management plan that reduces local flooding through the installation of stormwater collection sewers and BMPs in a watershed that is largely unsewered; to reduce local flooding through lower watershed BMPs that are designed to detain storm flows that otherwise cannot drain to the Lower Bay during high tide events when the outfall tide gates are closed; to amend the current drainage plan so that street elevations remain as close to the existing street grade as possible; and to provide ecological enhancements in Bluebelt wetlands that are used for BMPs.

PROPOSED BEST MANAGEMENT PRACTICES

The proposed New Creek watershed BMPs are listed in **Table 4.1-1** and the proposed locations are shown in **Figure 4.1-1**. A more detailed description of the proposed BMPs is provided below.

NC-1: MERRICK AVENUE

This BMP is proposed to be located at the east end of Merrick Avenue (just east of the mapped but unbuilt right-of-way of Woodhaven Avenue). The BMP site is about 0.1 acres and is at the headwaters of the watershed. It would serve a drainage area of about 20 acres. BMP NC-1 would be sited within the right-of-way of an unbuilt segment of Merrick Avenue on land near the Reeds Basket Willow Swamp Park (the stream that would be fed by the BMP currently flows into the park). The BMP site is located at the top of a steep ravine which has suffered from instability and head cutting due to uncontrolled flows. A velocity attenuator, composed of gabion baskets, is presently situated at this BMP location. It accepts flow from two catch basins at the end of Merrick Avenue and was installed as an emergency measure to stop bank failure.

Table 4.1-1
Proposed BMPs in the New Creek Watershed

BMP Number	BMP Name/ Location	BMP Footprint (acres)	Drainage Area (AC)	BMP Conceptual Design	Ownership/ Jurisdiction
NC-1	Merrick Avenue	0.1	19.7	Velocity attenuator and drop pipe	DPR Parkland (Reeds Basket Willow Swamp Park) NYCDOT mapped but unbuilt street ROW
NC-2	Ocean Terrace	0.1	18.2	Velocity attenuator and drop pipe	DPR Parkland (Reeds Basket Willow Swamp Park) and private easement to be acquired
NC-3	Annfield Court	0.3	17.5	Extended detention wetland and stream stabilization	DPR Parkland (Reeds Basket Willow Swamp Park)
NC-4	Whitlock Avenue	0.3	104.6	Extended detention wetland and detention chamber	NYSDEC (Richmond County Country Club Golf Course) sewer easement to be acquired
NC-5	Todt Hill Road	0.8	57.4	Extended detention wetland	NYSDEC (Richmond County Country Club Golf Course) sewer easement to be acquired
NC-6	Boundary Avenue	3.0	111.5	Extended detention wetland	DPR Parkland
NC-7	Nugent Street	4.7	189.4	Extended detention wetland, flood plain creation and stream realignment	DEP Bluebelt
NC-8	Freeborn Street	0.7	1.9	Extended detention wetland, flood plain creation and stream realignment	DEP Bluebelt
NC-9	Graham Boulevard	4.4	3.5	Extended detention wetland, flood plain creation and stream realignment	DEP Bluebelt
NC-10	Jefferson Avenue	4.5	50.7	Extended detention wetland and new ocean outfall	DEP Bluebelt
NC-11	Last Chance Pond	8.8	174.5	Extended detention wetland	DPR Parkland/ DEP Bluebelt
NC-12	Joyce Street	0.1	5.4	Outlet stilling basin	DEP Bluebelt
NC-13	Hylan Boulevard	2.9	52.8	Extended detention wetland	DEP Bluebelt
NC-14	Meadow Place	0.2	8.6	Outlet stilling basins	DEP Bluebelt
NC-15	Laconia Avenue	0.1	9.2	Outlet stilling basin	DEP Bluebelt
NC-16	Olympia Boulevard	12.0	28.5	Extended detention wetland	DEP Bluebelt
NC-17	Slater Boulevard	9.7	11.0	Extended detention wetland flood plain creation and stream realignment	DEP Bluebelt
NC-18	Patterson Avenue	8.4	57.1	Extended detention wetland	DEP Bluebelt
NC-19	Buel Avenue	0.1	13.2	Outlet Stilling Basin	DEP Bluebelt

Note: DEP Bluebelt includes lands acquired by DEP or to be acquired.
Source: DEP, Hazen and Sawyer, January 2011.

This proposed BMP is designed to attenuate increased storm flows from the build-out of storm sewers with velocity controls that would reduce downstream erosion and sedimentation. It would comprise two key features: an expanded velocity attenuator to be located at the end of the proposed sewer in Merrick Avenue and potential spot stabilization along the steep slopes below the attenuator and the streambank stabilization in Reeds Basket Willow Swamp Park (see **Figure 4.1-3**). The velocity attenuator would be a structured basin built of gabion baskets (stone wrapped in wire mesh). Below the attenuator, the slopes would be stabilized for a short distance for the purposes of preventing further erosion, steep slope collapse, and headcutting. Slope stabilization techniques to be designed with DPR might consist of riprap check dams or log water bars. (See typical streambank stabilization techniques provided in Appendix B.) Vegetative stabilization techniques would be applied to the slopes wherever possible, although shading caused by tree canopy may limit that approach. An accessway for future BMP maintenance would also be provided from the end of Merrick Avenue.

NC-2: OCEAN TERRACE

This proposed BMP would be located south of Ocean Terrace (just west of Coverly Avenue) on about 0.1 acres at the headwaters of the watershed. The drainage area for the BMP covers about 18 acres. The proposed BMP site is located at the top of a steep ravine which has suffered from instability and head cutting due to uncontrolled storm flows. Presently, a concrete flume accepts street flow and channels it into the park via a very steep drop.

BMP NC-2 is designed to attenuate flow and thereby provide velocity control that would reduce downstream erosion and sedimentation. The proposed elements of the BMP include: a drop pipe leading from the storm sewer in Ocean Terrace to provide flow attenuation; a velocity attenuator with a riprap apron at the outlet of the drop pipe; and spot stabilization on the very steep slope below the attenuator and potential stream bank stabilization below the BMP (see **Figure 4.1-4**). The velocity attenuator is a structured basin built of gabion baskets (stone wrapped in wire mesh) with the objective is to prevent downstream scour. Below the attenuator, the slopes of the stream corridor may be stabilized for a short distance for the purposes of preventing erosion, bank collapse, and/or headcutting. The velocity attenuator and slope stabilization would be within Reeds Basket Willow Swamp Park. Slope stabilization techniques to be devised with DPR might consist of riprap, check dams, or log water bars. Vegetative stabilization techniques would be applied to the slopes of the stream corridor along with check dams whenever possible (see typical streambank stabilization techniques provided in Appendix B) in a design that would be developed with DPR. An accessway for future BMP maintenance would be provided from Ocean Terrace within the proposed 30-foot sewer easement.

NC-3: ANNFIELD COURT

BMP NC-3 would be located on about 0.03 acres of DPR property within Reeds Basket Willow Swamp Park and along the north side of Annfield Court (see **Figure 4.1-5**). The proposed extended detention wetland BMP would handle a drainage area of about 17.5 acres and would be sited at the location of an existing storm outlet that receives flow from the local catch basins at the low point in Annfield Court. However, this outlet needs to be significantly upgraded to handle increased storm flows from the proposed build-out of the storm sewer network. Even with the current limited flows, there is significant head cutting and stream bank failure in the downstream reach.

The proposed BMP would contain the following: a forebay at the inlet to slow incoming flows from the storm sewer leading from Annfield Court and an extended detention basin that would detain flows for controlled release, thereby managing downstream outflow and reducing flooding, erosion, and sedimentation. In addition, a micropool would be provided at the end of the extended detention basin for sediment capture and a weir would serve as a structured outlet from the BMP and thereby establish the flood storage capacity of the extended detention basin (with a detention elevation about 2 feet above the permanent pool elevation). Below the BMP, outflow would continue in a southeasterly direction into Reeds Basket Willow Swamp Park where it would feed a downstream pond. That existing stream, which is severely impacted by excessive storm flows, would be stabilized as part of the proposed project (see typical stream bank stabilization techniques provided in Appendix B) in a design that would be developed with DPR. A construction accessway would remain post-construction for maintenance access. This maintenance access would be located on the easterly side of the BMP and would provide access from Annfield Court. It would allow for regular BMP maintenance and inspection.

NC-4: WHITLOCK AVENUE

BMP NC-4 is proposed to be located on NYSDEC property that is leased to the Richmond County Country Club and used as a golf course. Currently the site of the proposed BMP contains a swale that conveys uncontrolled flow down Whitlock Avenue and into an existing stream that then flows southwest into the golf course. The proposed BMP would be sited on about 0.3 acres within the NYSDEC property, and the conveying storm sewer would be located within the bed of Whitlock Avenue (see **Figure 4.1-6**). The storm sewer connection from Whitlock Avenue to the BMP would require acquisition of a 30-foot-wide sewer easement across private property. That construction and maintenance access for the BMP would require the opening of a segment of Whitlock Avenue which is mapped but not built. This BMP would handle a drainage area of about 103 acres.

The BMP is proposed to comprise a forebay at the inlet to slow incoming flows from the Whitlock Avenue storm sewer and an extended detention basin to detain flows for slow release thereby controlling downstream outflow and reducing flooding, erosion and sedimentation. A micropool would capture sediment at the end of the extended detention wetland and a weir would provide a structured outlet from the BMP. Below the BMP, outflow would continue in a southwesterly direction via the existing stream that flows across the golf course. The proposed BMP would not require any disturbance of the golf course layout. Hydrological studies of the stream below this BMP have determined that the stream requires some enhancements in order to handle the increased flows with the proposed project (typical stream bank stabilization techniques are provided in Appendix B).

Construction access from Whitlock Avenue would remain post-construction for maintenance access thereby allowing access to the BMP for regular maintenance and inspection.

In addition to the BMP, a storm sewer is proposed in Whitlock Avenue. This storm sewer would connect to and convey flows from a storm sewer proposed in Todt Hill Road and would also collect flows from an existing south flowing stream across private property to the east (see **Figure 4.1-6**). The storm flows coming in from Todt Hill Road would also be controlled via an in-line detention chamber that is proposed within Whitlock Avenue. With these proposed improvements an existing stream/drainage swale across private property south of Whitlock Avenue would be abandoned. This stream is currently subject to significant erosion and incising and with the proposed drainage plan would no longer be used for stormwater conveyance. Once abandoned, the property owner has the choice to do with the channel as they desire, recognizing that the proposed amended drainage plan would also reduce flooding and erosion impacts at this property. <u>But overall the proposed project would improve existing wetlands in within the area of the proposed BMP with a slight increase in wetland acreage due to the expanded wetlands that would result from the BMP.</u>

NC-5: TODT HILL ROAD

BMP NC-5 is also proposed to be located on about 0.8 acres of NYSDEC property that is leased to and part of the Richmond County Country Club. The proposed BMP would be sited on a parcel within the NYSDEC property, and the conveying storm sewer would be located within a proposed 30-foot-wide sewer easement across private property (see **Figure 4.1-7**). The storm sewer connection from Todt Hill Road to the proposed BMP would be at a location just west of the intersection of Windy Hollow Way and Todt Hill Road. Currently a small stream/drainage swale flows under Todt Hill Road and into the golf course, passing very close to existing residences before feeding the main stream that crosses the golf course. The existing stream,

flowing from Todt Hill Road, passes immediately next to the foundation wall of a house, creating a potentially dangerous situation.

The proposed BMP would be located at about elevation 121, would handle a drainage area of about 57.4 acres, and would have the following features: a forebay at the inlet would slow incoming flows from the Todt Hill Road storm sewer; an extended detention wetland (to a depth of about 3 feet) would detain flows for slow release thereby controlling downstream outflow and reducing downstream flooding, erosion and sedimentation. A micropool would capture sediment at the end of the extended detention basin and a weir would provide a structured outlet from the BMP and serve as the controlling structure for the flows out from the BMP. The BMP outlet would be sited just above the existing main stream that crosses the golf course and near a small bridge. Below the BMP, outflow would continue in a southerly direction via an existing stream that flows across the golf course.

Construction access from Todt Hill Road via the proposed easement would remain post-construction to provide maintenance access, thereby allowing for regular maintenance and inspection access to the BMP. The proposed maintenance access would extend along the west side of the proposed BMP to allow maintenance access to the proposed weir.

In addition to the BMP, a storm sewer is proposed in Todt Hill Road. This storm sewer would collect and convey flows from an existing stream under Todt Hill Road (see **Figure 4.1-7**). With the proposed BMP, a segment of this existing stream/drainage swale south of Todt Hill Road would be abandoned, which is currently subject to significant erosion and incising and near an existing house. Once an informal stream across private property is no longer needed for drainage, the property owner has the choice to do with the channel as they desire, recognizing that the proposed amended drainage plan would also reduce flooding and erosion impacts at this property. But overall the proposed project would improve existing wetlands in within the area of the proposed BMP with an increase in wetland acreage due to the expanded wetlands that would result from the BMP (see Figure 4.1-7).

The proposed BMP would not require any disturbance of the Richmond County Country Club golf course layout.

NC-6: BOUNDARY AVENUE

BMP NC-6 is proposed to occupy about 3 acres of an approximately 6-acre DPR parkland that is bounded by Lincoln Avenue to the west, Boundary Avenue to the north, Midland Avenue to the east, and PS 38 to the south. The DPR parcel, Boundary Avenue Park, is a natural area open space located at the headwaters of the West Branch of the New Creek watershed. Under the proposed plan, the existing informal drainage structures would be replaced by the proposed BMP with additional storm flows that would be conveyed to the site through storm sewers proposed in the local streets. With the increased storm flows the wetlands at the site would be expanded. Currently, the West Branch originates at an existing storm sewer outlet located at the intersection of Lincoln and Boundary Avenues. With the proposed project, storm sewers would be installed in local streets with sewer outlets from both Boundary Avenue and Lincoln Avenue supporting the proposed BMP (see **Figure 4.1-8**). The proposed storm sewer outlets would be located approximately across from the intersections of Boundary Avenue/Zwickey Avenue, Lincoln Avenue/Boundary Avenue, and Lincoln Avenue/Sanilac Street.

This proposed BMP, which would handle a drainage area of about 111.5 acres, is critical from a stormwater management perspective due to the large, flat, and low elevations in the lower watershed downstream. It would provide the necessary upstream detention that would allow the

lower watershed and its BMPs to drain and would be an important element in the distribution of storage throughout the watershed which is a fundamental objective of the proposed amended drainage plan.

The BMP has been designed to concentrate the clearing and grading to necessary create the proposed BMP on the northern portion of the Boundary Avenue parklands thereby avoiding the more sensitive natural area habitats on the southwest portion of this parkland (see **Figure 4.1-8**). With the proposed BMP, the northern portion of the site which is currently wooded would be regraded and replaced with a wetland shelf and open water/emergent wetland system that would serve as the permanent pool and the area of extended detention. Existing trees around the perimeter of the site, in particular clusters of trees in the northwestern corner of the property and along the Midland Avenue frontage would be preserved (see **Figure 4.1-8**). (An especially large oak tree previously identified for preservation was downed by Hurricane Sandy). In addition, the proposed project would also remove mounds of fill and debris. It is projected that this BMP would increase the wetland acreage at the site by about 3.0 acres supported by the hydrologic inputs of the proposed stormwater management system and the proposed wetland planting that is integral to the BMP design (this site is not currently mapped as NYSDEC wetlands). Additional details on the designs of the natural features of the proposed BMP are presented in Chapter 4.9, "Natural Resources of the New Creek Watershed."

Key elements of the proposed BMP include: forebays at the three BMP inlets for the purposes of attenuating incoming storm flows; an extended detention wetland (with about 5.1 acre feet of extended detention to a depth of about 18 inches) that would detain flows for slow release, thereby managing the storm surges and reducing downstream flooding, erosion, and sedimentation; a low-flow channel between the forebays at the inlet and micropool at the outlet would provide stream conveyance though the permanent pool; a micropool at the outlet would capture sediment deposited at the end of the low-flow channel; and a bi-level weir, one 20 feet in length and the other 55 feet in length, would provide a structured outlet from the BMP and would establish the BMP stormwater elevation and flood storage capacity. Downstream of the BMP, stream flows would continue under Midland Avenue in an easterly direction via the existing West Branch.

Maintenance access for the three forebays and one micropool would be from the adjacent streets, thereby allowing for regular maintenance and inspection access to the BMP.

NC-7: NUGENT STREET

BMP NC-7 is proposed to be located on about 4.7 acres of DEP Bluebelt property that is generally bounded approximately by Hunter Avenue to the west, Kiswick Street and Nugent Avenue to the north, residential properties to the east (these residential properties are close to Graham Boulevard), and Freeborn Street to the south. The proposed storm sewers to this BMP would be installed in the adjoining streets with outlets proposed from the ends of Kiswick Street, Nugent Avenue, Jefferson Avenue, and Grimsby Street (east side of the BMP) (see **Figure 4.1-9** and **Figure 4.1-9a)**. This BMP would handle stormwater flow from the storm sewers in the immediate area amounting to 189 acres. The overall drainage area flowing through the proposed BMP is about 300 acres.

This proposed BMP along with BMPs NC-8, -9, -10, and -17 (all described below) combine to form the relocation of the West Branch across this reach of the New Creek watershed. (These BMPs would also be part of the Mid-Island Bluebelt first capital project, see **Figure 4.1-19**.) This series of BMPs is designed to provide multiple objectives including detaining stormwater

volume, improving conveyance, and enhancing ecological diversity along with storage of floodwaters during high tide when the outfall tide gates are closed. This flood storage capacity prevents streets and private properties from being inundated. When the tide recedes and the gates open, the water stored in the BMP would drain to the bay.

Just upstream of this BMP, a reach of the West Branch between Bedford and Hunter Avenues parallel to Mason Avenue would be abandoned under the proposed amended drainage plan amendment. That existing stream segment is across the rear yards of private property and is not in good condition. Because of constrictions in this channel its functions are limited and therefore project flows would be diverted to a storm sewer.

BMP NC-7 is designed with the following features: forebays would be sited at the four inlets to stabilize incoming flows from the proposed storm sewers; an extended detention wetland (about 4 acre-feet in volume) with a permanent pool and low-flow channel would be constructed to serve the purposes of stormwater management. The existing stream in this segment has filled in with sediment and has been covered with a monoculture of common reed. With the proposed project, the stream would be restored and the common reed marsh would be transformed into a wide floodplain/wetland system with diverse native plantings. A micropool at the end of the channel would provide sediment removal; and a two level compound weir would be constructed at the outlet for the purposes of controlling flow establishing the hydrology of the BMP. Lastly, a culvert under Freeborn Avenue would replace an existing pipe in poor condition between Freeborn Street and Olympia Boulevard. The proposed culvert would convey flows to BMP NC-8 located immediately to the south (see the discussion below). A low landscaped berm (approximately 6 to 36 inches in height) would be constructed for the purposes of containing storm flows within the BMP (see also Chapter 1.1, "Project Description of the Overall Program," for a design description of the proposed berms).

Maintenance access for the forebays and micropool would be via the adjacent streets, thereby allowing for regular maintenance and inspection access to the BMP.

As noted above, currently the site of the proposed BMP is largely dominated by a common reed monoculture and the stream channel is filled with sediment. The proposed project would relocate the channel in order to improve conveyance and to prevent flooding by centering it in the Bluebelt corridor away from adjacent homes. Chapter 1.1, "Project Description of the Overall Program," also provides a description of the ecological design objectives that are common to the proposed BMPs, of the lower watershed.

NC-8: FREEBORN STREET

BMP NC-8 is proposed to be located on about 0.7 acres of Bluebelt property situated between Freeborn Street to the north and Olympia Boulevard to the south and immediately downstream of NC-7 in the West Branch of New Creek (see **Figure 4.1-9** and **Figure 4.1-9a).** Residential properties form the site boundary to the east and west (these properties are close to Graham Boulevard to the east and Hunter Avenue to the west). The proposed BMP would handle runoff from a small 1.9 acre drainage area; it is designed to convey flows from about 302 acres including the tributary upstream flows.

BMP NC-8 is proposed to include the following features: a drainage outlet from Freeborn Street would be sited at the northern end of the BMP near the proposed culvert under Freeborn Street; an extended detention wetland (with about 0.5 acre-feet of detention volume) to manage storm flows with conveyance to a micropool on the south end of the BMP. With these proposed improvements, the existing, undersized, and failing pipe that currently conveys flows between

Freeborn Street and Olympia Boulevard would be abandoned. A micropool would capture sediment at the end of the channel; and a culvert would be constructed under Olympia Boulevard. In addition, a low, landscaped berm (6 to 36 inches high) would be constructed for the purposes of containing storm flows within the BMP thereby protecting adjacent properties and streets (see also Chapter 1.1, "Project Description of the Overall Program," for a design description of the proposed berms). (BMP NC-8: Freeborn Street is proposed to be part of the Mid-Island Bluebelt first capital project, see **Figure 4.1-19**.)

Maintenance access for the proposed BMP would be via adjacent streets, thereby allowing for regular maintenance and inspection access to the BMP.

Currently the site of the proposed BMP is dominated by a common reed monoculture, and the stream channel is filled with sediment. The proposed project would create a channel that would improve conveyance and would also include a substantial ecological restoration element. Chapter 1.1, "Project Description of the Overall Program," provides a description of the ecological design objectives that are common to the proposed BMPs of the lower watershed.

NC-9: GRAHAM BOULEVARD

BMP NC-9 is proposed to be located on about 4.4 acres of Bluebelt property immediately south of NC-8. The site is generally bounded by Olympia Boulevard to the north and Patterson Avenue to the south with residential properties to the east and west (these residential properties are close to Graham Boulevard to the east and Hunter Avenue to the west). The proposed main inlet to the BMP would be the culvert under Olympia Boulevard that would convey the West Branch of New Creek (described above). In addition, proposed local storm sewers would provide drainage inputs to the West Branch via this BMP. These sewers would be installed in the adjoining streets with storm sewer outlets proposed for the ends of Colon Street and Baden Place. The proposed BMP would handle runoff from a small 3.5 acre drainage area with a total of 306 acres of drainage including the tributary upstream flows. This proposed BMP would store floodwaters during high tide events when the outfall tide gates are closed which would prevent flooding of streets and properties. When the tide recedes and the gates open, water stored in the BMP would drain to the Lower Bay. In addition, with this BMP an existing sediment-and-reed-filled reach of the West Branch that is adjacent to residences and causes flooding would be abandoned (see **Figure 4.1-9** and **Figure 4.1-9a).**

Currently the site of the proposed BMP is largely dominated by a common reed monoculture, and the proposed project would center the channel in the Bluebelt corridor away from adjacent homes to improve conveyance. Chapter 1.1, "Project Description of the Overall Program," provides a description of the ecological design objectives that are common to the proposed BMPs, particularly those in the lower watershed.

BMP NC-9 is designed with forebays at each of the proposed sewer outlets to reduce incoming flow velocities and capture sediment with an extended detention wetland (about 3.5 acres in size) and a permanent pool with a low-flow channel to serve stormwater management and conveyance functions. A micropool would provide for sediment removal at the end of the low-flow channel. A two tiered compound weir would be constructed at the BMP outlet for the purposes of controlling outflow and establishing the BMP hydrology for both NC-8 and NC-9. Lastly, a culvert would be installed under Graham Boulevard—this culvert would convey flows to BMP NC-17 located immediately downstream and to the east (see the description of NC-17 below).

With the above described improvements and the proposed stream relocation, what is left of the existing West Branch and the existing stream culvert located near the intersection of Patterson and Jefferson Avenues would be abandoned and some of the area incorporated into BMP NC-10. A low landscaped berm would also be constructed for the purposes of containing storm flows within the BMP (see also Chapter 1.1, "Project Description of the Overall Program," for a design description of the proposed berms). (The channel restoration of the proposed BMP NC-9: Graham Boulevard is proposed to be part of the Mid-Island Bluebelt first capital project, see **Figure 4.1-19**.)

Maintenance access for the BMP would be via adjacent streets, thereby allowing for regular maintenance and inspection access to the BMP.

NC-10: JEFFERSON AVENUE

BMP NC-10 is proposed to be located on about 4.5 acres of Bluebelt property that is generally bounded by Baden Place to the north, Father Capodanno Boulevard to the south, and Jefferson Avenue to the east with residential properties to the west (these properties generally are close to Hunter Avenue). The proposed storm sewers would be installed in the adjoining streets with storm sewer outlets into the BMP proposed from the ends of Baden Place, Jay Street, and Patterson Avenue.

The proposed BMP would handle a drainage area of about 50.7 acres which includes a number of low lying streets, such as Patterson, Hunter, Quincy and Seaver Avenues, Graham Boulevard, and Sioux, Iroquois, Cherokee, and Iona Streets. Because these streets are so low-lying, draining the proposed storm sewers from them into BMP NC-17 is not possible even though that BMP is immediately adjacent. Therefore, sewers proposed in those streets would discharge into the existing West Branch channel at the end of Quincy Avenue and Iroquois Street (see **Figure 4.1-10**). It would not be hydraulically connected to the West Branch; rather it would flow west to a proposed new outfall that would discharge to the Lower Bay (see the outfall description below). The lower permanent pool elevation and the new outfall to the bay, also set at a lower elevation than the surrounding outfalls, would allow this BMP to better convey local storm drainage and relieve flooding conditions in what is a very low lying area of the watershed. BMP NC-10 would store floodwaters during high tide when the tide gates on the new proposed ocean outfall are closed. This flood storage capacity would prevent streets and private properties from being flooded. When the tide recedes and the tide gates open, the water stored in the BMP would drain to the bay.

BMP NC-10 is designed with forebays at each of the proposed storm sewer drainage outlets to reduce velocities of incoming flows from the proposed storm sewers with an extended detention wetland (with about 7.8 acre-feet of extended detention volume) and a low flow channel to provide the stormwater management and conveyance system function between the forebays and the micropool. A micropool would be installed at the end of the low-flow channel to capture sediment prior to its discharge to a proposed outfall to Lower Bay (see the outfall description provided below). A low landscaped berm would also be constructed for the purposes of containing storm flows within the BMP (see also Chapter 1.1, "Project Description of the Overall Program," for a design description of the proposed berms).

Maintenance access for the four forebays would be via adjacent streets, thereby allowing for regular maintenance and inspection access to the BMP. Maintenance access for the outfall would be via Father Capodanno Boulevard onto the DPR oceanfront property where the outfall would be situated.

Currently the site of the proposed BMP is largely dominated by a common reed monoculture. The proposed project would transform the field of common reed into a diverse wetland complex with multiple zones and extensive native plantings. Chapter 1.1, "Project Description of the Overall Program," provides a description of the ecological design objectives that are common to the proposed BMPs, particularly those in the lower watershed.

NC-11: LAST CHANCE POND

BMP NC-11 is proposed to be located on about 10 acres of the 15.2 acre Last Chance Pond property (this 15.2 acres includes both the DEP and DPR-owned land, see **Figures 4.1-11** and **4.1-11a** for the delineation of the DEP and DPR property boundaries). The proposed BMP site is bounded by Stobe Avenue to the west, Zoe Street to the north, Naughton Avenue to the east, and the mapped but unbuilt Joyce Street to the south. DPR manages its land as a natural area open space. The site is primarily a wetland comprised of some open water and emergent wetlands in addition to wet woods. The stream that originates at the site is the headwaters of the Main Channel of the New Creek system. Much of the source water to the stream is from local runoff including an existing stormwater outlet that discharges into the southwestern portion of the property from Stobe Avenue (south of Zoe Street)--this outlet feeds a small pond and the overflow from the pond creates the southward flowing stream. (A more detailed description of the existing natural resources conditions at this site is provided in Chapter 4.9, "Natural Resources of the New Creek Watershed.")

Efforts to preserve this property date back to the mid-1960s when local residents advocated for its public acquisition. After some years, DPR took jurisdiction over a part of the wetlands and the Trust for Public Land (TPL) also held other parcels. In 2004, DEP accepted this land as a gift from TPL for the purposes of integrating this site into the Mid-Island Bluebelt program. DEP also acquired the remaining parcels for inclusion in the Bluebelt program.

The proposed project includes storm sewers to be installed in the surrounding streets with four sewer outlets, including one from the end of Cletus Street, two from the ends of Husson Street (one on the east side of the BMP and the other on the west side), and the fourth from Stobe Avenue (just south of Zoe Street), where there is an existing drainage outlet that currently feeds the wetlands (see **Figure 4.1-11**). The proposed storm sewer outlet from Husson Street on the west side of the BMP would involve the relocation of a plaque and landscaped seating area, installed by DEP to honor a family that donated property to the Bluebelt. The final design of that relocated "dedication site," as it is called, would be part of the overall BMP final design.

The BMP is proposed to handle a drainage area of about 194.5 acres. As with BMP NC-6, this BMP is critical from a stormwater management perspective due to the large, flat, and low elevations downstream in the watershed. The large extended detention basin at the site would therefore provide the necessary upstream detention that would allow the lower watershed and its BMPs to drain during and after the storm events. This site is therefore an important element in the distribution of floodwater storage throughout the watershed as part of the proposed amended New Creek drainage plan.

As compared with the common reed dominated BMP sites in the lower New Creek watershed, the Last Chance Pond site possesses habitats of higher ecological value with its mature wet woods and higher-valued emergent freshwater wetlands and plant diversity. Therefore, the footprint of this BMP (i.e., the area that requires clearing and grading) has been minimized to the extent possible by maximizing flood storage capacity in the downstream BMPs (see BMP NC-13, below). In addition, the proposed BMP conceptual design incorporates a number of

important design assumptions that were developed by DEP in conjunction with DEC for the purposes of avoiding (to the greatest extent possible) the more important ecological habitats of this site, while targeting the necessary clearing and grading to create the drainage-plan required floodwater storage capacity at this location towards the less ecologically sensitive areas portions of the site. For example, the wet woods at the corner of Husson and Naughton Avenue (on the DPR property) which have been identified as a silver maple-dominated swamp have been sited outside the footprint of the BMP as is the mature red-maple wet woods in the northwestern portion of the site (near corner of Stobe Avenue and Zoe Street, this area is Bluebelt property). In contrast, areas of the site dominated by common reed are targeted for excavation, so that the proposed hydrologic improvements can be designed in concert with natural area restoration. Thus, the monoculture common reed marsh in the southern portion of the site is proposed for clearing and grading since this is a lower-grade wetland that could benefit from a more diverse vegetative community that would come with the proposed BMP design. Finally, where higher-quality habitats could not be avoided, like the natural vegetation in the central wetland portion of the site, this wetland would be used as a source of wetland plants to be transplanted elsewhere in the BMP.

Under the proposed design, the existing structured outfall from Stobe Avenue would be reduced in length and upgraded with a forebay at the outlet. Forebays would also be sited at the locations of the other proposed storm sewer outlets to the BMP for the purposes of attenuating incoming storm flows velocities from the proposed storm sewers.

A permanent pool with about 11.7 acre feet of extended detention would form the center of the BMP with extended detention to a depth of about two feet that would store floodwaters for a delayed and slow release during storm events, thereby controlling outflow and reducing downstream flooding. A weir (about 50 feet in length) would be located downstream at Hylan Boulevard to provide a structured outlet from the BMP that would establish the BMP hydrology, flood water storage capacity, and surface water elevation. Below Joyce Street the Main Channel stream flow would join with the inputs from the proposed BMP NC-12 (see the description below) and continue south through a weir proposed just above Hylan Boulevard; once through the weir, the flows would continue southward through the culvert under Hylan Boulevard, and on to NC-13.

With the proposed BMP, the red maple/hardwood swamp (silver maple dominated) located north of Husson Street (between Seaver and Naughton Avenues) would actually increase in size by 0.53 acres. This increase would be achieved by clearing the existing *phragmites* cover type adjacent to the existing silver maple swamp, then grading and planting silver maples (and other trees) to expand this habitat.[1] The proposed BMP design would also expand and bring three new ecological zones to Last Chance Pond:

- Shallow emergent marsh (with arrow arum swamp rose mallow predominant);
- Ephemeral pools (with arrow arum and wetland grasses); and
- Expanded open water (with aquatic plants).

With regard to the shallow emergent marsh cover type (arrow arum predominant), the loss of that habitat in two existing wetland areas, separated by a narrow man-made berm, would be

[1] The full planting list for each of these new zones is presented in Table 1.1-1 in Chapter 1.1."Project Description of the Overall Program."

more than offset by new shallow emergent marsh areas that would be planted with salvaged and newly planted arrow arum, in addition to arrow arum proposed to be planted in the ephemeral pools. The proposed BMP design would also unify the various existing hydrologic regimes at the site (i.e., its streams and ponds), creating about 3.1 acres of permanent pool open water that would have a depth range of 6 inches to about 3 feet on average and up to 5 feet when flooded by storm events. To offset the clearing of some red maple/hardwood swamp, the existing street edge and terrestrial (successional old field) would be substantially enhanced. This would involve the removal of debris, and fill piles and clearing invasive trees and understory shrubs. Moreover, with the proposed project, these areas would be intensively reforested with native canopy trees, along with understory trees, shrubs and groundcover to create a full vertical structure in the restored woodland. It is therefore expected that with the new ecological zones, in concert with the existing habitats and restoration of the buffering street edge, the proposed project would provide significant ecological benefits, diversifying the vegetative cover and increasing habitat values at this site.

Maintenance access for the four forebays would be via adjacent streets. Maintenance access to the weir structure would be from Hylan Boulevard.

NC-12: JOYCE STREET

BMP NC-12 is proposed to be located on Bluebelt property at the stub end of Joyce Street one block north of Hylan Boulevard (see **Figure 4.1-12**). The proposed BMP would occupy about 0.1 acres and would handle new storm sewer inflow from Joyce Street and a small drainage area of about 5.9 acres. BMP NC-12 is a proposed outlet stilling basin with a drainage swale to connect the basin to the Main Channel with a new expanded culvert under Hylan Boulevard. Construction access from Joyce Street would remain in place post-construction to provide maintenance and inspection to the proposed weir and BMP.

NC-13: HYLAN BOULEVARD

BMP NC-13 is proposed to be located on Bluebelt property downstream of NC-12 and below Hylan Boulevard (see **Figures 4.1-12 and 4.1-12a**). The property is generally bounded by Hylan Boulevard to the north, Meadow Place (mapped but not built) to the south, and residential properties to the east (these residential properties generally front on Seaver Avenue). To the west, a car dealership, fronting on Hylan Boulevard, abuts the site. The proposed main inlet to the BMP would be the new culvert under Hylan Boulevard which would convey the flows in Main Channel. In addition, proposed local storm sewer connections would provide drainage inputs to the Main Channel through this BMP. These include two inlets from sewers in Hylan Boulevard (located on either side of the existing New Creek culvert under Hylan Boulevard). The proposed BMP would occupy about 2.9 acres and would handle drainage inputs from an area of about 52.8 acres.

Under this proposed BMP design, this segment of the Main Channel would be fully reconstructed for the purposes of improving both the hydrological and ecological functions of this Bluebelt property. Large areas of common reed would be removed and planted with emergent wetland plants to create flood storage areas. By transforming the common reed marshes into extended detention areas, project planners were also able to reduce the BMP footprint at Last Chance Pond in order to save higher value natural areas there.

Design elements of the proposed BMP NC-13 include forebays to be sited at each of the proposed outlets to the BMP to attenuate velocities of incoming flows from the proposed storm sewers. Pocket wetlands would be created downstream of the forebays, all flowing into a

micropool where sediment would accumulate for removal by Bluebelt field forces via maintenance accessways. Finally, the most downstream feature of this BMP is a weir across the Main Channel. Just above the 70-foot-long weir would be a micropool to collect debris that would be regularly cleared and maintained by DEP maintenance forces. The proposed weir would control the surface water elevations of the BMP complex. A low, landscaped berm would also be constructed for the purposes of containing storm flows within the BMP (see also Chapter 1.1, "Project Description of the Overall Program," for a design description of the proposed berms). The berm would be constructed along the eastern edge of the BMP parallel to Seaver Avenue, thus preventing flood waters during extended detention from spilling onto private properties.

Construction access from Hylan Boulevard would remain post-construction to provide the maintenance access to the BMP for both regular maintenance and inspections. Since this BMP is located adjacent to busy Hylan Boulevard, it would be an opportunity for high-visibility wetland restoration. Chapter 1.1, "Project Description of the Overall Program," provides a description of the ecological benefits of the proposed lower watershed BMPs.

NC-14: MEADOW PLACE

BMP NC-14 is proposed to be located on Bluebelt property immediately south and adjacent to BMP NC-13. The site is generally bounded by the mapped but unbuilt segment of Boundary Avenue to the north (and BMP NC-13) and a segment of Meadow Place (mapped and partially built) to the south (see **Figure 4.1-12**). Residential land uses abut the project site with a garden apartment complex on the other side of Meadow Place. The two storm sewers discharging into this BMP are situated at the stub end of Boundary Avenue and off of Meadow Place. Under the proposed BMP design, each of these discharge points would be equipped with an outlet stilling basin to attenuate incoming flows from the proposed storm sewers. Flows from the two basins would, in turn, feed an existing pond that would be expanded as part of the proposed project. All of the extended detention in this BMP and BMP NC-13 combined would amount to about three acres. BMP NC-14 alone would occupy about 0.2 acres and would handle flow from a drainage area of about 8.6 acres.

NC-15: LACONIA AVENUE

BMP NC-15 is proposed to be located on 0.1 acres of Bluebelt property immediately south of Laconia Avenue and east of the intersection with Rowan Avenue (see **Figure 4.1-13**). The proposed BMP would handle drainage from an area about 9.2 acres in size. This BMP is an outlet stilling basin to attenuate incoming storm flows from the proposed Laconia Avenue sewer before discharge into the Main Channel. The function of the outlet stilling basin is to capture sediment from the stormwater discharge and to reduce outflow velocity and prevent downstream erosion and scour. A channel (about 10 feet wide) would be excavated and stabilized below the BMP in order to create a drainage path from the outlet stilling basin to the Main Channel. Construction access from Laconia Avenue would remain post-construction and provide the maintenance access to this BMP for both regular maintenance and inspections.

NC-16: OLYMPIA BOULEVARD

BMP NC-16 is proposed to be located on Bluebelt property bounded generally by both opened and unopened segments of Mason Avenue to the northwest, a mapped and built segment of Olympia Boulevard to the southeast, Graham Boulevard to the southwest, and Seaver Avenue to the southeast. The proposed BMP is adjacent to residential uses that front on Stobe Avenue to the southwest and Slater Boulevard to the northeast. The proposed main inlet to the BMP would

be the Main Channel that flows south from BMPs NC-13, -14, and -15. In addition, proposed storm sewer outlets would drain into to the BMP including inputs from storm sewers in Seaver Avenue at the intersection with Mason Avenue, Rowan Avenue at the intersection with Mason Avenue, and Nugent Avenue at the intersection with Graham Boulevard (see **Figure 4.1-13**). This proposed BMP would occupy about 12 acres and would handle storm flow inputs from an immediate tributary of about 28.5 acres with a total drainage area of 280 acres, including the upstream flow.

The principal function of this BMP is to provide for large-scale storage of flood waters during high tide when the tide gates at the Naughton Avenue outlet are closed. When the tide recedes and the tide gates open, the stormwater contained in the BMP would then drain to the bay. The storage volume provided at this on-line BMP (some 11.2 acre-feet) is critical to lowering the water surface elevation of the lower watershed and its flood storage capacity would prevent local streets and properties from being inundated. BMP NC-16 is designed with the following key elements. Forebays would be installed at each of the three proposed storm sewer outlets to the BMP to attenuate velocities of incoming flows from the proposed storm sewers and to capture sediment. Outflow from the forebays would, in turn, flow through the permanent pool towards the weir at Olympic Boulevard. An area of extended detention would be created by excavating an existing vast monoculture of common reed, thus providing a floodplain on both sides of the Main Channel that would function as a low-flow channel. A micropool would be installed at the end of the channel, and a 65-foot-long weir and low-flow orifice would be constructed at the BMP outlet for the purposes of flow control and establishing the BMP hydrology. The location of the proposed weir would be just upstream of the existing culvert under Olympia Boulevard which would be expanded as part of the proposed project.

Maintenance access to the four forebays and the one micropool at Olympia Boulevard would be from the adjacent streets.

Currently, the site of the proposed BMP is largely dominated by a common reed monoculture with little or no topographic relief. The proposed BMP would provide a substantial ecological restoration, including a "deep pond" feature to improve the natural resource values at the site. Chapter 1.1, "Project Description of the Overall Program," provides a description of the ecological design objectives that are common to the proposed BMPs, particularly those in the lower watershed.

NC-17: SLATER BOULEVARD

BMP NC-17 would be located on about 9.7 acres of Bluebelt property, some of which is acquired while the balance is in the process of acquisition. It is generally bounded by Graham Boulevard to the southwest, Olympia Boulevard to the northwest, Slater Boulevard to the northeast, and residential properties that front on Quincy Avenue to the southeast (as well as the street ends of Seaver Avenue, Ionia and Cherokee Streets). Located at the convergence of the West Branch and the Main Channel, the proposed inflow to the BMP would come from the West Branch flows east from Graham Boulevard and the Main Channel flows south from Olympia Boulevard. Local storm sewer connections would also provide drainage inputs via this BMP with storm sewer inputs from Graham, Slater and Olympia Boulevards and Baden Place (see **Figures 4.1-14** and **4.1-14a**). In total the proposed BMP would handle storm flows from an immediate tributary area of about 11 acres (600 acres of drainage including the upstream sources).

Like BMP NC-16, the primary function for BMP NC-17 is the large-scale storage of flood waters to attenuate peak flows at the Naughton Avenue trunk sewer. The 7.3 acre-feet of storage in this BMP would help reduce flooding in this low-lying area. When the tide recedes and the tide gates open, the water stored in the BMP would drain to the bay.

Design elements at the BMP include forebays to be installed at each of the six proposed storm sewer outlets to the BMP. These design features attenuate incoming flows and capture sediment. Outflow from the forebays would, in turn, feed the two low-flow channels that converge just upstream of Slater Boulevard. The area of extended detention would be created by excavating an existing, vast monoculture of common reed, thus creating floodplains on both sides of the Main Channel. The outlet from the BMP would pass under the existing Slater Boulevard Bridge. No new weir is necessary at this BP since the inlet at the Naughton Avenue sewer establishes the proper elevation.

With the above-described improvements, the West Branch would be relocated and the Main Channel fully reconstructed for the purposes of improving both their hydraulic and ecological functions within the Bluebelt property. An additional proposed hydraulic improvement is a second pipe for the Main Channel culvert under Olympia Boulevard. This would supplement the existing culvert and improve channel capacity during storm events.

A low landscaped berm (approximately 6 to 36 inches in height) would also be constructed for the purposes of containing storm flows within the BMP footprint, thereby preventing the flooding of Seaver, Ionia and Cherokee Streets, among others (see also Chapter 1.1, "Project Description of the Overall Program," for a design description of the proposed berms).

Maintenance access for the seven outlet stilling basins would be via adjacent streets. The inlet into the Naughton Avenue trunk sewer is serviced via a roadway on top of the sewer that is not open to the public. (The channel restoration of the proposed BMP NC-17: Slater Boulevard is proposed to be part of the Mid-Island Bluebelt first capital project, see **Figure 4.1-19**.)

Currently the site of the proposed BMP is largely dominated by a common reed monoculture with little or no topographic or habitat variation. The proposed BMP design includes a substantial ecological restoration element, including creation of a "deep pond" and a "wooded island" to improve the natural resource values of the site. The proposed project would also remove areas of fill at this BMP site that would expand wetlands by about 3.8 acres. Chapter 1.1, "Project Description of the Overall Program," provides a description of the ecological design objectives that are common to the proposed lower watershed BMPs.

NC-18: PATTERSON AVENUE

BMP NC-18 is proposed to be located on Bluebelt property (some of which is acquired, the balance is in the process of acquisition). The site is bounded approximately by Buel Avenue to the northwest, Dongan Hills Avenue and Naughton Avenue to the southwest, Quincy Avenue to the southeast, and residential properties that front on Seaview and Patterson Avenues to the northeast. This BMP is located at the head of the East Branch of the New Creek stream system. Under the proposed amended drainage plan, local storm sewer connections would provide drainage inputs to the East Branch through this BMP. These inputs would come from sewers proposed in Olympia Boulevard and Patterson Avenue (both from the east and west street ends), all flowing to the planned BMP (see **Figure 4.1-15**). This proposed BMP would occupy about 8.4 acres and would handle storm flow inputs from a drainage area of about 57.1 acres.

The primary objective for BMP NC-18 is to prevent local streets and private properties from flooding by storing stormwater during high tides when the Naughton Avenue and Seaview Avenue outfall tide gates are closed. An important hydraulic improvement is a proposed flow splitter chamber that would divert some high flows from the Seaview Avenue trunk sewer during large storm events. This high-level relief storm sewer, to be constructed along Patterson Avenue between the Seaview Avenue trunk sewer and the BMP, would reduce surcharges in the Seaview Avenue trunk sewer during major storms and the 9.9 acre-feet of storage in this BMP would serve to relieve flooding in low-lying neighborhoods in the vicinity of the East Branch. BMP NC-18 would then store floodwaters during the storm event. When the tide recedes and the tide gates open, the water stored in the BMP would drain to the bay via the Naughton Avenue trunk sewer.

BMP NC-18 is designed with the following features. Forebays would be installed at each of the three proposed storm sewer outlets to the BMP to attenuate incoming flows from the local sewers and capture sediment. Outflow from the forebays would, in turn, then flow to the East Branch. A 32-foot-long weir with a low-flow orifice would also be constructed at the BMP outlet for the purposes of controlling outflow and establishing the BMP hydrology. Just upstream of the weir, a micropool would help insure good outlet conditions at the weir. With the above-described improvements, the East Branch would be reconstructed for the purposes of improving both its hydraulic and ecological functions as it passes through this Bluebelt property. At the extreme downstream end of the BMP, the outflow would drop into the existing Naughton Avenue trunk sewer after passing through a micropool and over a weir.

Maintenance access to the three forebays would be via adjacent streets; the micropool just upstream of the weir would be inspected and serviced via an extention of the existing roadway on top of the sewer in the bed of Naughton Avenue which is not open to the public.

The proposed BMP would also provide a number of ecological benefits. For example, the current site conditions are largely dominated by a common reed monoculture and the East Branch is also filled with sediment. Thus, the stream is only partially visible through the thick common reed monoculture. The proposed BMP extended detention would be created by excavating fill material within an existing vast common reed dominated marsh, thus providing a widened stream and floodplains on both sides of the newly constructed East Branch and would reconstruct this reach for the purposes of improving its conveyance capability while restoring its ecological functions. Lastly, an existing wetland, constructed as mitigation for an adjacent residential development is being acquired by DEP and authorization is being sought through ULURP. This property (Block 3708, Lots 35 and 43) would be an important addition to the Bluebelt as that low-lying property can also be incorporated into the area of extended detention. Chapter 1.1, “Project Description of the Overall Program,” also provides a description of the ecological design objectives that are common to the proposed lower watershed BMPs.

NC-19: BUEL AVENUE

BMP NC-19 is an outlet stilling basin that is proposed to be located on 0.1 acres of Bluebelt property located at the west end of Buel Avenue (west of the intersection with Quincy Avenue, see **Figure 4.1-15**). The proposed BMP would handle drainage from an area about 13.2 acres in size and would attenuate incoming storm flows from the Buel Avenue storm sewer before discharging into BMP NC-18 and the East Branch. The proposed outlet stilling basin would capture sediment from the stormwater discharge and would reduce its velocity. Excavation for a new low-flow channel would be necessary to connect the outlet to NC-18. Construction access

from Buel Avenue would remain post-construction to provide maintenance access to this BMP for both regular maintenance and inspections.

LOWER BAY OUTFALLS

One new outfall, eight feet wide by five feet high, is proposed as part of the proposed amended drainage plan. That outfall, to be constructed in conjunction with BMP NC-10, is necessary because low-lying streets along Father Capodanno Boulevard can only be drained with a new outfall hydraulically distinct from the rest of the system (see **Figure 4.1-16**). It would exit BMP NC-10 between Hunter Avenue and Jefferson Avenue and would also include a new tide gate that would be installed under Father Capodanno Boulevard. The proposed outfall would extend across FDR Boardwalk and Beach Park, which is a City park under the jurisdiction of DPR. It would also cross beneath Father Capodanno Boulevard which is a City street under the jurisdiction of NYCDOT.

In addition to the new outfall for BMP NC-10, the proposed amended drainage plan also includes the installation of a secondary outfall, about 14 feet wide and five feet high, adjacent to the existing outfall at Seaview Avenue. The secondary outfall would also cross under Father Capodanno Boulevard and DPR parkland.

Based on conceptual designs, DEP would also map 40-foot-wide sewer corridors across DPR property to ensure future access for maintenance purposes. Final designs would more definitively establish the two areas of impact and delineate that portion of the outfall that would impact tidal wetlands. Because this area is public parkland, the proposed outfall designs would be subject to DPR review and approval.

PROPOSED STREET DEMAPPINGS

A number of mapped but unbuilt street segments are proposed for demapping in order to accommodate construction of the BMPs and as a measure necessary to consolidate Bluebelt property acquisitions and land transfers (see and **Table 4.1-2**).

Future Uniform Land Use Review Procedure (ULURP) actions are required to formally demap these unbuilt streets and would be implemented by DEP at a later date.

MODIFICATIONS TO STREET GRADES

The proposed project would require the modification of street grades along certain street segments in order to provide positive drainage in the stormwater collection system and adequate street cover over the sewers. The street segments affected by these proposed modified street grades are presented in **Figures 4.1-17a** and **4.14-17b**. Along these street segments, the maximum change in grade would range between 6 inches and up to 24 inches above the existing street grade (the greater increases would be nearer the outlets to the BMP).

It is standard procedure to raise streets in low-lying areas in order to provide proper cover over the proposed storm sewers, and the City has done this on many projects. As part of the capital project design, site specific survey would be performed to determine the actual street elevation conditions for each individual project and all design techniques would be utilized to limit the raising of street grades to the maximum extent possible. During this process, DEP and DDC, the agency that would manage the project through design and construction, would meet with each individual homeowner prior to construction to limit the impacts of street grade changes and to assist homeowners in developing the best drainage solution possible.

PROPOSED EASEMENTS

Provided in **Table 4.1-3** are the easements across private property that would be necessary to implement the proposed drainage plan (see also **Figures 4.1-18a and 4.1-18b**). Three of the proposed easements are for storm sewers that directly connect to BMPs (see **Figures 4.1-4, 4.1-6, and 4.1-7** for the locations of those easements). The other two easements are for sanitary and storm sewers (see **Figures 4.1-18a and 4.1-18b** for locations of the proposed sewer easements). These easements would be for construction of sewers as well as future DEP maintenance access. Future ULURP actions would be required to acquire those sewer easements.

Table 4.1-2
Mapped but Unbuilt Streets to be Demapped under the Proposed Project (New Creek Watershed)

BMP	BMP Location	Street Segment to be Demapped
NC-7	Nugent St.	Unpaved portion of Grimsby St. between Hunter Av. & Graham Blvd.
		Jefferson Av. between Nugent Av. & Freeborn St.
		Unpaved portion of Mason Av. between Adams Av. & Hunter Av.
NC-8	Freeborn St.	Jefferson Av. between Freeborn St. & Olympia Blvd.
NC-9	Graham Blvd.	Unpaved portion of Baden Pl. between Hunter Av. & Graham Blvd.
		Jefferson Av. between Olympia Blvd. & Patterson Av.
		Unpaved portion of Colony Av. between Hunter Av. & Graham Blvd.
NC-10	Jefferson Ave.	Unpaved portion of Sioux St. between Canoe Pl. & Quincy Av.
		Jay St. between Hunter Av. & Jefferson Av.
		Jay St. between Jefferson Av. & Graham Blvd.
		Unpaved portion of Sioux St. between Canoe Pl. & Quincy Av.
		Canoe Pl. South between Graham Blvd. & Slater Blvd.
		Unpaved portion of Iona St. between Canoe Pl. & Quincy Av.
		Patterson Av. between Jefferson Av. & Hunter Av.
		Unpaved portion of Seaver Av. between Canoe Pl. & Quincy Av.
NC-11	Last Chance Pond	Cletus St. between Stobe Av. & Naughton Av.
		Husson St. between Stobe Av. & Seaver Av.
		Seaver Av. between Zoe St. & Husson St.
		Unpaved portion of Vera St. between Stobe Av. & Seaver Av.
NC-12	Joyce St.	Unpaved portion of Joyce St. between Stobe Av. & Seaver Av.
NC-13	Hylan Blvd.	Unpaved portion of Filbert Av. between Hylan Blvd. & Mason Av.
		Unpaved portion of Laconia Av. between Filbert Av. & Seaver Av.
NC-14	Meadow Place	Stobe Av. between Boundary Av. & Meadow Place
		Boundary Av. between Stobe Av. & Filbert Av.
		Bermuda Pl. between Hylan Blvd. & Meadow Pl.
		Unpaved portion of Meadow Pl. between Bermuda Pl. & Filbert Ave.
NC-16	Olympia Blvd.	Filbert Av. between Mason Av. & Nugent Av.
		Freeborn St. between Seaver Av. & Graham Blvd.
		Grimsby St. between Seaver Av. & Graham Blvd.
		Mason Av. between Filbert Av. & Rowan Av.
		Nugent Av. between Graham Blvd. & Seaver Av.
		Rowan Av. between Mason Av. & Nugent Av.
		One half of Seaver Av. between Mason Av. & Nugent Av.
NC-17	Slater Blvd.	Colony Av. between Graham Blvd. & Seaver Av.
		Unpaved portion of Baden Place between Graham Blvd. & Seaver Av.
		Patterson Av. between Seaver Av. & Slater Blvd.
		Seaver Av. between Olympia Blvd. & Canoe Pl.
		Patterson Av. between Graham Blvd. & Seaver Av.
NC-18	Patterson Ave.	Patterson Av. between Dongan Hills Av. & Buel Av.
		Unpaved portion of Buel Av. between Olympia Blvd. & Quincy Av.
		Unpaved portion of Dongan Hills Av. between Patterson Av. & Quincy Av.
NC-19	Buel Ave.	Olympia Boulevard between Dongan Hills Av. and Buel Av.
		Unpaved portion of Quincy Av. between Dongan Hills Av. & Liberty Av.
		Lola St. between Canoe Pl. South & Quincy Av.
		Canoe Pl. South between Liberty Av. & Slater Blvd.
		Canoe Pl. between Canoe Pl. South & Father Capodanno Blvd.
		Unpaved portion of Naughton Av. between Patterson Av. & Quincy Av.
		Unpaved portion of Dongan Hills Av. between Patterson Av. & Quincy Av.

Source: DEP Staten Island Bluebelt Unit, January 2011.

Table 4.1-3
Proposed Easements on Private Property to be Acquired

BMP	Location	Purpose
NC-2	Between two residences on Ocean Terrace	Storm sewer drop pipes from street sewer to BMP, construction and maintenance access
NC-4	From Whitlock Ave to Richmond County Country Club	Storm sewer connection to BMP, construction and maintenance access
NC-5	Private driveway off Todt Hill Rd at Windy Hollow Way	Storm sewer connection to BMP in Richmond County Country Club, construction and maintenance access
N/A	Northeast between Esmac Court North cul-de-sac and Forest Road	Proposed 30-ft-wide permanent sanitary and storm sewer easement
N/A	Between stub end of Romer Road and Forest Road	Proposed 30-ft-wide permanent sanitary and storm sewer easement

SANITARY SEWERS

The proposed amended drainage plans also include sanitary sewers in all streets (see **Figure 4.1-2a**) Implementation of future capital improvement projects would therefore complete the sanitary sewer network in accordance with proposed amended drainage plan. The one significant area of the watershed without sanitary sewers is Todt Hill in the upper watershed. The proposed amended drainage plan calls for sanitary sewers in these streets. Once the proposed sewers are installed, individual sanitary connections would then be made by lot owners, and septic systems would be decommissioned. In addition, the proposed sanitary sewer plans call for upgrading existing sewers from 8-inch to 10-inch, where necessary in the watershed in compliance with the current standard for minimum sewer size. All collected sanitary wastewater would then be provided secondary treatment at the Oakwood Beach WWTP prior to discharge in Lower Bay.

C. DRAINAGE PLAN CONSTRUCTION PHASING

Due to the interconnected hydrology of the watershed, constructed improvements upstream have the potential to impact downstream hydrology and potential flood risk. This is particularly the case if additional conveyance is provided without increased flood storage. Given these important phasing considerations, construction in this watershed is anticipated to proceed as follows:

- West Branch BMPs: The lower West Branch of New Creek is severely constricted and lacks a positive gradient and flow conveyance. Therefore, the first Mid-island capital project involves the BMPs NC-7 and NC -8, and the low flow channels of the proposed BMPs NC-9, and NC-17 (see also Figure 4.1-19).
- Main Channel BMPs: Capital projects along the Main Channel should begin at the lower watershed and proceed upstream. BMP NC-16 should therefore be the first capital project exclusively along the Main Channel, followed by BMPs NC-15, -14, -13, and -12.
- East Branch BMPs: The detention wetland on the East Branch, BMP NC-18, must be provided in order for the relief sewer from Seaview Avenue to be built.
- Headwater BMPs: BMPs NC-6 and NC-11 are located at the headwaters of the West Branch and Main Channel, respectively. As they provide significant detention for the stormwater from the surrounding neighborhoods, the Last Chance Pond BMP (NC-11) may be constructed prior to downstream improvements. However, the West Branch relocation should still be completed before NC-6, due to the severe problems along the lower West Branch.
- Upper watershed BMPs: BMPs NC-1 through NC-5 are located in steeper, upland areas that are not affected by the backwater flooding along New Creek. These BMPs and their associated storm sewers may be constructed at any time. ✷

Proposed BMP Site

Existing Lower Bay Outfall

Proposed Lower Bay Outfall

Drainage Area Tributary to New Creek Bluebelt

Proposed Drainage Plan Area Tributary to Existing Ocean Outfalls

Existing Stream

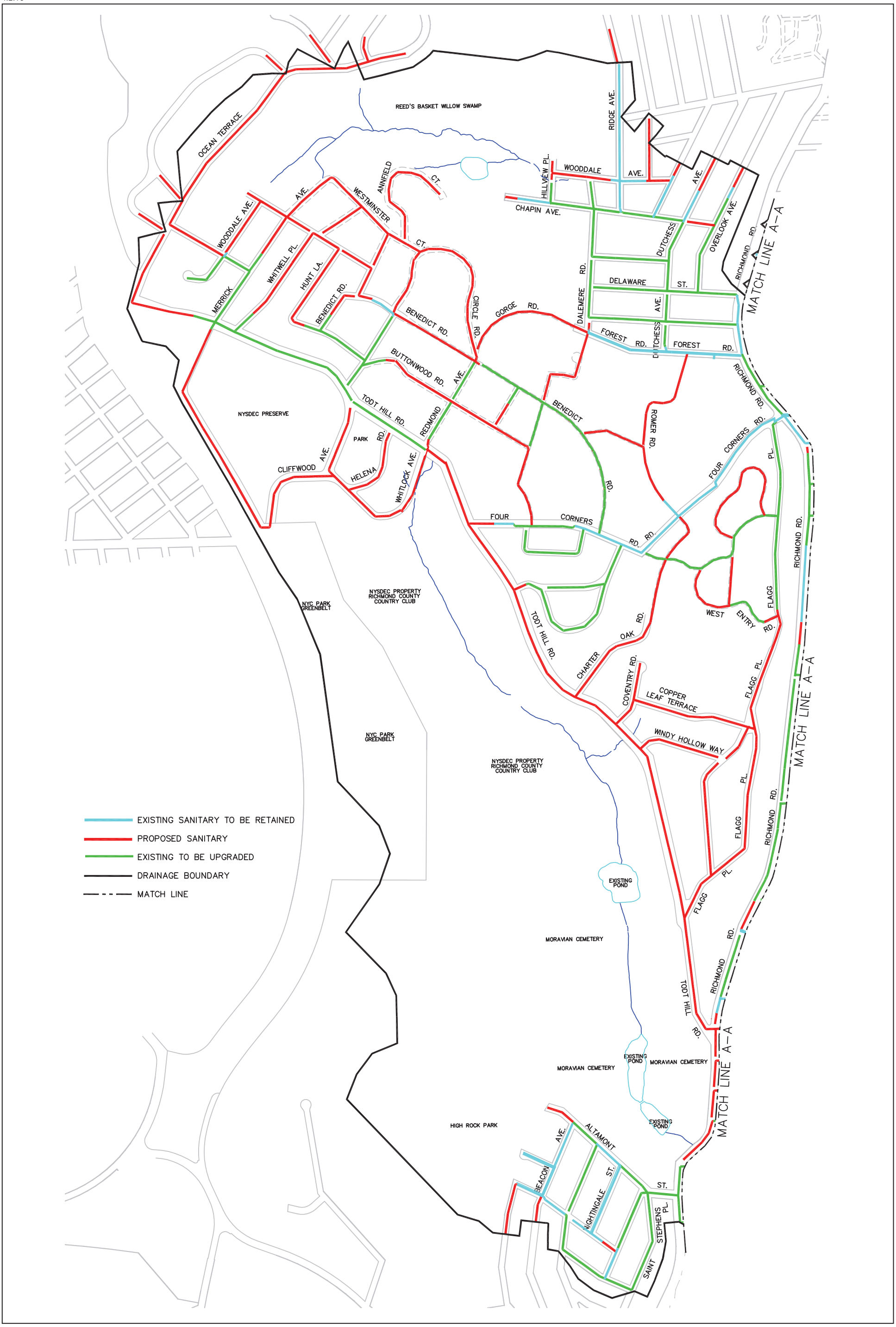
Parks and Open Space (City, State & Federal)

DEP Bluebelt Property (Acquired or in the Process of Being Acquired)

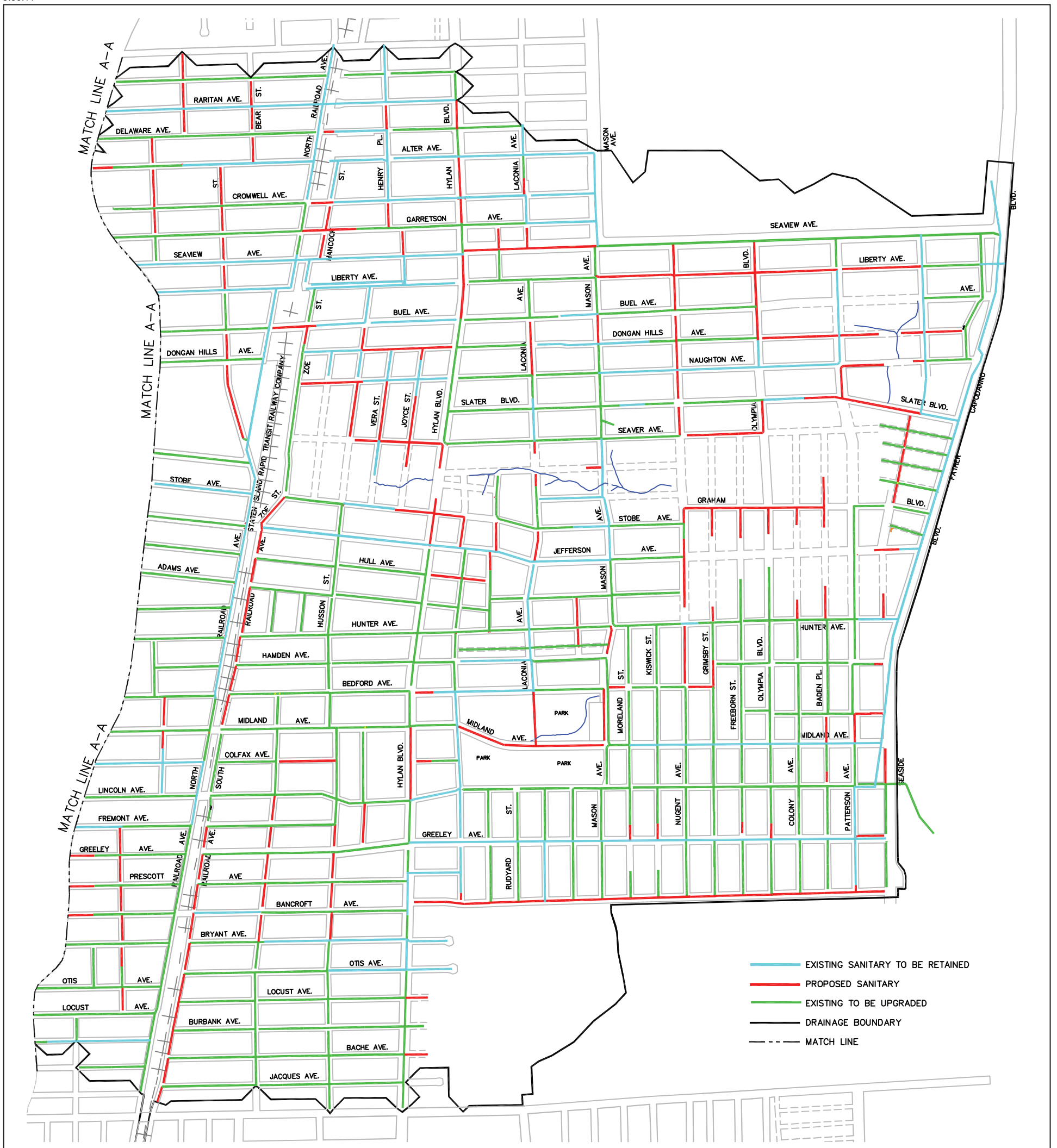
Rail Line/Rail Station

New Creek Watershed - Proposed BMP Sites

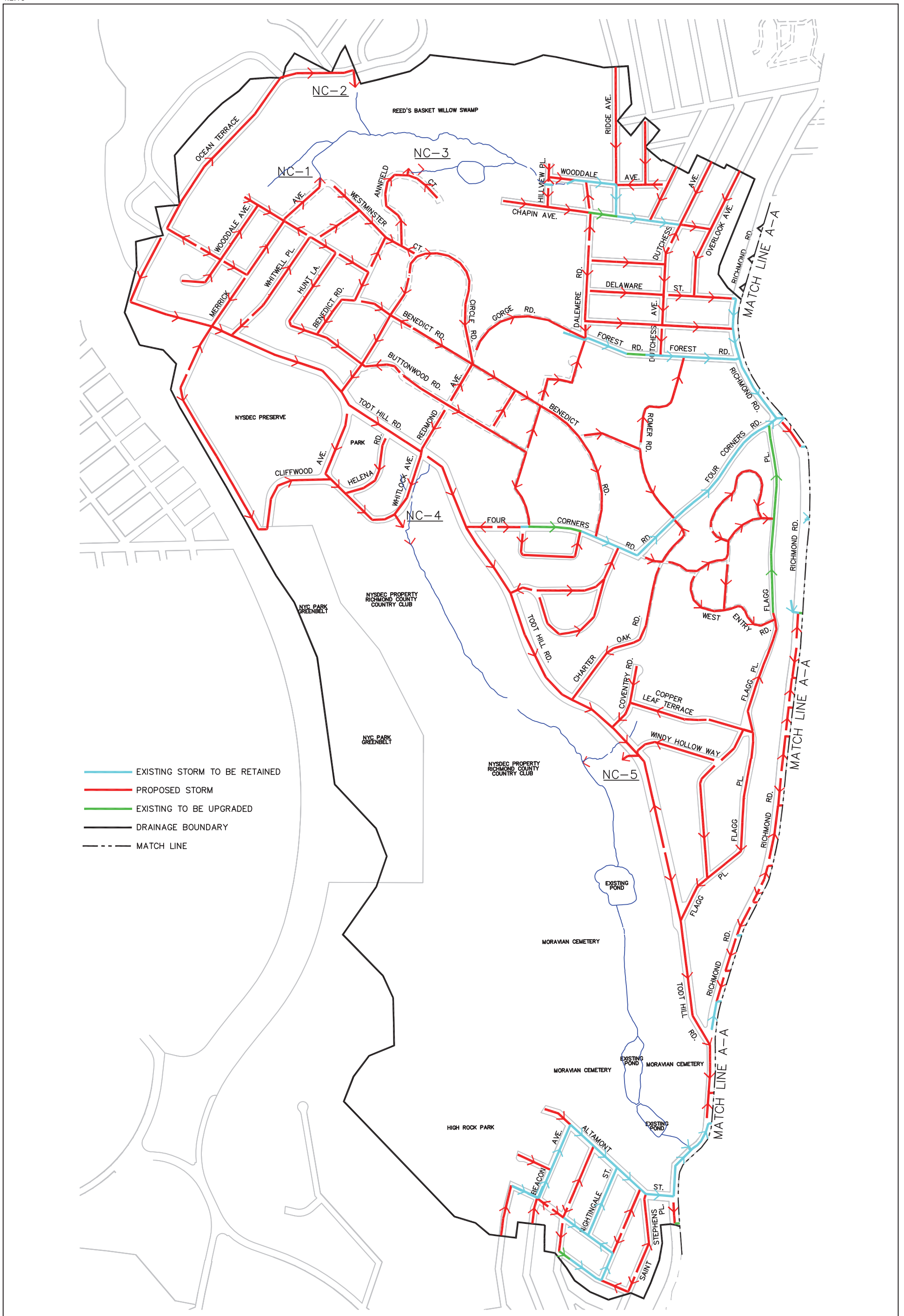
Figure 4.1-1



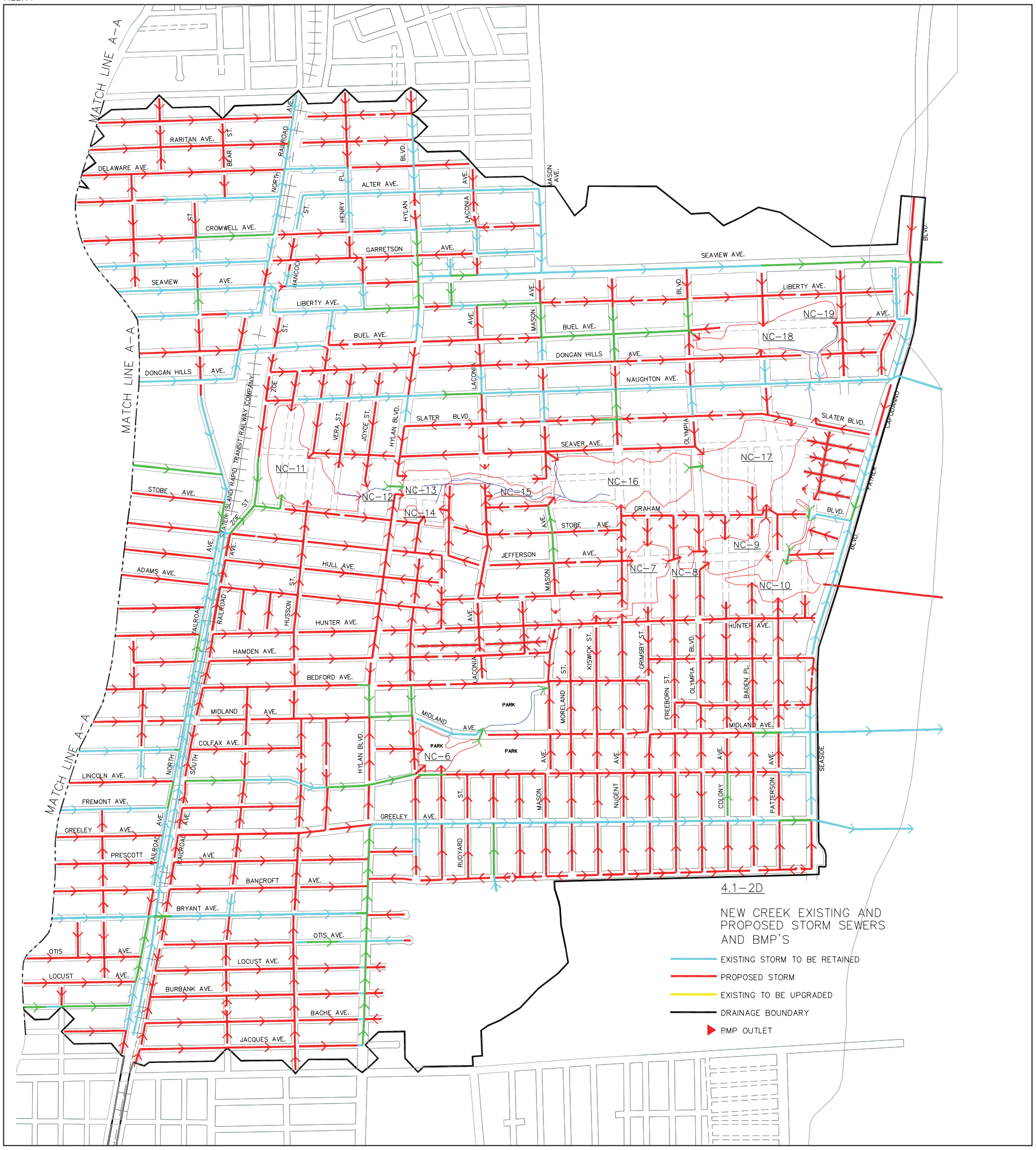
New Creek Upper Watershed:
Existing and Proposed Sanitary Sewers
Figure 4.1-2a



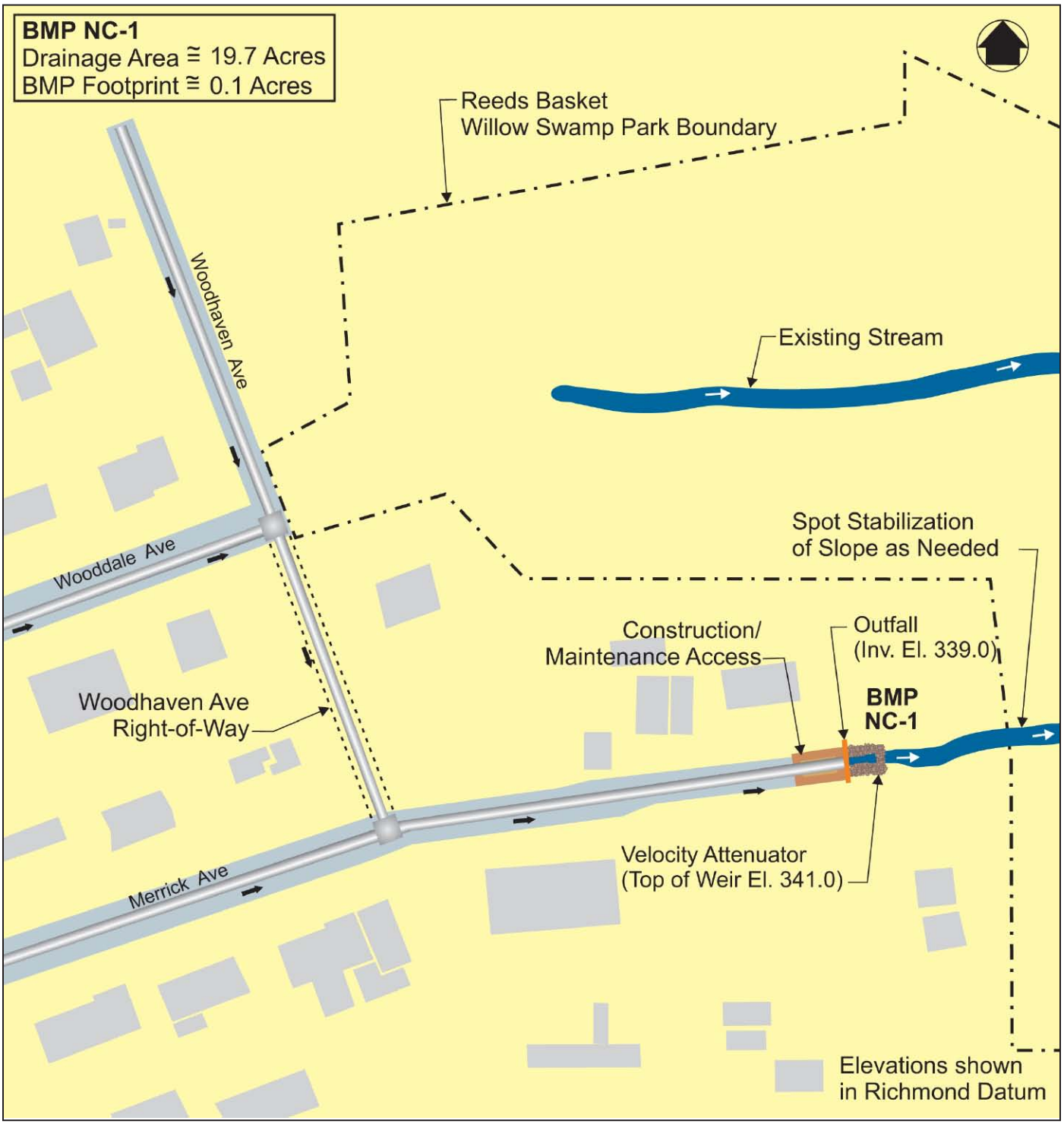
New Creek Lower Watershed:
Existing and Proposed Sanitary Sewers
Figure 4.1-2b



New Creek Upper Watershed:
Existing and Proposed Storm Sewers
Figure 4.1-2c



New Creek Lower Watershed:
Existing and Proposed Storm Sewers
Figure 4.1-2d



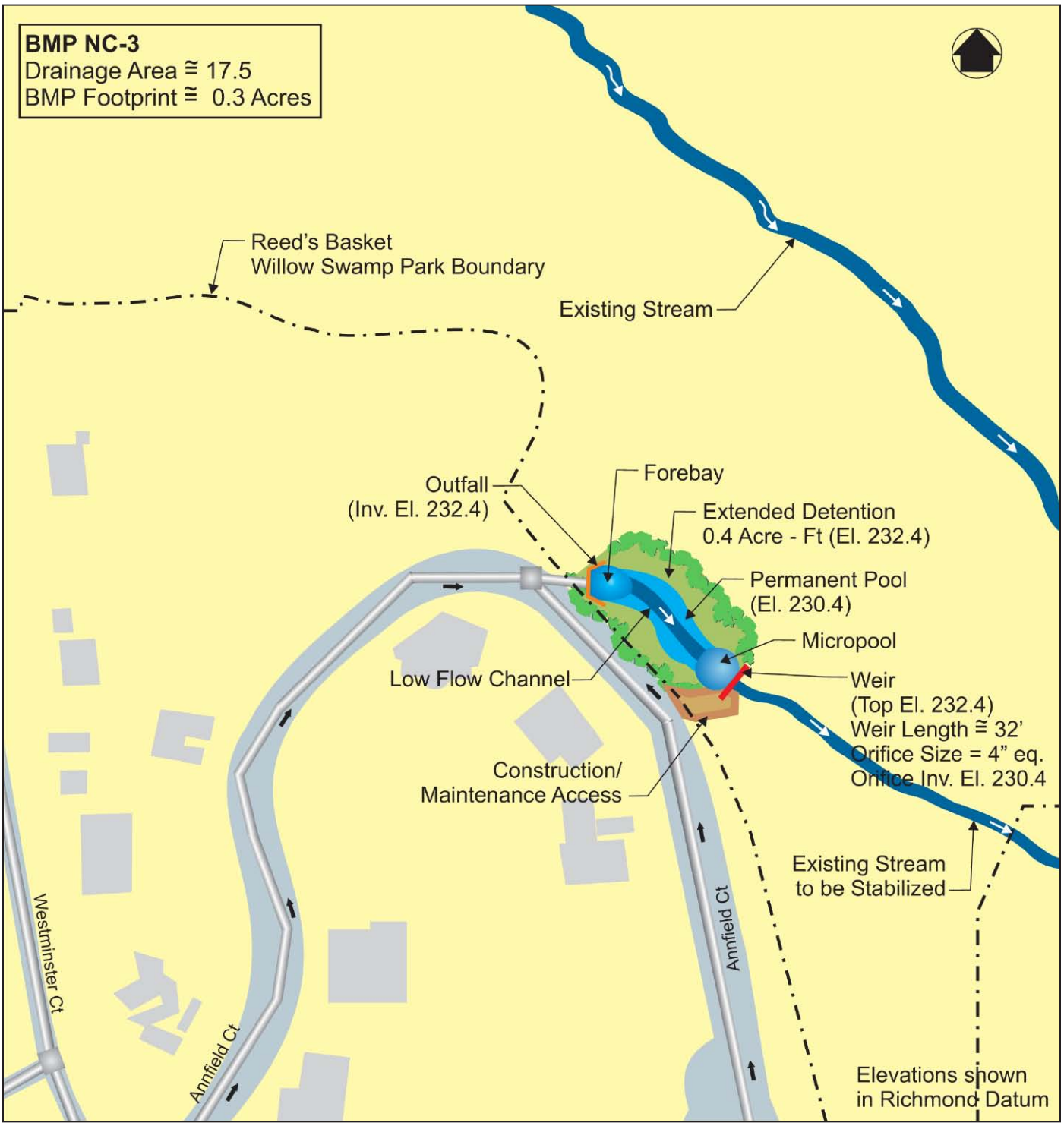
SOURCE: Hazen & Sawyer, 2010

BMP NC-1:
Velocity Attenuator and Slope Restoration
at Merrick Avenue

Figure 4.1-3a

SOURCE: Hazen & Sawyer, 2010

BMP NC-2:
Drop Pipe and Velocity Attenuator
at Ocean Terrace



SOURCE: Hazen & Sawyer, 2010

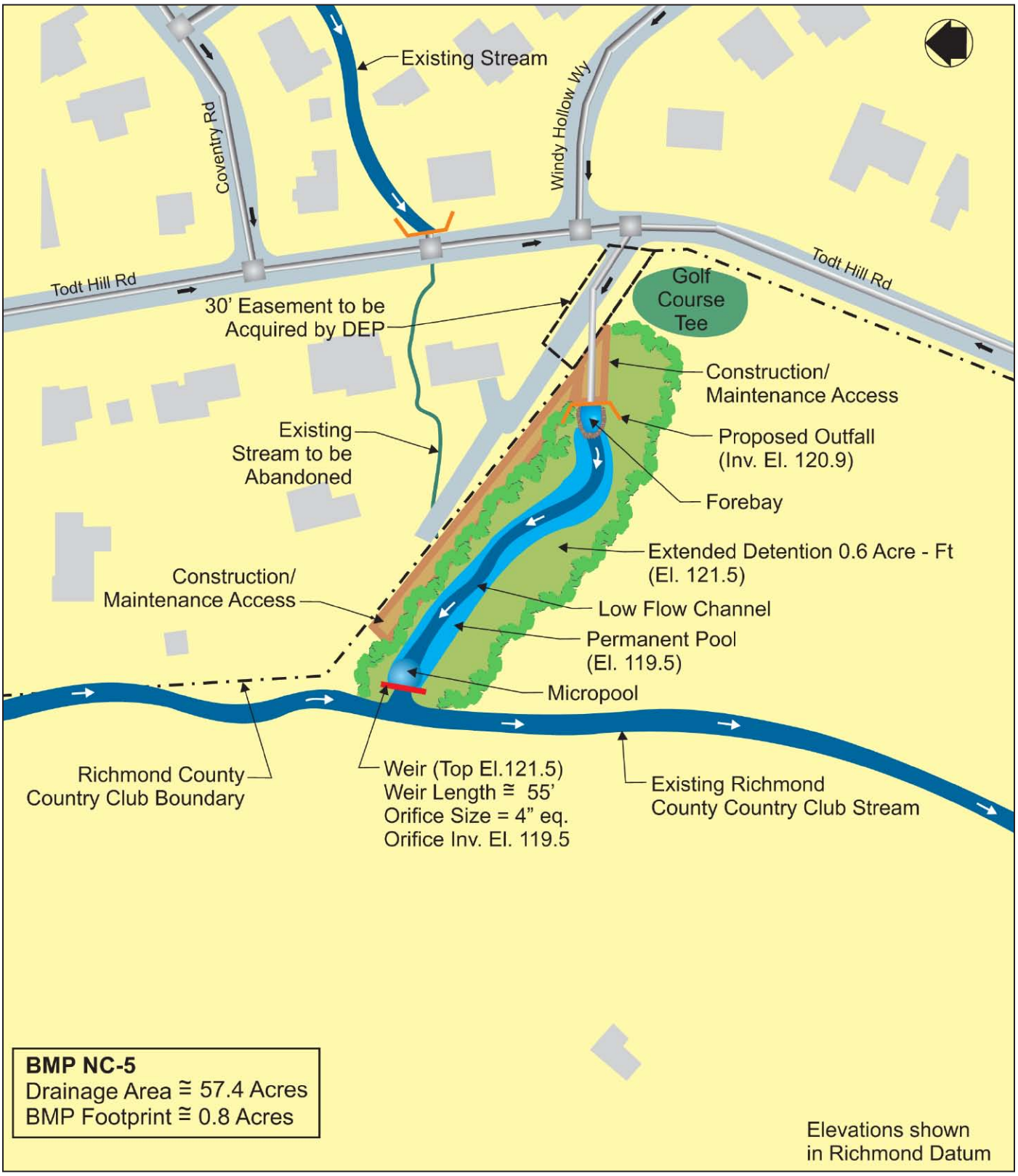
BMP NC-3:
Extended Detention Wetland and
Stream Stabilization at Annfield Court

Figure 4.1-5

SOURCE: Hazen & Sawyer, 2010

BMP NC-4:
Extended Detention Wetland and
Detention Chamber at Whitlock Avenue

Figure 4.1-6

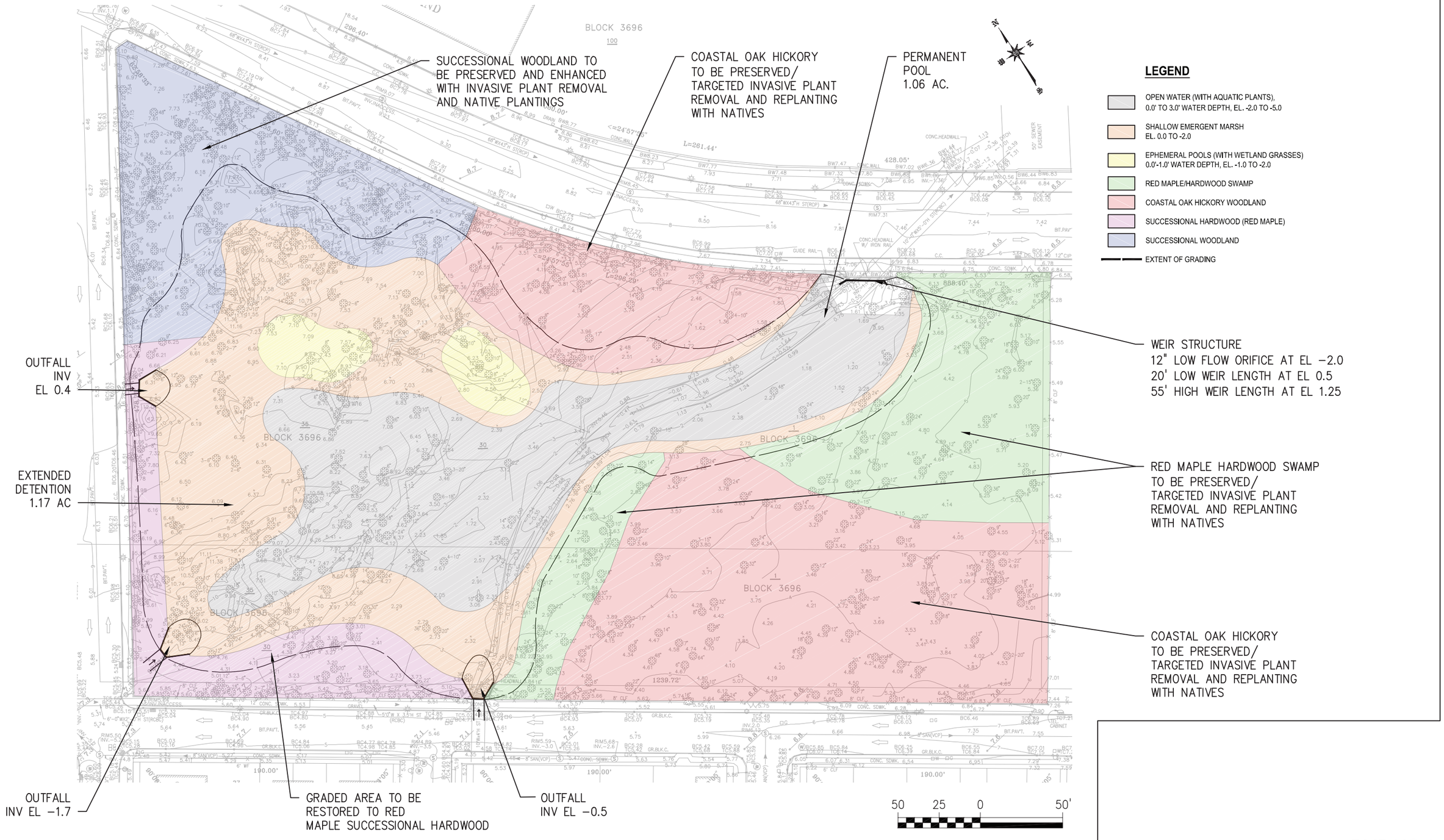


SOURCE: Hazen & Sawyer, 2010

BMP NC-5:
Extended Detention Wetland
at Todt Hill Road

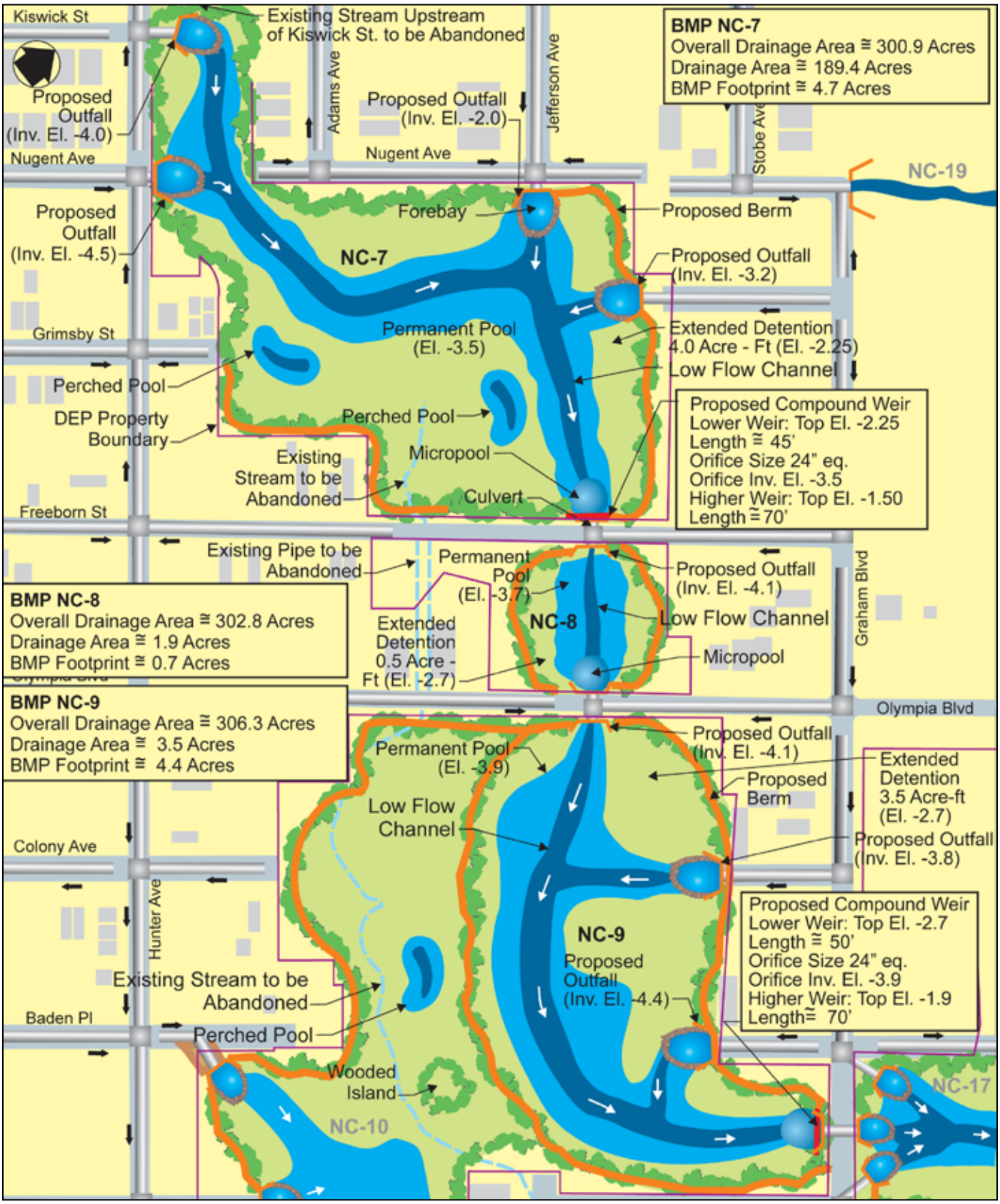
Figure 4.1-7

View of Steep Slope Below Site of Proposed BMP NC-1



BMP NC-6:
Extended Detention Pond and
Wetland at Boundary Avenue
Figure 4.1-8

5.29.13



SOURCE: Hazen & Sawyer, May 2013

BMPs NC-7, NC-8 and NC-9:
Extended Detention and Stream Relocation at
Nugent Avenue, Freeborn Street and Graham Boulevard

Figure 4.1-9

10.18.13

Aerial View of Proposed BMPs
NC-7, NC-8 and NC-9

Mid-Island Bluebelt Project

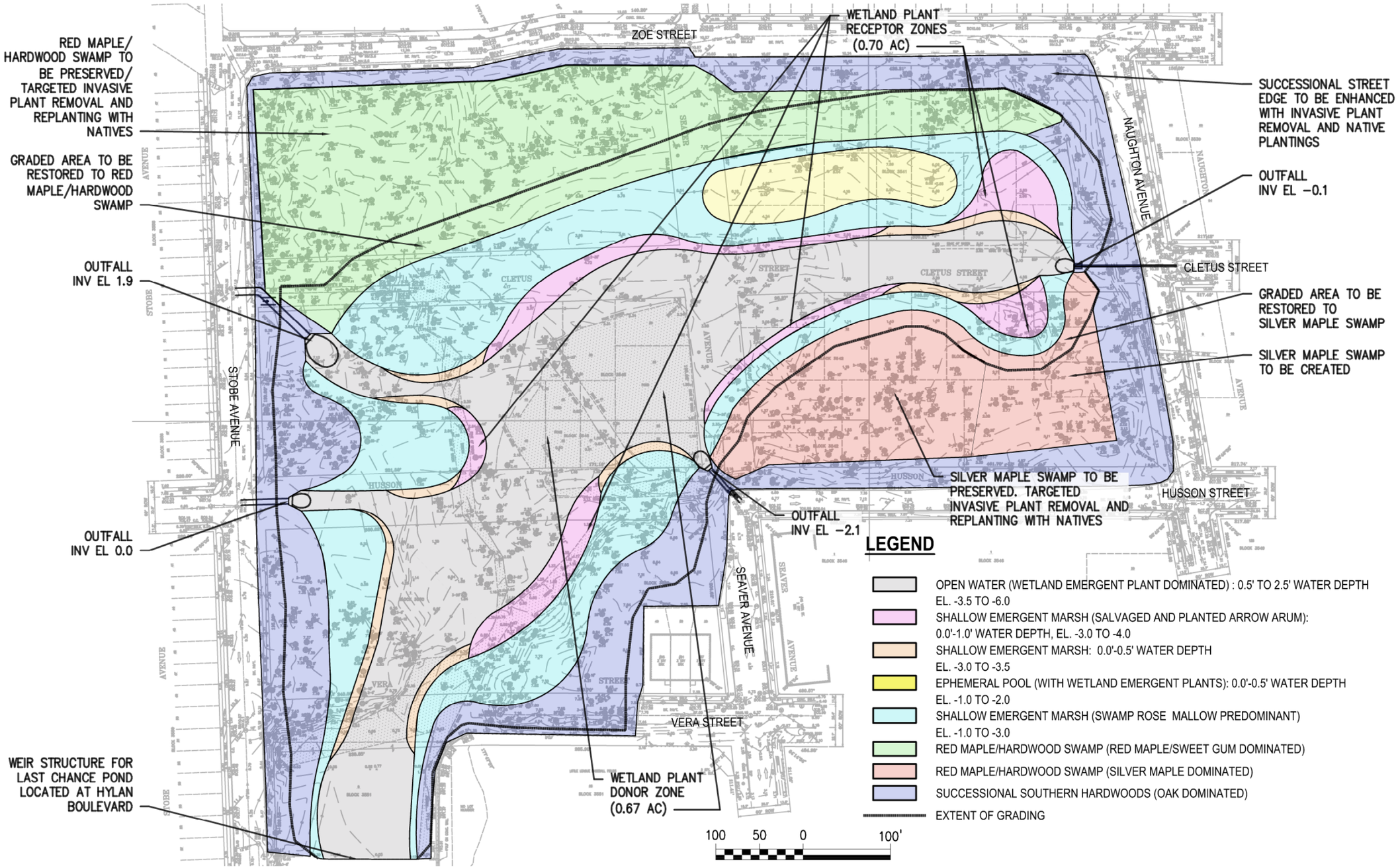
Figure 4.1-9a

10.16.13

SOURCE: Hazen & Sawyer, May 2013

BMP NC-10:
Extended Detention Wetland
and Ocean Outfall

Figure 4.1-10



BMP NC-11:
Extended Wetland Detention
at Last Chance Pond
Figure 4.1-11

2.17.11

View of Site for Proposed BMP NC-11 (Last Chance Pond) from Intersection of Seaver Avenue and Husson Street

BMPs NC-12, NC-13 and NC-14:
Outlet Stilling Basin at Joyce Street
Extended Detention Wetland at Hylan Boulevard
and Outlet Stilling Basins at Meadow Place

10.16.13

SOURCE: Hazen & Sawyer, 2010

BMPs NC-15 and NC-16:
Outlet Stilling Basin at Laconia Avenue and
Extended Detention at Olympia Boulevard

Figure 4.1-13

10.16.13

SOURCE: Hazen & Sawyer, May 2013

BMP NC-17
Extended Detention Wetland
at Slater Boulevard

Figure 4.1-14

1.30.13

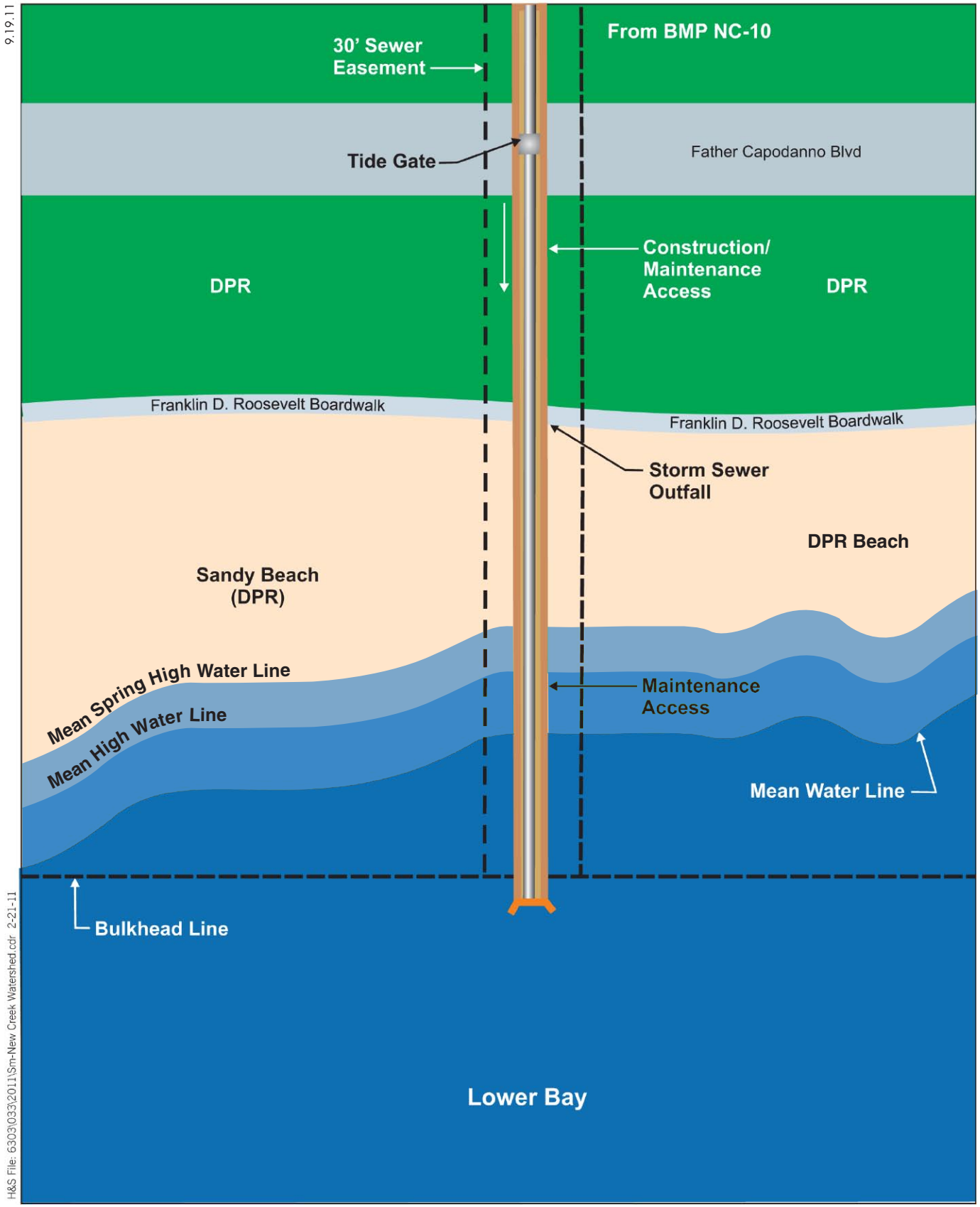
SOURCE: Hazen & Sawyer, October 2012

BMP NC-18 and NC-19
Extended Detention Wetland at Patterson Avenue
and Outlet Stilling Basin at Buel Avenue

2.17.11

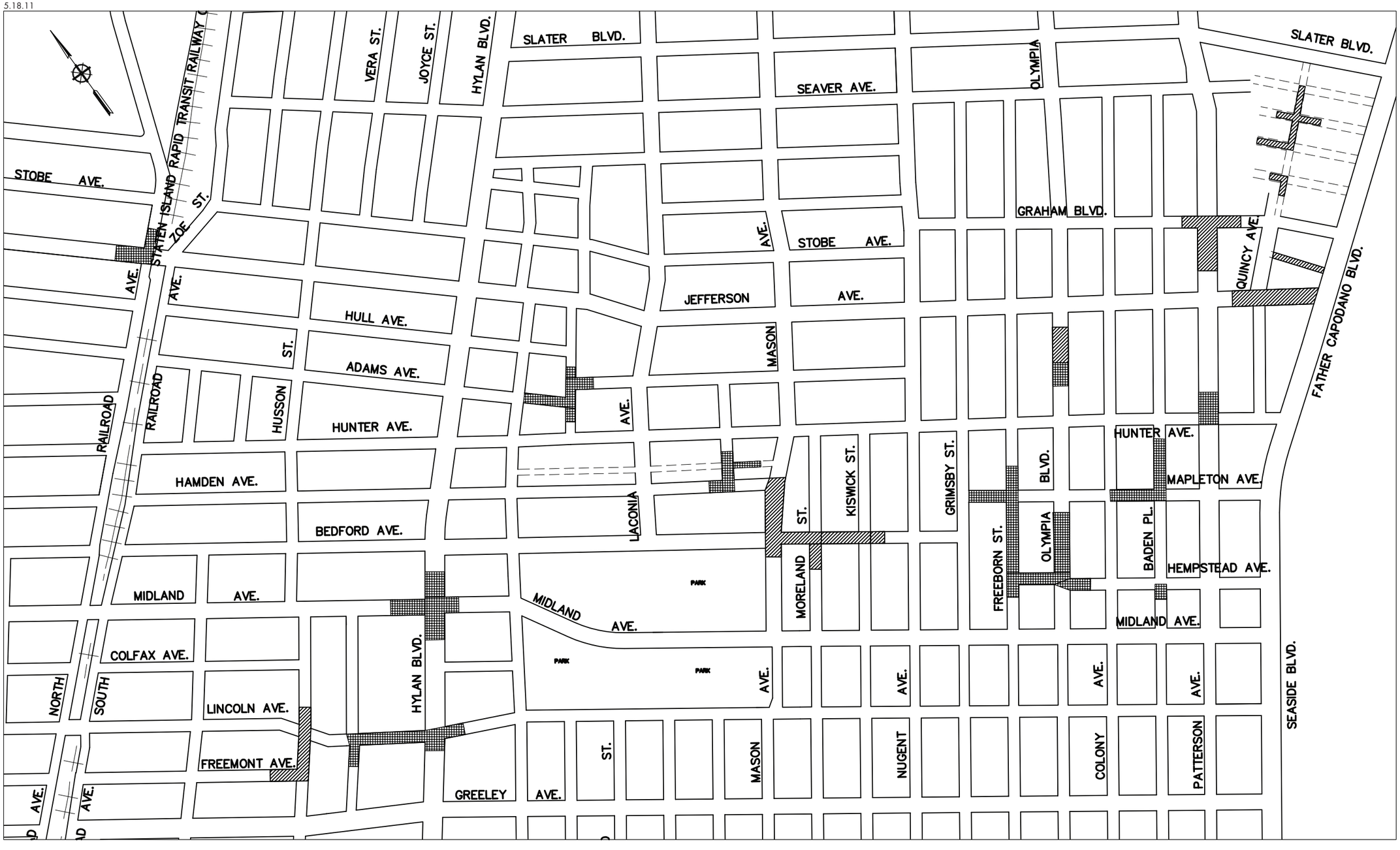
View of Site for Proposed BMP NC-13 Looking South
from Hylan Boulevard

View of Site for Proposed BMP NC-17 Looking North
from Father Capodanno Boulevard



Lower Bay Outfall for BMP NC-10:
New Creek Watershed

Figure 4.1-16

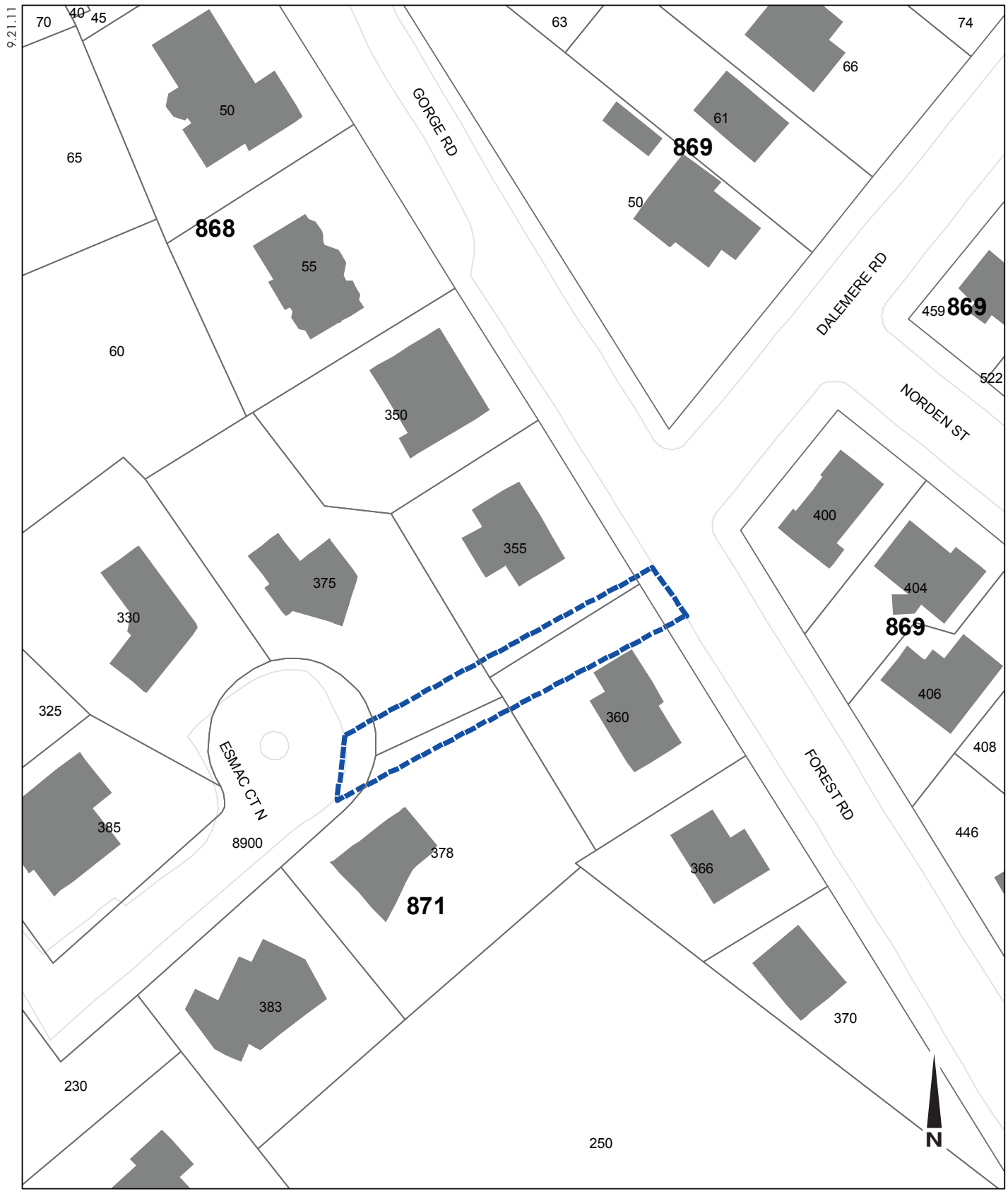


ROAD TO BE RAISED GREATER THAN 1 FT, LESS THAN 2 FT (MAX. 1.42 FT AT OLYMPIA BLVD. BETWEEN JEFFERSON AVE AND HUNTER AVE.)

ROAD TO BE RAISED LESS THAN 1 FT (MIN. 0.15 FT AT BADEN PL. BETWEEN MAPLETON AVE. AND HUNTER AVE.)

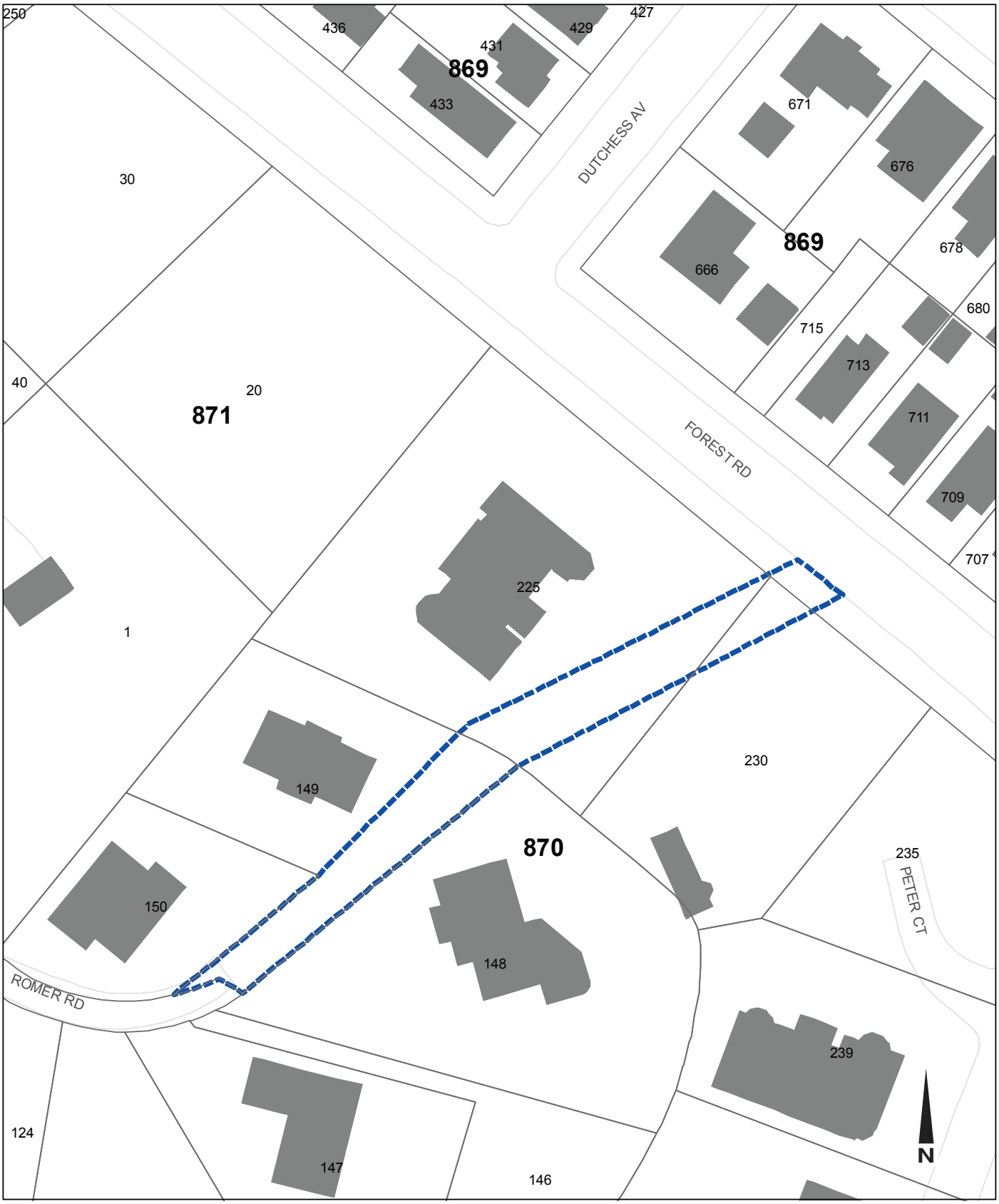
Proposed Modified Street Grades:
New Creek Watershed (Location Map)
Figure 4.1-17a

Proposed Modified Street Grades:
New Creek Watershed (Detail Map)
Figure 4.1-17b



Proposed Sanitary/
Storm Sewer Easement Corridor:
New Creek Watershed (Block 871)

Figure 4.1-18a



Proposed Sanitary/
Storm Sewer Easment Corridor:
New Creek Watershed (Block 870)

Figure 4.1-18b

First Proposed Mid-Island Capital Project: New Creek West Branch
BMPs NC-7and NC-8 and NC-9 and NC-17 (Low-Flow Channels)

Staten Island Bluebelt Mid-Island Watersheds

Figure 4.1-19

Chapter 4.2: Land Use, Zoning, and Public Policy of the New Creek Drainage Plan

A. INTRODUCTION

This analysis of land use, zoning, and public policy describes the existing conditions in the watershed as a whole and within 400 feet of the proposed BMP sites and outfalls. The 400-foot study area is the area that, based on the *New York City Environmental Quality Review (CEQR) Technical Manual*, has the greatest potential to be affected by the proposed action. This chapter also characterizes anticipated changes in these areas independent of the proposed project and the proposed project's consistency with future land uses, ongoing development trends, zoning, and public policies. Sources used to conduct this analysis include field surveys; evaluation of land use and zoning maps; and consultation with other sources, such as the New York City Zoning Resolution. To determine future conditions without the proposed action, those changes in land use, zoning, and public policy that are likely to occur by 2043 were evaluated based on discussions with public agencies involved in development in the area.

B. EXISTING CONDITIONS

LAND USE

The New Creek watershed is the largest of the Mid-Island watersheds. As shown in **Figure 4.2.1** and **Table 4.2-1**, the 2,248-acre New Creek watershed is developed and urbanized and is comprised primarily of residential (about 42 percent), open space (about 16 percent), public facility (about 6 percent), commercial (3 percent) and developed roadbed (17.5 percent) uses. Table 4.2-2 shows the land use conditions at each BMP site and within the 400 foot study area.

Table 4.2-1
Land Use in New Creek Watershed

Land Use	Acres	Percentage of total watershed
Residential	943.7	42.0
Road bed/sidewalks	394.5	17.5
Open space *	363.6	16.2
Vacant **	165.9	7.4
Public facilities/institutional	139.3	6.2
Commercial	67.0	3.0
Transportation/utility	24.1	1.1
Mixed residential/commercial	9.6	0.4
Other (industrial, parking, etc.)	140.2	5.5
Total Area	**12,248.8**	**100.0**

Note: ***Open Space includes City parkland and NYSDEC property.
**Vacant land includes Bluebelt property which totals about 94 acres.
Source: New York City Department of City Planning, MapPLUTO (2010)

Residential uses are predominantly single-family detached homes, although there are also some two-family homes and multi-family apartment buildings in the watershed. In the Todt Hill area there are larger homes in the vicinity of Reeds Basket Willow Swamp Park and one particularly large structure is under construction just west of the proposed BMP NC-3: Annfield Court site. Commercial uses include restaurants, food markets, small offices and a larger commercial center along Hylan Boulevard. Public facilities and institutional uses, including places of worship and public and private schools, comprise a small portion of the watershed and include the Staten Island University Hospital, located east of Seaview Avenue.

Major access roads within the watershed include Hylan Boulevard and Richmond Avenue which run east to west, and Todt Hill Road and Seaview Avenue, which run north to south. The Staten Island Railway line, a rail service operated by the Metropolitan Transit Authority (MTA), runs parallel to Richmond Avenue and offers transit service between Tottenville and St. George. Transit stations within the watershed are located in the Dongan Hills, Jefferson Avenue and Grant City communities.

Larger open spaces in the watershed include the Richmond County Country Club (a golf course on NYSDEC-owned land), St. Francis Woodlands (also NYSDEC land) and the Reeds Basket Willow Swamp Park (DPR land), all of which are located in the upper watershed, north of Richmond Avenue. Smaller City parks such as Last Chance Pond and Midland Field Park are located south of Richmond Avenue. The Lower Bay waterfront/shoreline is also parkland that is part of the Franklin Delano Roosevelt (FDR) Boardwalk and Beach Park which extends along Staten Island's south shore (see Chapter 4.5, "Open Space of the New Creek Watershed," for additional information).

Only about 7 percent of the land use in the watershed is vacant. The majority of this vacant land is freshwater wetlands in the lower watershed where development is regulated by NYSDEC and the USACE. Some of this land is DEP-owned, and has been acquired (or is to be acquired) for the purposes of the proposed project. This Bluebelt property totals about 94 acres.

ZONING

As shown in **Table 4.2-2** and **Figure 4.2-2**, the New Creek watershed contains a mix of lower-density residential zoning districts including R1-1, R3-1, R3-2, R3X and R5 with one commercial zoning district, C8-1.

R1-1 zoning districts contain single-family homes that are characterized by larger yards (e.g., 0.25 acres and greater), with an allowable floor area ratio (FAR) of 0.5. R3-1 zoning districts allow single- and two-family detached or semi-attached houses with a maximum FAR of 0.5. R3-2 zoning districts permit a variety of housing types, including garden apartments, rowhouses and single- or two-family homes. The R3-2 district allows a maximum FAR of 0.5 and corner lots are limited in coverage to 60 percent of the lot. This zoning designation is intended to allow greater density than in the R3-1 district. The R3X district is mapped primarily in the central portion of the watershed. This district was mapped within New York City as a contextual zoning district to allow single- and two-family detached houses on lots with a minimum width of 35 feet. The R3X zoning district has a maximum FAR of 0.5, with an additional attic allowance of 0.2 FAR. R5 districts are also common in the central portion of the watershed. This district allows a variety of housing types with an FAR up to 1.25. Development under this zoning district can produce small apartment buildings and attached houses. Within the watershed this zoning district covers about eight blocks, is limited to the area south of the Jefferson Avenue train station, and extends south to Hylan Boulevard.

Table 4.2-2
Land Use and Zoning in the New Creek Proposed BMP Sites (and within 400 feet)

BMP Number	BMP Name/Location	Approximate BMP Footprint (acres)	Land Use at the BMP site	Predominant Land Uses within 400 feet of the BMP	Zoning at the BMP sites
NC-1	Merrick Ave	0.1	DPR Parkland (Reeds Basket Willow Swamp Park)	Open space/residential	N/A
NC-2	Ocean Terrace	0.1	DPR Parkland (Reeds Basket Willow Swamp Park) and private easement	Open space/residential	N/A
NC-3	Annfield Court	0.2	DPR Parkland (Reeds Basket Willow Swamp Park)	Open space/residential	N/A
NC-4	Whitlock Avenue	0.3	NYSDEC (Richmond County Country Club Golf Course)	Open space/residential	N/A
NC-5	Todt Hill Road	0.9	NYSDEC (Richmond County Country Club Golf Course)	Open space/residential	N/A
NC-6	Boundary Avenue	3.0	DPR Parkland	Open space/residential	N/A
NC-7	Grimsby Street	4.7	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-8	Freeborn Street	0.7	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-9	Graham Boulevard	4.4	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-10	Jefferson Ave	4.5	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-11	Last Chance Pond	8.8	DPR Parkland/DEP Bluebelt	Open space/residential	R5
NC-12	Joyce Street	0.1	DEP Bluebelt	DEP Bluebelt/Residential	R5 (with commercial overlay)
NC-13	Hylan Boulevard	2.9	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-14	Meadow Place	0.2	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-15	Laconia Avenue	0.1	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-16	Olympia Boulevard	12.0	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-17	Slater Boulevard	9.7	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-18	Patterson Avenue	7.4	DEP Bluebelt	DEP Bluebelt/Residential	R3-1
NC-19	Buel Avenue	0.1	DEP Bluebelt	DEP Bluebelt/Residential	R3-2
N/A	New Outfall from NC-10	0.6	City Street (Father Capodanno Boulevard) and DPR Parkland	City Street and Parkland	N/A
N/A	Expanded outfall at Seaview Avenue	Within existing sewer corridor	City Street (Father Capodanno Boulevard) and DPR Parkland	City street and Parkland	N/A

Note: DEP Bluebelt refers to lands owned by DEP or pending acquisition. The area of the proposed outfall corridor is assumed to be 40 feet wide and between the BMP and the bulkhead line.

The only commercial district in the study area is a C8-1 district. This commercial district is for automotive-related and heavier commercial activities, including auto repair, car washes and gas stations. C8-1 districts are typically large and have an allowable FAR of 1.0. This district is mapped along Hylan Boulevard between Midland Avenue and Stobe Avenue. Other commercial uses in the watershed are permitted under a commercial overlay district mapped along Hylan Boulevard and portions of Richmond Avenue.

SPECIAL SOUTH RICHMOND NATURAL AREA DISTRICT (SNAD)

The northern portion of the watershed (in the Todt Hill area) is within the Special South Richmond Natural Area District (SNAD). The purpose of this special zoning district is to guide new development and site alterations with the objective of preserving existing natural characteristics, including woodlands, rock outcrops, steep slopes, creeks and a variety of botanic and aquatic environments. In these districts, the City Planning Commission (CPC) reviews proposals for all new development, enlargements and site alterations to determine if they comply with these objectives. The review must determine that natural features are protected by limiting modifications in topography, preserving trees, plants, marine life and natural water courses, and that clustered development has been encouraged. In addition, pursuant to Section 105-91 of the Zoning Resolution (ZR), when a NA-1 district is designated on a public park, any natural feature existing as of December 19, 1974, cannot be removed, destroyed, or altered unless authorized by CPC.

PUBLIC POLICY

The proposed project is located within the boundaries of New York City's coastal zone. The New York City Waterfront Revitalization Program (WRP) is the City's principal coastal zone management tool and establishes policies for management of the coastal zone. The WRP policies also provide a framework for evaluating discretionary actions. The proposed project is located in the City's coastal zone and was therefore analyzed for its consistency with the WRP (see below and Appendix A). It has also been analyzed in accordance with the City's Comprehensive Waterfront Plan (2010).

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

There are currently no land use planning studies in development for the New Creek watershed. It is expected that over the next 30 years, additional residential and commercial development will occur. However, given the limited number of vacant and underdeveloped lots, development is expected to be limited. Portions of the watershed could be rezoned for a variety of purposes by 2043. However, at this time, no rezoning proposals are under review by DCP. In addition, no changes to public policy in the watershed are expected in the future without the proposed action. However, given the long-term build year is expected that the City's Comprehensive Waterfront Plan will be updated. However, no substantive changes in land use, zoning or public policy are anticipated in the future without the proposed action.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

LAND USE

Proposed street demappings associated with the proposed project would be subject to the City's Uniform Land Use Review Procedures (ULURP) and recorded on the City map. The streets proposed for demapping are on Bluebelt land (acquired or to be acquired) and are the proposed sites of the BMPs. BMPs NC-1 through NC-3 are proposed on City parkland (Reeds Basket Willow Swamp Park) and BMPs NC-4 and NC-5 are proposed on NYSDEC property at the Richmond County Country Club. These BMPs would be at locations that would avoid any impacts on the open space land uses. BMPs NC-6 and NC-11 are proposed partially or entirely within City parkland. All other BMPs would be constructed on DEP-owned Bluebelt property (acquired or to be acquired). All proposed BMPs would be designed with planted buffers and are

compatible with adjacent land uses and activities. Thus, the proposed BMPs and street demappings would not result in land use impacts. Rather, the proposed BMPs would preserve and restore existing open space, including wetlands and buffer areas for improved habitats and stormwater management. In addition, the proposed outfall would be largely below grade as its passes across FDR Boardwalk and Beach Park. The proposed enlarged outfall would result in larger footprints and headwalls, but would be constructed at the same elevation below grade and adjacent to the existing outfall. The proposed sanitary sewer easements would also allow the installation of below-grade sewers and would not require the displacement of any residential uses as the easements would extend within the yards and between the existing buildings (see Figures 4.1-18a and 4.1-18b). Therefore, the proposed project would not result in potential significant adverse impacts to land use.

ZONING

None of the proposed BMPs or outfalls would require any zoning text amendments. Where proposed street demappings are recorded on the City map the City would likewise modify the zoning map. Where special permits are required to allow construction (e.g., NC-1 through NC-5 are in the SNAD), all required approvals from DCP would be obtained by DEP prior to construction. Therefore, the proposed project would not result in potential significant adverse impacts to zoning.

PUBLIC POLICY

NEW YORK CITY WATERFRONT REVITALIZATION PROGRAM POLICIES

The proposed project was analyzed for consistency with the WRP and a Consistency Assessment Form was prepared (see Appendix A). The New Creek Drainage Plan would be consistent with all of the policies that would be applicable to it, and would advance several goals of the WRP as follows:

- Policy 4: "Protect and restore the quality and function of ecological systems within the New York City coastal area" by implementing the Bluebelt Program which would reduce the adverse impacts of uncontrolled runoff, flooding, erosion, and sedimentation, while enhancing freshwater wetlands and habitats throughout the watershed.
- Policy 5: "Protect and improve water quality in the New York City coastal area" with the implementation of proposed amended drainage plans calling for infrastructure improvements that would control and treat stormwater runoff before discharge into the Lower Bay.
- Policy 6: "Minimize the loss of life, structures, and natural resources caused by flooding and erosion," through a comprehensive stormwater management program that reduces flooding with the least cost and the greatest public benefit.

In March 2011, the New York City Department of City Planning released "Vision 2020: New York City Comprehensive Waterfront Plan." This plan outlines goals for improving New York City's waterfront, and recognizes the range of waterfront uses and opportunities created from the City's approximately 520 miles of shoreline. The following components of the proposed project would be compatible with and would support Vision 2020 goals: improving water quality through measures that benefit natural habitats and enhance waterfront communities; expansion of the Bluebelt program to the Mid-Island area of Staten Island; restoring and protecting wetlands and shorefront habitats; acquiring and supporting protection of wetlands, along Staten

Island's south shore; improving water quality and protecting natural resources; and improving public access to the waterfront. conclusions

The proposed project would provide stormwater management infrastructure in areas that currently experience flooding and erosion and sedimentation. The proposed BMPs would be installed in areas that are currently in City parkland, DEP Bluebelt property (acquired or to be acquired), or in the case of two BMPs, NYSDEC property. Each BMP would be designed with planted buffers to blend in with existing and adjacent uses. The proposed outfalls would provide discharge points for the stormwater runoff and would be largely below grade within DPR's FDR Boardwalk and Beach Park. Thus, the proposed BMPs and street demappings would not result in land use impacts. Rather, the proposed BMPs would maximize the preservation and restoration of existing open spaces, wetlands and buffer areas while providing natural stormwater conveyance and treatment features.

As part of the proposed amended drainage plan, a number of segments of mapped but unbuilt streets would be demapped. Chapter 4.1, "Project Description," describes all of the proposed street demappings. The streets proposed for demapping are on lands that would support the permanent protection of wetlands and buffer areas. In all cases, the street demappings would meet all ULURP requirements, would not conflict with local land uses and the zoning map would also be amended to reflect the changes in the City map. Where special permits are required to allow construction (e.g., NC-1 through NC-5 are in the SNAD), all required approvals from DCP would be obtained by DEP prior to construction.

The proposed project would also be consistent City's WRP and with the NYC Comprehensive Waterfront Plan and would assist the City in advancing several goals of the WRP and the Plan.

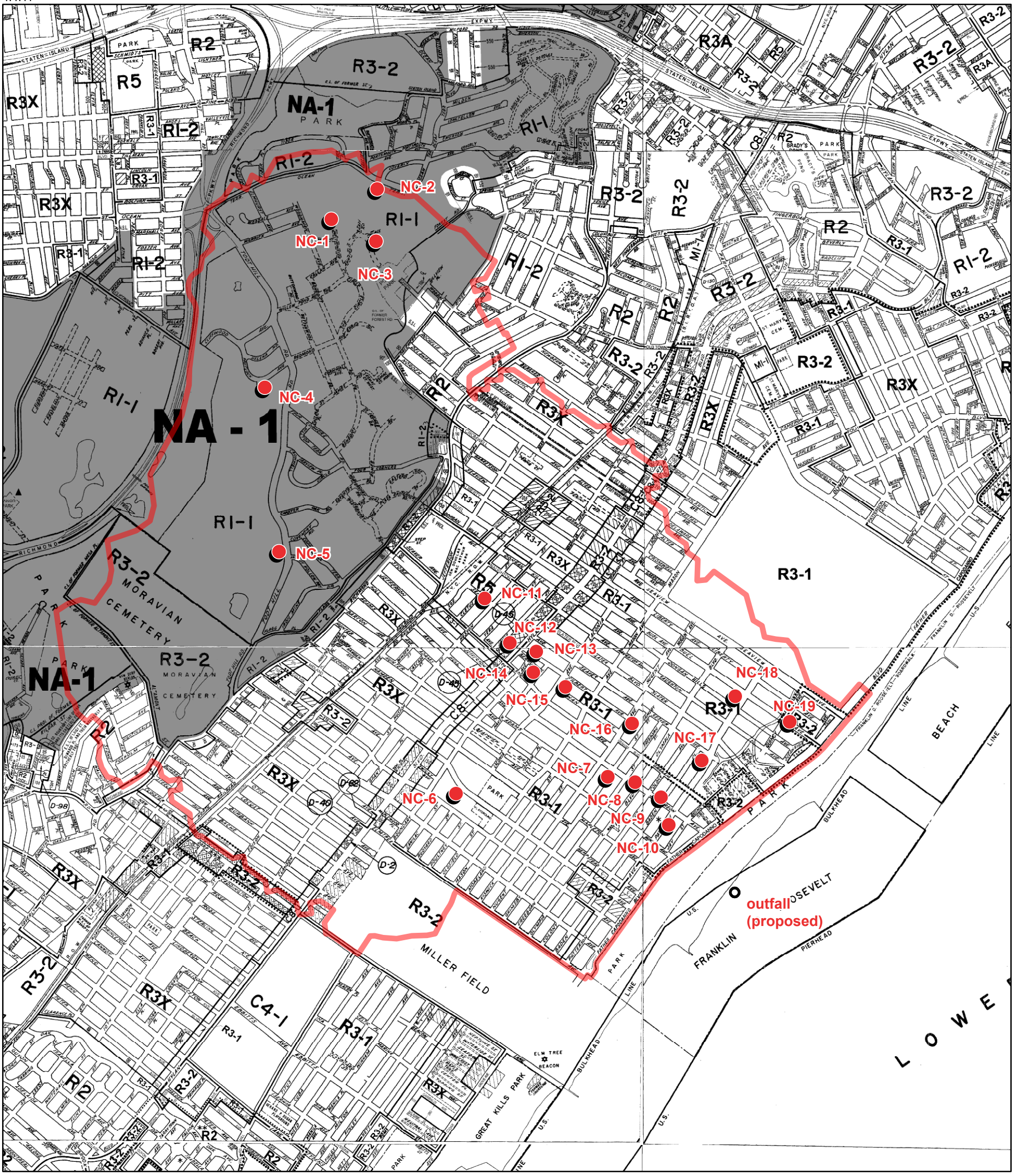
Therefore, the proposed project would not result in potential significant adverse impacts to land use, zoning and public policy. ✷

- Proposed BMP Site
- Existing Lower Bay Outfall
- Proposed Lower Bay Outfall
- Drainage Areas Tributary to New Creek Bluebelt
- Proposed Drainage Plan Area Tributary to Existing Outfalls
- DEP Bluebelt Property (Acquired or in the Process of Being Acquired)

Land Uses

- Residential
- Residential with Commercial Below
- Commercial, Office and Retail Buildings
- Industrial and Manufacturing
- Transportation and Utility
- Public Facilities and Institutions
- Parking & Roads
- Open Space and Outdoor Recreation
- Stream / Open Water
- Rail Line / Rail Station

New Creek Watershed Land Uses
Figure 4.2-1



Proposed BMP Site
(Best Management Practice Bluebelt Site)

Proposed Outfalls

New Creek Watershed

NA-1 Natural Area District

New Creek Watershed Zoning
Figure 4.2-2

Chapter 4.3: Socioeconomic Conditions of the New Creek Drainage Plan

The proposed project would not result in new development in the study area. In addition, the proposed project would neither directly nor indirectly displace existing residential, business and employee populations, nor would it have adverse effects on real estate or specific industry conditions. A complete analysis of the potential for secondary impacts is presented in Chapter 4.20, "Growth Inducing Impacts." Therefore, the proposed project would not result in potential significant adverse impacts to socioeconomic conditions. ✷

Chapter 4.4: Community Facilities and Services of the New Creek Drainage Plan

According to the *City Environmental Quality Review (CEQR) Technical Manual*, a community facilities analysis is needed if there would be potential direct or indirect effects on community facilities. The proposed project would not result in an increase in residential units or population, nor would it directly or indirectly affect any community facilities. None of the proposed BMPs is located adjacent to any community facilities and the proposed BMPs would not require any community services. Therefore, the proposed project would not result in potential significant adverse impacts to community facilities and services. ✷

Chapter 4.5: Open Space of the New Creek Drainage Plan

A. INTRODUCTION

This chapter examines the potential impacts of the proposed project on open space. Based on the *CEQR Technical Manual*, an open space analysis is necessary if a proposed project could directly or indirectly impact open space. Direct impacts include a reduction of public open space acreage or alterations of open space such that it no longer provides the same facilities or serves the same user population. Indirect impacts include added noise, air, or odor emissions, shadows or increased user demands. The proposed project would not generate any open space users, nor would it generate any environmental effects (air, noise, or shadows) that would indirectly impact open space. However, portions of proposed BMPs NC-1, NC-2, and NC-11 as well as a portion of the outfalls to the Lower Bay and all of proposed BMPs NC-3 and NC-6 would be constructed in City parkland. In addition, all of NC-4 and NC-5 would be located in NYSDEC parkland. The remaining BMPs would be located on DEP Bluebelt property, and therefore are not included in this analysis. Chapter 6.1, "Impacts During Construction," assesses the potential for temporary impacts on open space during construction (i.e., the temporary loss of open space, seasonal waterfront uses)

B. EXISTING CONDITIONS

Table 4.5-1 lists the major parklands of the New Creek Watershed and also identifies the location of any proposed BMPs within these parklands (see also **Figure 4.5-1**). As shown in the table, there are a number of large parks in the watershed, including City parks such as Reeds Basket Willow Swamp Park, Last Chance Pond Park and Boundary Avenue Park, and State parks including St. Francis Woodlands and Richmond County Country Club, which are under the jurisdiction of NYSDEC. A general description of each of these parks and open spaces follows.

REEDS BASKET WILLOW SWAMP PARK

Reeds Basket Willow Swamp Park is a large natural area park that occupies about 48 acres. It is part of the larger 2,800-acre Staten Island Greenbelt and is located in the headwaters of the New Creek watershed. Reeds Basket Willow Swamp Park is primarily a natural area park with large areas of forested wetlands, a pond and contributing streams. A more detailed description of natural features and habitats is provided in Chapter 4.9, "Natural Resources of the New Creek Drainage Plan," as well as in Appendix C. In addition to its natural features, there are also public hiking trails though and around the park.

Table 4.5-1
Open Space in the New Creek Watershed

Name	BMP Sites	Total Acreage	Ownership/ Jurisdiction
DPR Open Spaces			
Reeds Basket Willow Swamp Park	NC-1, NC-2, NC-3	47.78*	DPR
Boundary Avenue Park	NC-6	4.0*	DPR
Last Chance Pond Park	NC-11	3.9*	DPR
Midland Field Park	N/A	5.0*	DPR
FDR Boardwalk and Beach Park	Lower Bay Outfalls	638.5*	DPR
Gerard P. Dugan Playground	N/A	5.5*	DPR
NYSDEC Open Spaces			
St. Francis Woodlands	N/A	27*	NYSDEC
Richmond County Country Club	NC-4, NC-5	N/A	NYSDEC
Notes: *Sizes of parkland shown are total park acreages and not just the portion within the watershed.			

BOUNDARY AVENUE PARK

Boundary Avenue Park is a natural area park that occupies about six acres. It is primarily a wooded natural area with a stream that runs from west to east (this is the headwaters of the West Branch of the New Creek drainage system). A more detailed description of this park is provided in Chapter 4.9, "Natural Resources." There are no formal hiking trails or recreational facilities in the park and the parkland is essentially fenced off, prohibiting public access.

LAST CHANCE POND PARK

Last Chance Pond Park is also a natural area park that covers about 3.9 acres. It is bounded by DEP-owned Bluebelt properties to the west and south. Last Chance Pond Park is primarily comprised of wooded and emergent wetlands with a small pond situated at the headwaters of the Main Channel of the New Creek drainage system. A more detailed description of the natural resources conditions in the park is provided in Chapter 4.9, "Natural Resources." There are no formal hiking trails or recreational facilities in the park, although informal access from adjoining streets is available.

MIDLAND FIELD PARK

Midland Field Park is a recreational field located southeast (across Midland Avenue) from the Boundary Avenue parkland. This park is dedicated to active recreation and has ballfields and benches.

FRANKLIN DELANO ROOSEVELT (FDR) BOARDWALK AND BEACH PARK

The FDR Boardwalk and Beach Park is a large waterfront open space that fronts Lower Bay and is the one of the largest beachfront parks on Staten Island's South Shore. It is an important recreational resource and includes a 2.5-mile boardwalk, ballfields, playgrounds, basketball courts and a roller hockey rink, in addition to memorials and statues. There is also a pier for year-round fishing and the park provides one of three public swimming beaches on the South Shore.

ST. FRANCIS WOODLANDS

The St. Francis Woodlands is a 27-acre natural area park owned by NYSDEC and adjacent to the St. Francis Seminary. It is located in the upper watershed, just west of Reeds Basket Willow Swamp Park, and is also considered part of the larger 2,800-acre Staten Island Greenbelt. The St. Francis Woodlands is primarily a natural area open space, with large areas of steep sloped woodlands and a pond (Priory Pond), which is at the headwaters of the stream that flows south into the Richmond County Country Club. The St. Francis Woodlands includes trails that connect to the larger Greenbelt trails.

RICHMOND COUNTY COUNTRY CLUB

The Richmond County Country Club is a golf club that operates on land that is leased by the NYSDEC to the golf course operator. The parcel also contains a wooded buffer area and trails, along the west side of the park, that are part of the Greenbelt, but its primary purpose is active recreation.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project, DPR has a project at the end of Seaview Avenue that will install new recreational facilities. Under the current conceptual design improvements proposed are landscaping and facilities for small concerts and outdoor gathering spaces for summer recreation. Also proposed are supporting facilities such as a comfort station and café. In addition to this project, other park improvement projects are not currently proposed at study area parks through the 2043 build year.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

BMP NC-1: MERRICK AVENUE AND NC-2: OCEAN TERRACE

For both of these proposed BMPs, the main elements are velocity attenuators. The velocity attenuator at BMP NC-1 would be sited outside of parkland, but the velocity attenuator at BMP NC-2 and the streambank stabilization at both BMPS may extend downstream into Reeds Basket Willow Swamp Park. The proposed BMPs would both be situated at the top of unstable slopes in the park with evident head cutting and erosion due to the existing uncontrolled flows. Both BMPs are therefore designed to attenuate storm flows with velocity controls measures that would reduce downstream erosion and sedimentation impacts within the park.

The proposed BMPs would not interfere with any existing DPR operations at the property, nor would they displace any DPR structures or facilities. Neither BMP would impact any trail networks or impede public access opportunities at the park. As described in Chapter 4.9, “New Natural Resources,” the proposed BMPs would also not result in potential significant adverse impacts to natural resources. All activities within the park, including construction and operation activities, would require a permit from DPR, which DEP would obtain prior to construction. In addition, DEP and DPR would coordinate on the final design of the proposed BMPs as well as the tree replacement plan to be developed based on final design and tree surveys. Therefore, these proposed BMPs would not result in potential significant adverse impacts to open space.

BMP NC-3: ANNFIELD COURT

BMP NC-3 is proposed on about 0.2 acres of parkland at the edge of Reeds Basket Willow Swamp Park, just off Annfield Court. An existing storm outlet at this location handles street runoff. However, this storm outlet is constructed of non-standard materials and there is significant erosion in the park below the outlet and along the stream corridor (including channel incision and erosion of the bed). As part of the proposed BMP, extended detention and velocity control measures would be installed to stabilize runoff from the proposed storm sewer and into the park. Below the BMP, stream flow would continue further into Reeds Basket Willow Swamp Park where streambank stabilization would be provided, as necessary.

The proposed BMP would not interfere with DPR operations, nor would it displace any DPR structures or facilities. It would also not impact any trails or public access opportunities. Impacts on natural resources and habitats are limited and are described in Chapter 4.9, "Natural Resources." All BMP installation activities within the park including construction and operation activities would require a permit from DPR, which DEP would obtain prior to construction. In addition, DEP and DPR would coordinate on the final design of the proposed BMP with the objective of minimizing potential impacts to parkland and trees, while maximizing the parkland and ecological benefits of the proposed BMP design. In addition, the proposed project would include a replacement plan for trees that would need to be cleared within DPR parkland and appropriate tree planting locations and landscaping would be determined in conjunction with DPR. Therefore, the proposed BMP NC-3 would not result in potential significant adverse impacts to open space.

BMP NC-4: WHITLOCK AVENUE AND BMP NC-5: TODT HILL ROAD

Both of these BMPs would be located within the Richmond County Country Club. BMP NC-4 would be located on about 0.3 acres of land and BMP NC-9 would occupy about 0.9 acres. BMP NC-3 would be installed at the west end of Whitlock Avenue and BMP NC-5 would be installed approximately west of the intersection of Todt Hill Road and Windy Hollow Way. Both proposed BMPs include extended detention and velocity control measures. The proposed BMPs would stabilize and control runoff, thereby reducing downstream erosion and sedimentation. Below the proposed BMPs, stream flow would continue in a southwesterly direction along the existing watercourse across the Richmond County Country Club golf course and the proposed project would install stream bank stabilization, as necessary. Maintenance access would be provided from the end of Whitlock Avenue. This would allow for regular BMP maintenance and inspection with limited interference to golf course recreational activities.

The proposed BMPs would not conflict with any existing golf course operations at the Richmond County Country Club, nor would they displace any structures, facilities, trails or public access opportunities. All proposed BMP installations would require a permit from NYSDEC, which DEP would obtain prior to construction of the BMP. In addition, DEP would coordinate with NYSDEC in the final design of the proposed BMP with the objective of minimizing impacts to the open space while maximizing the landscaping and aesthetic benefits. In addition, the proposed final BMP design would include a replacement plan for trees that would need to be cleared and appropriate tree planting locations would then be determined in conjunction with NYSDEC. Therefore, these proposed BMPs would not result in potential significant adverse impacts to open space.

BMP NC-6: BOUNDARY AVENUE

BMP NC-6 is proposed to be located within Boundary Avenue Park and upon completion would occupy about 3.0 acres. The principal objective of this BMP is to provide a large extended wetland to detain storm flows at the head of the West Branch of the New Creek watershed. Maintenance access would be provided from Midland Avenue for both regular maintenance as well as inspections.

Boundary Avenue Park is a natural area park and the proposed project would not alter the principal functions of the park as it would expand natural features such as open water and emergent wetlands. While currently the site of the proposed BMP is largely a wooded cover with a stream channel, the proposed BMP would reconstruct this stream and provide the extended detention hydrological and ecological functions. A full analysis of potential impacts of this proposed BMP on natural resource habitats at this site is presented in Chapter 4.9, "Natural Resources."

The proposed project would not interfere with any existing DPR operations at the property, nor would it displace any DPR structures or facilities. It would also not impact any trails or public access opportunities at the property since this open space is fenced off and provides no formal public access. All BMP installation activities within the park would require a permit from DPR, which DEP would obtain prior to construction. In addition, DEP would coordinate with DPR on the final design of the proposed BMP with the objective of minimizing impacts to natural resources (in particular mature woodland stands as well as large and specimen trees), while maximizing the ecological benefits from the proposed BMP design. In addition, the proposed project would include a replacement plan for trees that would need to be cleared within the site and appropriate tree planting locations would be determined in coordination with DPR. Therefore, the proposed BMP NC-6 would not result in potential significant adverse impacts to open space.

BMP NC-11: LAST CHANCE POND

BMP NC-11 would be partially located within Last Chance Pond Park. Upon completion, it would occupy about 3.0 acres of this 3.9 acre park and would be developed within the freshwater wetlands and adjacent areas of the park. (This proposed BMP would also occupy about 5.8 acres of Bluebelt property to the west and south of the Last Chance Pond parkland.) This proposed BMP would provide extended wetland at the headwaters of the Main Channel of the New Creek watershed. Maintenance access would be provided across the DEP Bluebelt portion of the site from Joyce Street to the south, thereby allowing for regular BMP maintenance and inspection, which may include the removal of accumulated sediment.

Last Chance Pond Park is a natural area park with no formal public trails or facilities and the parkland portion of the BMP is characterized by wooded, emergent or limited open water (ponded) wetlands. The proposed project would transform these wetlands into extend detention wetlands including open water and emergent wetlands. Thus, while the project would transform the wetlands, it would maintain the natural resource functions of this open space. A full analysis of potential natural resource impacts at this site are presented in Chapter 4.9, "Natural Resources."

The proposed project would not interfere with any existing DPR operations at the property, nor would it displace any DPR structures or facilities. It would also not impact any trails or public access opportunities since there is no formal public access (although informal access is available

from the adjoining streets and would continue to be available with the proposed project). All BMP installation activities within the park would require a permit from DPR, which DEP would obtain prior to BMP construction. In addition, DEP would coordinate with DPR on the final design of the proposed BMP with the objective of minimizing potential impacts to natural resources (in particular important wetland habitats and trees), while maximizing the ecological benefits of the proposed BMP design. The proposed project would also include a replacement plan for trees that would need to be cleared and appropriate tree planting locations would be determined in conjunction with DPR. Therefore, the proposed BMP NC-11 would not result in potential significant adverse impacts to open space.

LOWER BAY OUTFALLS

The proposed new outfall would be installed in a 40-foot-wide wide corridor to be mapped and the outfall at Seaview Avenue would be constructed adjacent to the existing outfall and within an existing corridor. The new outfall would be located along New Dorp Beach between Jefferson and Hunter Avenues and the supplemental outfall would be an extension from Seaview Avenue. Both outfalls would cross recreational areas as well as the sandy beach and shoreline of FDR Boardwalk and Beach Park. The proposed outfalls would be below grade with the exception of the section at the shoreline and the headwall extending out into the waters of the bay which would be an exposed structure at the shoreline edge. The affected park areas would include recreational facilities, sandy beach, and the benthic subtidal habitat of Lower Bay. Under the proposed outfall designs, much of the outfall would be buried and the land surface restored except for the sections at the shoreline and into the bay.

The proposed outfalls would not interfere with any existing DPR operations, nor would they permanently displace any DPR structures or facilities or impact any trails or public access. The affected open space along the proposed outfall routes would potentially include portions of the park boardwalk and associated recreational areas, such as those proposed at the end of Seaview Avenue. Therefore, the proposed project would need to restore these areas to their current (or future) functions. Given that most of the outfall would be buried with at-grade cover (e.g., landscaping, sand beach), there would not be any permanent impacts on the upland open space. The beach is also several hundred feet wide at this location and even with the proposed outfalls in place would continue to provide the opportunity for public access along the shoreline. Thus, the proposed outfalls would not impede public access along the beach as access would remain available upland along the sandy beach since all outfalls would be designed consistent with the existing outfalls and constructed below grade. Any grade changes necessary to bury the outfall in sand along the beach would be minor and not visually distinguishable and would not impede public access. It is also not expected that the proposed outfalls would adversely impact swimming beaches. All outfall installation activities within the park would require a permit from DPR, which DEP would obtain prior to construction. In addition, DEP and DPR would coordinate on the final design of the proposed outfall with the objective of minimizing potential impacts to recreational facilities, open space users, and natural resources including park trees and vegetation. The proposed project would also include a replacement plan for trees needing to be cleared within parkland; appropriate tree planting locations would be determined in conjunction with DPR. Therefore, the proposed outfalls would not result in potential significant adverse impacts to open space.

E. CONCLUSIONS

The proposed project includes infrastructure improvements within four City-owned parklands, Reeds Basket Willow Swamp Park, Boundary Avenue Park, Last Chance Pond Park, and FDR Boardwalk and Beach Park. It also includes activities in the Richmond County Country Club, which is a golf course operated on NYSDEC land. At Reeds Basket Willow Swamp Park, no DPR recreational facilities or trails would be impacted by the BMPs, although there may be some limited tree clearing. The proposed BMP designs would also be coordinated with DPR and the proposed project would include a replacement plan for trees that would need to be cleared to construct the proposed BMP. There are also no recreational (golf course) facilities that would be impacted at BMPs NC-4 and NC-5. In addition, DEP would coordinate the design of these two BMPs and the associated streambank stabilization with NYSDEC so that the proposed BMP designs support the golf course landscaping and do not conflict with recreation or maintenance.

The proposed BMPs NC-6 and NC-11 would be developed within natural areas at the Boundary Avenue and Last Chance Pond Parks. While the proposed BMPs would change the habitat cover at these sites (increasing open water and emergent wetlands), they would not displace any DPR facilities and the principal park use, natural area with wetlands, would remain unchanged. Neither BMP would modify any public access or trails or affect any open space user activities at these sites. Installation of the proposed BMPs would require a permit from DPR. DEP would also coordinate the final design of the proposed BMPs with DPR for the purposes of minimizing impacts to existing natural resources at these sites and in developing a tree replacement plan.

The proposed project would also install a new outfall and add to an existing outfall across FDR Boardwalk and Beach Park. These proposed outfalls would require activities across the sandy beach and recreational facilities of the park including the boardwalk. Installation of the proposed outfalls would require a permit from DPR prior to construction and DEP would also need to restore all affected DPR facilities and lands. Neither outfall would impact public access along this wide sandy beach nor would the proposed outfalls adversely impact swimming beaches. Therefore, the proposed project would not result in potential significant adverse impacts to open space in the New Creek watershed. ✷

Chapter 4.6: Shadows of the New Creek Drainage Plan

The *CEQR Technical Manual* states that an assessment of shadows is needed for actions that would result in new structures or additions to existing structures of 50 feet or more in height. The proposed project would not result in any structures 50 feet in height, nor would it result in any structures that would create shadows. The proposed storm sewer connections would be below grade and the proposed BMPs are largely at or below grade and are natural constructs. Therefore, the proposed project would not result in potential significant adverse impacts to shadows. ✷

Chapter 4.7: Historic and Cultural Resources of the New Creek Drainage Plan

A. INTRODUCTION

Preliminary amended drainage plans have been developed for the New Creek watershed with the objectives of improving water quality, reducing flooding and erosion, and enhancing vegetative communities and wildlife habitats. The proposed project would require site-specific and subsurface changes on private and public properties. This chapter considers the potential effects of the proposed project on historic and cultural resources in the New Creek watershed. As described in Chapter 2.1, "Methodology," the proposed amended drainage plan has been examined to determine if there would be potential significant adverse impacts to architectural and archaeological resources within the New Creek watershed.

B. EXISTING CONDITIONS

ARCHAEOLOGICAL RESOURCES[1]

PRECONTACT ARCHAEOLOGICAL SENSITIVITY

BMPs NC-1, NC-2, and NC-3

Although these proposed BMP sites are in close proximity to natural fresh water streams and have well drained soils, these proposed BMP sites also contain steep landforms. This suggests that these proposed sites do not contain precontact occupation. Therefore, it is concluded that these proposed BMP sites do not possess precontact archaeological sensitivity.

BMP NC-4

The proposed site of BMP NC-4 is located along a small stream in the upper watershed. The landform on the proposed BMP site has a gentle slope and the soils are well drained. No significant disturbance to this proposed BMP site was evident based on field inspection. It is therefore concluded that this proposed BMP site has a high precontact archaeological sensitivity.

BMP NC-5

The proposed site of BMP NC-5 is located adjacent to the confluence of two streams. It is clear that there has been disturbance to the site from the creation of a golf course and a golf cart path. Comparison of the 1911 topographical map with the modern survey map confirms that this area, which originally contained small wetlands, has been filled to create an artificially flat surface. The stream banks also appear to have been manipulated, with unnatural berms surrounding them

[1] Provided below is a summary of the report "New Creek Watershed Phase IA Archaeological Documentary Study," Historical Perspectives, March 2011. That Phase1A was accepted as complete by the City's Landmarks Preservation Commission on April 18, 2011.

within the proposed BMP site. Due to the degree of disturbance at this proposed BMP location, it is concluded that this proposed BMP site does not possess archaeological sensitivity.

BMP NC-6

Historic maps, including the 1911 topographical map, show that in its natural state, the proposed site of BMP NC-6 was an area that would have had a high precontact archaeological sensitivity. This location was well drained, level and comprised of woodland along the West Branch of New Creek, elevated several feet above the creek and its nearby marshland. The portion of the proposed BMP site along Boundary Avenue is clearly disturbed and exhibits large mounds of soil and debris. However it is possible that the central portion of the proposed BMP site, between the disturbed area and the creek, could have areas of intact landform, which if not previously disturbed, would have a high precontact archaeological sensitivity. It is therefore concluded that this central section of the proposed BMP site has a high precontact archaeological sensitivity, but that the remainder of the proposed BMP site no longer contains any sensitivity.

BMPs NC-7 through BMP NC-19

Based on a review of historic maps, it appears that in their original state, these proposed BMP sites contained branches of the original New Creek drainage system. The maps do not show any naturally raised landforms, or hummocks, that were elevated above the wetlands. During the twentieth century, discrete portions of some of the proposed BMP sites were filled, as evidenced by review of modern survey maps, which show raised topography. Review of the soil borings for these proposed BMP sites, coupled with site visit surveys, suggest that these proposed BMP areas have been disturbed from grading and filling. It is therefore concluded that none of these proposed BMP sites possess any precontact archaeological sensitivity.

HISTORIC PERIOD ARCHAEOLOGICAL SENSITIVITY

Historic maps indicate that none of the 19 proposed BMP sites within the New Creek watershed have had any historic period development within or immediately adjacent to their boundaries. It is therefore concluded that none of the proposed BMP sites contain historic period archaeological sensitivity.

ARCHITECTURAL RESOURCES

DESIGNATED RESOURCES

There are no designated architectural resources within the study area for proposed BMPs NC-1 through NC-19.

POTENTIAL RESOURCES

There are no potential architectural resources within the study area for proposed BMPs NC-1 through NC-19.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project, additional structures and sites could potentially be designated as historic resources through the year 2043. However, there are no known pending designations at this time. In addition, is assumed there would be no site disturbance at any of the proposed BMP sites.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

ARCHAEOLOGICAL IMPACTS

A Phase IA study was conducted for the study area for the purposes of identifying areas of potential archaeological sensitivity. This Phase IA study concluded that the proposed sites of BMP NC-4 and a portion of BMP NC-6 contain discrete areas of precontact archaeological sensitivity. The remaining proposed BMP sites contain no precontact period archaeological sensitivity. None of the proposed BMPs contain historic period archaeological sensitivity. The Phase 1A study recommends that Phase1B archaeology testing be performed at this proposed BMP site. This testing would involve several shovel tests that would be used to determine the presence or absence of any Native American archaeological resources. The Phase 1B archaeological field testing would be implemented as part of the proposed project and would not commence until review and approval of a testing protocol by LPC and SHPO. All Phase 1B testing would be performed by a certified professional archaeologist and in accordance with a protocol that meets LPC's Guidelines for Archaeological Work in New York City (2002), the recommendations of the New York State Education Department, Cultural Resources Survey Program, and SHPO standards. The archaeology team would also be required to notify both LPC and SHPO when testing is scheduled to begin and it is anticipated that staff from each agency may visit the site during the testing process. Once the testing is completed, the archaeologist would also be required to submit a Phase 1B report that documents the field investigations and findings to LPC and SHPO.

To avoid impacts, this investigation would be performed after final design is completed and the contract is awarded, but prior to the start of construction. With these measures in place, the proposed project would not result in potentially significant adverse archaeology impacts.

ARCHITECTURAL IMPACTS

There are no designated or potential historic resources in the New Creek watershed in the vicinity of the proposed BMPs. Therefore, the proposed project would not result in potential significant adverse impacts to historic architectural resources.

E. CONCLUSION

With respect to archaeological resources, a Phase 1A study was conducted to determine if the proposed BMPs have any archaeological sensitivity. That study concluded that the proposed site of BMP NC-4 and a portion of the proposed site of BMP NC-6 contain discrete areas of pre-contact archaeological sensitivity. Therefore, Phase IB archaeological testing would be conducted at these sites, if final design would impact these areas. This Phase 1B would be submitted to and reviewed by LPC and implemented as part of the proposed capital project.

With respect to architectural resources, the proposed project would not have any direct or indirect impacts on historic architectural resources as none have been identified in the vicinity of the proposed BMPs.

Therefore, the proposed project would not result in potential significant adverse impacts to historic and cultural resources. ✷

A. INTRODUCTION

This chapter examines the potential effects of the proposed project on urban design and visual resources in the New Creek watershed. The analysis of the proposed project was completed to identify potential changes to the urban setting or local visual experiences from the perspective of adjacent residences, pedestrians and open space users. The proposed amended drainage plan would install new storm sewers, one new and one expanded outfall, and 19 BMPs. The proposed sewers would be below grade. However, certain structures within the BMPs (e.g., weirs) and proposed berms would be above grade. In addition, outfall improvements would be partially above grade. There are also limited segments of local streets where the street grades would need to be raised in order to install the proposed storm sewers. This analysis examines the lower watershed BMPs together because of similar baseline conditions and proposed designs. This analysis also examines the proposed lower watershed BMPs collectively because the baseline conditions and proposed designs are similar among these BMPs. This includes NC-7 through NC-19, excluding NC-11. Because the proposed outlet stilling basin BMPs are small in size, they are not included in this analysis. This includes the proposed sites of BMPs NC-12, NC-14, NC-15 and NC-16.

B. EXISTING CONDITIONS

NC-1: MERICK AVENUE, NC-2: OCEAN TERRACE

The location of these two proposed BMP sites are within a mapped but unbuilt City street and a private yard, respectively. The yard segment is residential property between existing houses and the proposed site of NC-2 also includes an existing small concrete spillway that manages runoff from the street (Ocean Terrace). Below the proposed BMPs is Reeds Basket Willow Swamp Park. Within the park, the visual setting is characterized as steep wooded slopes and incised streambeds. The woodlands include stands of oak trees that create a well-defined high canopy some 20-30 feet in height. The BMP sites are not particularly visible from the local streets, but the stream reaches are visible from public trails within the park.

NC-3: ANNFIELD COURT

This proposed BMP site, about 0.2 acres in size, is located along the roadside of Annfield Court and within a portion of Reeds Basket Willow Swamp Park. Since this site is along the road edge, it is flatter and primarily visible to the public and from the local street and few local views from private residences along Annfield Court. There is also an existing deteriorated drainage structure at this site. There are private views to the site from residences on the south side of Annfield Court.

NC-4: WHITLOCK AVENUE, NC-5: TODT HILL ROAD

Both of these proposed BMP locations are within the Richmond County Country Club golf course in the vicinity of Whitlock Avenue and Windy Hollow Way, respectively. The sites include shrubs, small trees and golf course turf. Both sites are somewhat accessible to the public via the existing golf course pathways. There are no private views to the site.

NC-6: BOUNDARY AVENUE

This proposed BMP site would occupy approximately 3 acres of a City park property, bounded by Boundary and Midland Avenues to the north, Lincoln Avenue to the west, and a City school property to the south. The most evident visual feature of this site is its mature woodland of large trees that creates a full and high tree canopy (20-30 feet), comprised primarily of red maple with a variety of oaks including some with trunks as large as 50 inches in diameter. Running from east to west across the property is a narrow stream. Although the stream is a secondary visual feature of the site, it forms a corridor about 5 to 10 feet wide that is visible from the sidewalk. There are also some visible piles of fill and downed trees. This property, although under the jurisdiction of DPR, is enclosed by a tall fence and is not publicly accessible, although it is visually accessible to pedestrians from the surrounding public streets and sidewalks. There are also private views to the site from across the bordering streets.

NC-11: LAST CHANCE POND

The proposed 8.8-acre site for BMP NC-11 is located partially within DPR's Last Chance Pond Park, which occupies about 3.9 acres, while the balance, about 4.9 acres, is in DEP Bluebelt property. The site is primarily visible to the public from the surrounding adjacent public streets (there are no sidewalks fronting the property).While there is informal access to the site (i.e., the site is open and there are no physical barriers to public access), there is no formal trail system. There is a public seating area and memorial (recently installed by DEP) that fronts the site on the Stobe Avenue side (near the end of Husson Street and within the Bluebelt portion of the property). Outside of the BMP site, the visual setting is comprised of residential houses, including some multi-family housing immediately to the north, from which there are views to the site.

The most defining visual characteristic of this site from the public views is its wooded wetlands. There are some limited open waters (small ponds) on the interior of the site, but these ponds are generally not visible from the neighboring streets. The woodland composition includes red maple-hardwood swamp/emergent marsh that is more common on the interior, albeit screened by the wooded and shrub layers at the site perimeter. Directly along the street edges, the vegetation resembles a successional southern hardwood community that is dominated by non-native and successional upland species in the canopy, shrub, and herbaceous strata. On the southerly portion of the site is an area of common reed marsh that has few trees.

LOWER WATERSHED BMPS

The proposed lower watershed BMPs sites are generally located between Hylan Boulevard on the north, Father Capodanno Boulevard on the south, and along the West Branch, Main Channel, and East Branch stream corridors. These sites are flat, dominated by common reed marsh with some isolated stands of woodlands, narrow stream channels and some open water ponds, the majority of which are not visible to the public from the adjoining streets except at street crossings (e.g., the Main Branch is visible at the Olympia Boulevard crossing). In the interior

portions of the proposed BMP locations, where the elevation increases slightly, there are wooded hummocks; however, these features too are generally not visually prominent from either the public or private vantage points, particularly when compared with the thick stands of the tall common reed that can obscure public views into these sites from adjacent streets. In most cases, the proposed BMP site edges are bordered by single-family homes. Private views from residential homes are also generally limited to the edges of the proposed BMP sites. Limitations on views from the local street and adjacent private properties are due to the flat topography, the absence of public vantage points and the thick common reed vegetation at the street edges that can grow up to and above the average eye level (i.e., equal to or greater than five feet above grade). There is also some evidence of prior disturbance at many locations, including filling, along with deteriorated and abandoned concrete sidewalks oriented in a north to south direction along the bed of the paper streets (remnants of mapped but only partially built streets). Street edge conditions are also characterized by more by debris and loose litter along with some erosion due to unmanaged runoff from the local streets.

LOWER BAY OUTFALLS

The proposed corridor for the new outfall extends from the proposed site of BMP NC-10 out to Lower Bay. In addition, the site of the existing Seaview Avenue outfall is proposed for additional outfall expansion. The Lower Bay is a large marine open water system with an intertidal sandy beach shoreline that, at this location, is several hundred feet wide. The sandy beach is part of DPR's Franklin Delano Roosevelt Boardwalk and Beach park which includes a public boardwalk inland from the beach and the sandy beach which has open views (east to west) along the shoreline. Currently this view includes a number of in-water structures including existing outfalls and a pier.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project, no major changes in the built form of the watershed are expected as no major developments are currently proposed. It is also assumed that stormwater flows will remain unabated with regular flooding during storms and high tides. Wetlands currently degraded with debris, erosion, and invasive plant species, would remain in a similar or declining condition without an improvement or maintenance program in place. As a result, episodic brush fires across the common reed-dominated habitats would continue to occur. It is also proposed by DPR in the future without the proposed project to provide additional programmed public open space along the waterfront at the end of Seaview Avenue in existing open space within FDR Boardwalk and Beach Park. This would potentially provide more a more natural landscaped setting along this stretch of the shoreline with additional public access.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

NC-1: MERICK AVENUE, NC-2: OCEAN TERRACE

As stated above, these proposed BMPs are comprised of conveyance structures across City or private property with potential streambank improvements in Reeds Basket Willow Swamp Park. The proposed conveyance structures would be at or below grade and not visible, and therefore would not modify the current visual setting or any public or private views. The velocity attenuators below the outlet pipes would also be small structures at or below grade with a limited visual presence. Some limited downstream bank stabilization comprised of natural constructs

such as check dams, live stakes and rock toe plantings may also be installed, but would be designed to be contextual with the natural setting of the stream corridor. In addition, these proposed BMPs are expected to require only limited tree clearing. The proposed project would include a replacement plan for trees that need to be cleared and appropriate tree planting locations and landscaping plans would be determined in conjunction with DPR. Therefore, these proposed BMPs would not result in potential significant adverse impacts to urban design and visual resources.

NC-3: ANNFIELD COURT

This proposed BMP would be about 0.2 acres and is not expected to substantively alter the visual setting of this site in either public or private views. Rather, the proposed BMP would provide the benefit of clearing debris and addressing long-term erosion problems at this location. It would also be planted with a variety with the native plantings such that, after a grow-in period, the proposed BMP would visually integrate to adjoining woodland setting. Any downstream bank stabilization, as needed, would be comprised of natural constructs such as check dams, live stakes and rock toe plantings that would be designed as part of the natural setting along a stream corridor. The proposed project would include a replacement plan for trees that would need to be cleared and appropriate tree planting locations and landscaping plans would be determined in conjunction with DPR. Therefore, the proposed BMP would not result in potential significant adverse impacts to urban design and visual resources.

NC-4: WHITLOCK AVENUE, NC-5: TODT HILL ROAD

These two proposed BMPs would be landscaped extended detention BMPs and would include some at- or below-grade structures such as weirs; however, the proposed BMPs would not alter the existing visual landscape of the golf course and would have limited public and private visibility. The creation of new open water and natural streams, the diverse wetland plantings of the proposed BMPs, and the general cleanup of the sites would be expected to enhance the visual setting at both locations and would be compatible with the existing golf course landscape. The proposed BMPs would also require NYSDEC approval prior to the start of construction. Therefore, these proposed BMPs would not result in potential significant adverse impacts to urban design and visual resources.

NC-6: BOUNDARY AVENUE

This proposed BMP would remove the interior woodlands of the site, affecting approximately three acres, or about half of the Boundary Avenue parkland, to create the proposed BMP. The proposed clearing is necessary to create a low flow channel and extended detention wetland as part of the BMP, which would expand the extent of visible open water as may be seen from the adjacent sidewalks and local residences. However, with the proposed BMP, visual access would remain limited to the views from the surrounding sidewalks, streets and homes. In the current and project conditions, no public access into the site is proposed.

With the proposed BMP, while there would be clearing and grading at the site, a wooded perimeter would be maintained as would the southerly woodlands. This would preserve existing woodland borders (in particular the larger trees and stands of mature trees) that would screen the site while the BMP vegetation grows and matures. As this vegetation grows and fills in, although the site would have different ecological habitats than under existing conditions, both public (pedestrian) and private views from the surrounding residences would continue to enjoy a

natural landscape, since no new significant above-grade structures are proposed at the BMP. It is expected that the limited BMP structural elements would not be prominent in any public or private views as they would be at or below grade and screened by the proposed vegetation.

In addition, this BMP would require DPR authorization for work at the site, since the proposed BMP would be on DPR property. Final landscape design of all the proposed BMPs within parklands would be made to enhance natural features local natural aesthetics through a diverse planting program with appropriate tree planting locations to be determined in conjunction with DPR and located as close to the BMP sites as possible. Therefore, the proposed BMP would not result in potential significant adverse impacts to urban design and visual resources.

NC-11: LAST CHANCE POND

This proposed BMP would remove the interior trees of the site, to create the proposed BMP. The removal would create additional open water, expanding the existing small. Thus, the proposed BMP would transform the visual setting of the site by reducing the tree canopy, but creating more open water, emergent marsh and high marsh landscapes that would be planted with native wetland species tolerant of periodic inundation.

Preserving the wooded border would both maintain existing trees as well as screen the site while the BMP vegetation grows and matures. Once the proposed BMP vegetation becomes established, both the public and private views would continue to be of a natural landscape, since no new above-grade structures are proposed. The structural elements of the proposed BMP would not be prominent in any public or private views as they would be at or below grade and screened by the proposed vegetation.

In addition, DPR approval would be required for that portion of the BMP that is within parkland. Therefore, DEP, through its coordination with DPR, would minimize visual impacts of the BMP. Final landscape design of all the proposed BMPs within parklands would be made to enhance natural features local natural aesthetics through a diverse planting program with appropriate tree planting locations to be determined in conjunction with DPR and located as close to the BMP sites as possible. Therefore, these proposed BMPs would not result in potential significant adverse impacts to urban design and visual resources. Therefore, the proposed BMP would not result in potential significant adverse impacts to urban design and visual resources.

LOWER WATERSHED BMPS

These proposed lower watershed BMPs would visually diversify the existing on-site habitats by relocating stream corridors to the interior of the Bluebelt property and creating more open water. The transformation of the existing common reed marsh into a more diverse landscape would also open up new views for the community and enhance the appearance of each site through planting programs, new island habitats and deep ponds to provide aesthetically diverse and pleasing views for the surrounding community. Woodland borders and hummocks would be protected to the extent possible during final BMP design for the purposes of minimizing impacts to trees and existing wooded visual borders. Existing wooded tree stands on the perimeters of Bluebelt properties and at specific BMPs would be preserved as visual screens and borders to the greatest extent possible during final design. An ongoing Bluebelt monitoring and maintenance program would also secure the site, provided regular maintenance and cleanup and monitor the success of the planted vegetation and replace plantings as necessary. While there would be a grow-in period as the BMP wetland and upland plantings become established, the landscaped areas and wetlands of the proposed BMP would have mature vegetation and attractive landscape

with the benefits of new views of open water and wetlands from the public street corridor, in addition to private vantage points.

There would also be the installation of new structures at the proposed BMP sites (e.g., outfall segments, forebays, berms, outlet stilling basin, weirs). These structures would be at or below grade and not visually prominent from local sidewalks or pedestrian views and would be screened by the proposed BMP planting plan. Visually prominent structures would be stone-faced, similar to existing Staten Island Bluebelt designs in South Richmond. The proposed berms would be constructed low-rise features, about 6 to 36 inches in height, and planted with a final vegetated cover that once grown in, would visually integrate them to their surroundings. The Bluebelt monitoring and maintenance program would also secure the site, provide regular maintenance and cleanup and monitor the success of the planted vegetation and replace plantings as necessary.

Therefore, these proposed BMPs would not result in potential significant adverse impacts to urban design and visual resources.

LOWER BAY OUTFALLS

The proposed project would install new and supplemental storm sewer outfalls out to the Lower Bay that would be buried below ground and not visible as they extend beneath the Bluebelt property, Father Capodanno Boulevard, and out into FDR Boardwalk and Beach and Park, which is DPR parkland. The segments of the proposed outfalls that would be visible are along the shoreline at the headwall (which is a concrete encasement installed at the end of outfall). The proposed outfall at NC-10 would be about eight feet wide five feet high and the outfall to be enlarged at Seaview Lane would be about 14 feet wide and five feet high at the shoreline where the structures would first appear from below grade. Any grade changes necessary to bury the outfall in sand along the beach would be minor and not visually distinguishable. The sections of the outfall between the shoreline and the water line would also be limited in length and not significant structural additions to the public beach. There are other outfalls and structures along this segment of the shoreline such that the proposed added outfalls would not significantly alter public views along the sandy beach and shoreline. Therefore, the proposed outfalls would not result in potential significant adverse impacts to urban design and visual resources.

SEWER IMPROVEMENTS AND STREET RAISINGS

The proposed project would require the modification of existing street grades in order to install the proposed storm sewers. Some street segments would be raised from current street grades by between 6 and 24 inches. Given the limited number and length of street segments that would need to be raised (see Chapter 4.1, “Project Description”) as well as the small increase in grade, these increased street elevations would not be perceptible from a visual or urban design perspective and would not impact urban view corridors or streetscapes along affected streets. The design of the street cross-section would be determined during the final sewer (and street) design for these affected streets in order to minimize differences between the proposed street grade and adjacent private property grade. This would limit transitions between local property and sidewalk elevations. Therefore, the proposed modified street grades would not result in potential significant adverse impacts to urban design and visual resources.

E. CONCLUSION

The proposed project would not significantly alter urban design features or visual character conditions of the New Creek upper watershed. These five proposed BMPs are smaller in size and even with potential streambank stabilization would not be visually prominent as they are generally at or below grade and are generally comprised of natural elements (i.e., wetland plantings, trees, rocks) such that the BMPs would not impact the visual setting or public views in either Reeds Basket Willow Swamp Park or the Richmond County Country Club. The two proposed BMPs in the Richmond County Country Club would be sited in areas previously disturbed and would be designed in conjunction with NYSDEC input with the objective of enhancing the visual setting at these two locations. The Bluebelt monitoring and maintenance program would also secure the sites, provide regular maintenance and cleanup and monitor the success of the planted vegetation and replace plantings as necessary. Thus, the proposed project would not have any adverse visual impacts on the upper watershed.

BMPs NC-6 and NC-7 would clear and grade interior woodlands at these sites in order to create the proposed open water and emergent wetlands of the proposed BMPs. These wooded interiors are generally not visible in public views from the adjacent streets (neither site has designated trails or formal public access) or the private views from nearby residences. Thus, while the proposed BMPs would transform the visual setting by reducing interior tree canopy, they would conversely create more open water along with emergent and high marsh wetlands. Preserving the wooded borders at the sites would both maintain existing woodlands while screening the BMPs as the planted vegetation grows and matures. Once the proposed BMP vegetation becomes established, both the public and private views would continue to be of a natural setting, since no new above-grade structures are proposed. The structural elements of the proposed BMPs are generally below grade and would not be prominent in any public or private views, particularly with the proposed vegetation. Visually prominent structures would be stone-faced, similar to existing Staten Island Bluebelt designs in South Richmond. In addition, DPR approval would be required since both BMPs involve the use of City parkland. Final design of the proposed BMP would be made to enhance natural features local natural aesthetics through a diverse planting program with appropriate tree planting locations to be determined in conjunction with DPR and located as close to the BMP sites as possible. Appropriate tree planting locations and landscaping would also be determined in conjunction with DPR. Therefore, the proposed BMP would not result in potential significant adverse impacts to urban design and visual resources.

The proposed lower watershed BMPs would transform existing views of large monocultures of common reed into more visually diverse wetlands with open water and a variety of plantings. Views from adjacent streets and private homes would potentially be opened up at street ends from vantage points where common reed currently grows to eye level and above obscuring views into these sites. This would be a visual benefit for the community. To protect, to the extent feasible, existing trees and woodland stands at these sites, final BMP designs would include survey details for the purposes of minimizing tree clearing, particularly at those BMP sites where wooded borders are part of the local streetscape or could potentially screen the BMP site during the grown-in phase. Structures at the proposed BMPs would generally be at or below grade and would not visually prominent. Visually prominent structures would be stone-faced, similar to existing Staten Island Bluebelt designs in South Richmond. In addition, the proposed berms in the lower watershed would be low features and landscaped such that do not affect public views from streets or private views from adjoining properties. DEP would also develop a

tree replacement plan, as necessary, to replace trees that may need to be cleared to create the proposed BMPs. In addition, with the proposed BMPs, the sites would be regularly maintained including the removal of litter, elimination of fill, and the maintenance of vegetation which would contribute positively to the local visual character, particularly along the public street frontages. With the proposed BMPs, brush fires could also be controlled which would limit the potential for visual scarring of the landscape as is caused by the uncontrolled brush fires that have occurred historically in this area. Therefore, the proposed lower watershed BMPs would not result in potential significant adverse impacts to urban design and visual resources.

The proposed sewer segments would be below grade with the exception of the outfalls. The proposed new and enlarged outfalls and headwall would be visible as the outfalls extend from the shoreline into the Lower Bay; however, given the presence of existing outfalls and the limited size of the proposed structures (the proposed secondary outfalls would also be adjacent to existing outfalls), the proposed outfalls would not be expected to significantly impact public views along the beach.

Given the anticipated limited increases in street grades, the proposed modified street grades would not impact view corridors or streetscapes along the affected streets. In addition, the final design of the street cross-sections would be based on site specific topographic information to minimize transitions between adjacent properties and the street and sidewalk.

Therefore, the proposed project would not result in potential significant adverse impacts to urban design and visual resources. ✷

Chapter 4.9: Natural Resources of the New Creek Watershed

A. INTRODUCTION

A proposed preliminary amended drainage plan has been developed for the New Creek watershed (se **Figure 4.9-1**) with the objectives of improving water quality, reducing flooding and erosion, and enhancing vegetative communities and wildlife habitats. Overall the proposed project would benefit natural resources; however, certain project elements may result in site-specific changes to hydrology, water quality, groundwater, wetlands, vegetation and trees, and wildlife. The proposed project has been examined in this section to determine if there would be any potential significant adverse environmental impacts to natural resources within the New Creek watershed.

B. EXISTING CONDITIONS

HYDROLOGY

UPPER WATERSHED

In the upper watershed, a small creek originates in a forested area just north of the Richmond County Country Club. Referred to on some maps as Moravian Brook, it flows through the Richmond County Country Club and Moravian Cemetery before entering a culvert under Richmond Road (see **Figure 4.9-2**). Here the creek drains into an existing trunk storm sewer that ultimately discharges to the Lower Bay via the existing Greeley Avenue ocean outfall. There are three existing ponds located along the path of the creek and several smaller weir-controlled waterbodies within the creek corridor. The creek drains approximately 450 acres that includes forested open space, a golf course and low density residential uses. Runoff is conveyed via overland flow throughout this sub-drainage area of the upper watershed.

DPR's Reeds Basket Willow Swamp Park in the northwest portion of the watershed is characterized by very steep slopes (46 percent grade at some locations) and is surrounded by residential properties. Runoff from streets and surrounding residences flows overland to small channels in the park. Stormwater from one of the small streams flows into a small pond near the bottom of the park before joining with another stream and flowing under Ridge Loop (a private street) in two locations and then Hillview Place prior to entering the storm sewer on an unbuilt section of Woodale Avenue between Hillview Place and Dalemere Road. This sewer outlets via overland flow at Chapin Avenue between Dutchess Avenue and Overlook Avenue, before entering storm sewers at Richmond Road and discharging to Lower Bay via the Seaview Avenue trunk sewer and outfall.

Priory Pond is an approximately 0.6 acre freshwater pond, located south of Saint Francis Seminary and to the west of Todt Hill Road (it is located within the NA-12 wetland system). The pond is owned and managed by the NYSDEC as a conservation area and is part of the St. Francis Woodlands. The proposed amended drainage plan would add storm sewers and catch basins along Todt Hill Road, east of the Priory Pond, which is a public pond located in the St.

Francis Seminary. A field investigation at the pond and its environs revealed no inlet structures, erosion, gullies, or overland flow entering into the pond. A weir at the southwest side of the pond provides the outlet from the pond, and field investigations of the pond in summer 2010 found no outflow from the pond and the channel below the weir was dry. This suggests that the pond is groundwater-fed and not directly reliant on stormwater flow.

Analysis of the 5-year storm at the existing culverts downstream of Reeds Basket show that flooding occurs at the roadways, with a peak flow water surface elevation of 1.68 feet above the existing roadway at the uppermost culvert.

Existing stream velocities are also high given the steep slopes in this part of the watershed. **Table 4.9-1** presents the stream velocities under the existing conditions during a 1-year storm for the upper watershed streams. As can be seen from the table, the velocities in Reeds Basket are quite high and well above the standard for erosive velocity of 3.5 to 5 feet per second (fps). As a result, the stream bed and banks are currently unstable and eroded. The existing stream through the Richmond County Country Club also has erosive flows during a 1-year storm.

Table 4.9-1
Stream Velocities Under Existing Conditions

Location	Velocity (fps)
Reeds Basket Upper Main Channel	9.1
Reeds Basket Tributary Channel	10.8
Reeds Basket Confluence	11.6
Richmond County Country Club between Whitlock Avenue and Charter Oak Road	10.3
Richmond County Country Club between Charter Oak Road and Flagg Road	6.4
Source: Hazen and Sawyer, January 2011	

LOWER WATERSHED

Approximately half of the lower watershed, or about 1.2 square miles (generally southeast of Richmond Road), drains overland to the three branches of New Creek (the Main Channel and the East and West Branches), while the other half drains directly to existing trunk sewers and outfalls to Lower Bay (see **Figure 4.9-3**). All three channels of New Creek are fed by street runoff, either localized or from existing storm sewer outfalls. The Main Channel originates at Last Chance Pond, the West Branch originates at about Midland Avenue (and the existing Boundary Avenue wetlands), and the East Branch starts at the southern end of Dongon Hills Avenue south of Nugent Avenue. The West Branch and Main Channel join near Quincy Avenue and Slater Boulevard, and then both the East Branch and Main Channel enter the Naughton Avenue trunk sewer between Patterson Avenue and Quincy Avenue, before discharging to Lower Bay via the Naughton Avenue outfall to the Lower Bay.

Existing drainage conditions were modeled in the watershed for the 10-year storm event to determine a modeled baseline condition for water surface elevations and flood conditions. Therefore, this analysis provides the water surface elevations at Naughton Avenue, where all the streams enter the trunk sewer. Under existing conditions, the 10-year design storm produces a peak flow elevation of 0.38 feet above Staten Island Datum.

Additionally, the baseline conditions indicate that because of the prevailing flat topography of the lower watershed, surcharging at the Naughton Avenue trunk sewer can lead to flooding

across the lower watershed. During the peak stage of the 10-year storm event, the flood water surface elevations are nearly level throughout the lower watershed as a result of the closing of the tide gate. When the tide gate is closed, floodwaters cannot discharge through the outfall to Lower Bay and the lower watershed floods with continuous upstream runoff.

Since the lower watershed has a level grade, erosion is not a concern and no stream velocity modeling was conducted.

FLOODPLAINS

Figure 4.9-4 presents the 100-year floodplain (area with a 1 percent chance of being inundated in any given year) and 500-year flood plain (area with a 0.2 percent of being inundated in any given year) boundaries within the watershed. New York City is affected by local (e.g., flooding of inland portions of the City from short-term, high-intensity rain events in areas with poor drainage), fluvial (e.g., rivers and streams overflowing their banks), and coastal flooding (e.g., long and short wave surges that affect oceans and bays such as Lower Bay, and tidally influenced rivers, streams and inlets). Much of the lower watershed is within the 100-year floodplain, which extends north to Hylan Boulevard). Standing water in the streets and slumping of soil and pavement in low lying areas is evidence of frequent local flooding within the study area.

Based on an examination of the Flood Insurance Rate Maps (FIRM) for the watershed (#3604970336F), the 100-year flood elevation varies based on location from 10 feet to 11 NGVD (6.8 feet to 7.8 feet Staten Island Datum) in the lower watershed. The Federal Emergency Management Agency (FEMA) has not calculated 100-year flood elevations for the upper watershed, indicating that there are no known major storm flooding issues in the upper watershed.

GROUNDWATER

Groundwater monitoring wells were installed along Dongan Hills Avenue, Seaver Avenue, Freeborn Street, Graham Boulevard, and at Last Chance Pond, approximately corresponding to the proposed locations of proposed New Creek BMPs NC-18,-17,-7,-16, and -11 (**Figure 4.9-5**).

Groundwater elevations at each well were averaged over the course of a season for the spring, summer, and fall monitoring periods (all in 2010). Monitored conditions within those seasons is presented in **Figure 4.9-6**. In general, results of the groundwater monitoring indicate that the water table in the lower watershed is not far below ground surface elevations. The spring monitoring was done in April 2010 after one of the wettest months of March on record. Water table elevations are highest during the wet period in the spring (i.e., April and May). Summer and fall water table elevations are fairly similar, with July observations slightly lower than October and November elevations. Recorded elevations at Freeborn Street ranged from -1.44 to -0.72 feet (**Table 4.9-2**). At Last Chance Pond, groundwater elevations fell between 3.27 and 2.46 feet. Highest recorded elevations at Graham Boulevard, Seaver Avenue, and Dongan Hills Avenue were -0.64, -0.78, and -0.38 feet, respectively. The lowest observed groundwater elevations at Graham Boulevard, Seaver Avenue, and Dongan Hills Avenue were -1.34, -1.44, and -1.40, respectively (**Table 4.9-2**). In general, spring water table elevations were about 0.75-1.0 feet higher than at the same well in the summer and fall.

Table 4.9-2
Range of Observed Groundwater Elevations
During 2010 Monitoring Period

Location	Highest Levels (Spring)	Lowest Levels (Summer/Fall)
Freeborn Street	-0.72	-1.44
Last Chance Pond	3.27	2.46
Graham Boulevard	-0.64	-1.34
Seaver Avenue	-0.78	-1.44
Dongan Hills Avenue	-0.38	-1.40

Note: All elevations in Staten Island Datum.
Source: Hazen and Sawyer, January 2011.

Groundwater elevations were also found to fall between typical low- and high-tide elevations, which is consistent with the assumption that the low tide elevation sets the minimum water table elevation. However, no correlation was found between the tide elevation at the time of measurement and the groundwater elevation. This finding indicates that while sea level controls the broader water table elevation, individual tidal cycles do not impact the movement of groundwater in these areas of the New Creek watershed.

WATER QUALITY

In the upper watershed, the ponds at the Richmond County Country Club and Reeds Basket are either unclassified or listed as Class B water bodies by the NYSDEC. Class B water bodies allow for direct human contact (e.g., swimming) but are not suitable for drinking. Under existing conditions, there are no known water quality issues in the surface water bodies of the upper watershed. The streams in the lower watershed are small and, as a result, many are not classified for water quality standards or goals. The Main Channel and the East and West Branches of New Creek are classified as I/C or C (see **Figure 4.9-7**). These designations are for marine or fresh waters that support fisheries and are appropriate for recreational fishing and secondary contact activities (such as boating). The Lower Bay is classified as SB for marine waters best used for swimming and boating. Activities proposed within these designated water bodies cannot degrade water quality, introduce new contaminants or diminish flows or oxygen concentrations such that it impairs or compromises the function or intended use of the water body.

Untreated stormwater runoff transports pollutants such as phosphorus, oil, and sediments from rooftops, lawns, roadway surfaces and other urban areas directly to local streams and ultimately to the Lower Bay. There are also the erosive forces of unmanaged runoff which leads to sedimentation in local water bodies. Under existing conditions, organic matter enters local waterways and flows to the Lower Bay increasing biochemical oxygen demand (BOD) within the water column. As a result, reduced dissolved oxygen (DO) concentrations stress natural communities. In addition, an increase in coliform bacteria from untreated runoff can result in eutrophic conditions that produce phytoplankton blooms and nuisance algal forms which further depress DO levels.

WETLANDS

Five NYSDEC freshwater wetlands and a variety of National Wetlands Inventory (NWI) wetlands have been mapped within the New Creek watershed. **Figures 4.9-8** and **4.9-9** show the locations of freshwater wetlands within the watershed as well as the extent of tidal wetlands (i.e, the littoral zone) in the Lower Bay. Historically much of the lower watershed was a tidal marsh

connected to the Lower Bay. However, filling, development, and alterations in hydrology have greatly modified those wetlands and all but eliminated the tidal wetlands, replacing them with freshwater wetlands supported by runoff from the upper watershed. Proposed BMPs to be located within or adjacent to freshwater wetlands are listed in **Table 4.9-3** and described below (i.e., NA-5, NA-8, and NA-9). Each of these wetland designations along with other NYSDEC wetlands within the watershed but not affected by the proposed project are described in Appendix C.

Table 4.9-3
NYSDEC-Mapped Freshwater Wetlands of the New Creek Watershed

NYSDEC Wetland Code	Location	BMP Sites	Wetland Class
NA-5	Reeds Basket Willow Swamp	NC-3	I
NA-8	Last Chance Pond	NC-11	I
NA-9	Dongan Hills	NC-7, -8, -9- -10, -12, -13, -14,-15,-16,-17,-18,-19	I

Note: **NYS**DEC identifies four classes of wetlands. Class I is the most critical for preservation and protection typically because it is a diminishing resource in an urban setting and provides flood control and important wildlife habitat.
Source: NYSDEC, 1987.

NYSDEC Freshwater Wetlands

Wetland NA-5: Reeds Basket Willow Swamp

As shown on **Figure 4.9-8**, the Reeds Basket Willow Swamp NA-5 wetland is located within DPR's Reeds Basket Willow Swamp Park. NA-5 is a 7-acre wetland that contains two basins with 30 percent cover of emergent marsh and 70 percent cover of deciduous swamp that is located on one of the highest elevations of Staten Island and surrounded by an undisturbed mature upland forest (NYSDEC 1987).

Wetland NA-8: Last Chance Pond

NYSDEC-mapped wetlands NA-8 is a 15-acre freshwater wetland that occupies the headwaters of the Dongan Hills (NA-9) wetland, described below. Last Chance Pond is a Class I wetland with approximately 62 percent of the wetland is characterized as a deciduous swamp, 25 percent as an emergent marsh, and 13 percent with floating and submergent vegetation. Wetland benefits related to natural resources include flood and storm control, wildlife habitat, watershed/groundwater protection, pollution treatment, erosion and sediment control, and a source of nutrients.

Wetland NA-9: Dongan Hills

As shown in **Figure 4.9-8**, wetland NA-9 covers most of the Lower Watershed. It is a common reed-dominated marsh that contains the three branches of the New Creek drainage system. Despite the historical impacts of filling and other hydrologic alterations to this system, it is a Class I wetland and recognized for providing flood control pollutant removal, and important ecological habitat for raptors and fish (NYSDEC 1987). It is 118 acres in size with approximately 89 percent of the wetland identified as common reed dominated emergent marsh and 11 percent as open water. The wetlands are subject to brush fires when the common reed has dried out, particularly in the late winter and early spring.

Wetland NA-12 St. Francis

Wetland NA-12 is part of the Staten Island Greenbelt, a nine-acre wetland located to the west of Todt Hill Road in the upper watershed. This wetland is one of two Staten Island wetlands that

are perched at a high elevation. The wetland sits in a flat bowl at the bottom of steep, forested slopes that drain to the wetland. A small branch of this wetland includes a pond and outlet stream that joins the wetland at its lower end. NA-12 is a Class II wetland for the sole reason that it is located within an urbanized area. Wetland benefits associated with natural resources of this wetland include wildlife habitat (NYSDEC, 1987).

NWI WETLANDS

NWI-mapped wetlands are found throughout the watershed including palustrine wetlands of the upper watershed (PUBHh) and emergent, common-reed dominated wetlands of the lower watershed (PEM5Fh). Estuarine subtidal and intertidal wetlands are mapped along the shoreline and within the bay. **Figure 4.9-9** shows the locations of these wetlands within the watershed.

VEGETATION AND TREES

Overall, the New Creek watershed has vegetative diversity with a contrast between the hilly woodlands of the upper watershed and the low flat common reed marshes of the lower watershed. The diversity of estuarine and palustrine wetland habitats, including slow moving waters of ponds, downed logs, spring-fed headwaters, and areas of muck provide habitat for a variety of wildlife as do the mature native woodland habitat, including portions of the Staten Island Greenbelt (see the discussion below). In the lower watershed, although the common reed dominated wetlands and disturbed woodland edges may be degraded as a result of previous disturbances, these habitats can provide forage, shelter, nesting, and resting opportunities for migratory and resident wildlife.

Reflecting the general distribution of vegetative cover, tree densities and sizes are greatest in the upper watershed. In contrast, the lower watershed has fewer trees, and wooded stands are generally limited to the edge of wetlands where the grade rises to meet the street and in the elevated hummocks within the common reed wetlands.

WILDLIFE

BIRDS

The New Creek watershed has been surveyed as part of the *New York State Breeding Bird Atlas*, and 70 species have been identified (see Appendix C for atlas inventory data for the watershed). Bird species expected in the forested upper reaches of the watershed include a number of aerial foragers, such as flycatchers, and canopy birds (i.e., warblers) and ground feeders such as the brown thrasher,[1] American robin, and wood thrush. Woodpeckers (e.g., hairy and downy) and a variety of songbirds (e.g. warblers, vireos, Baltimore oriole) would be expected to occur in the wooded areas of the upper watershed. Species expected of the lower watershed include passerines common in edge and forested habitats, such as gray catbird, northern flicker, American crow, Carolina wren, eastern phoebe, tufted titmouse, American robin, yellow warbler, common yellowthroat, common grackle, song sparrow, and northern cardinal. Common passerines associated with aquatic habitats, including barn swallow and red-winged blackbird would also be expected in the lower watershed.

Waterbirds listed in the Breeding Bird Atlas include mallard, great egret, black-crowned night-heron, and glossy ibis. Long-legged wading birds, such as herons, egrets and ibis appear to forage within the lower New Creek watershed. These species are known to nest on Hoffman

[1] Latin species names are provided in Appendix C.

Island, one of the largest of ten nesting islands within the New York/New Jersey Harbor area, and located approximately one mile from the southern shore of the New Creek watershed (Bernick and Craig 2008).

Two state-protected species are also known to occur within the New Creek watershed. The peregrine falcon and the common nighthawk are listed for Block 5749C by the *New York State Breeding Bird Atlas* and are discussed in more detail in the "Endangered, Threatened, and Special Concern Species and Communities" section of this chapter.

REPTILES AND AMPHIBIANS

Six species of salamanders and a variety of toads, frogs, and snakes are expected in the habitats of the upper New Creek watershed. Northern red salamanders and northern dusky salamanders are known to be present in and near streams, springs, ponds, and bogs in deciduous, conifer, and mixed forests of the upper watershed (Gibbs et. al. 2007). Ponds are the primary habitat for the spotted salamander and the red spotted newt on Staten Island. Within the lower watershed, the eastern red-backed salamander is the only species of salamander expected to occupy the proposed BMP sites. With respect to other reptile and amphibian fauna, all of the frogs, toads, and snakes common to the Mid-Island area may be present within the lower watershed (see Appendix C).

FISH

Existing fishery resources in the New Creek watershed are likely limited by the presence of tide gate-controlled outfalls that separate the inland streams from the bay. These structures present a physical obstacle that restricts fish movement or migration between the bay and the inland streams. However, two NYSDEC wetland designation reports for the New Creek wetlands, NA-8: Last Chance Pond and NA-9: Dongan Avenue, identified potential fish habitat along the New Creek Main Channel. The wetland report for Last Chance Pond identified specific fish species including bullhead catfish, gambusia, pumpkinseed goldfish and goldfish. No specific fish species were identified for the Dongan Avenue wetlands in the lower watershed. No potential fish habitat was reported for the other wetlands of the watershed, NA-12: St. Francis Woodlands and NA-5: Reeds Basket Willow Swamp Park. In addition to the NYSDEC reports, local naturalists have reported Atlantic silversides, striped and branded killifish, three spine stickleback, golden shiners and American eel in the lower reaches of the New Creek Main Channel. August 2011 project surveys also identified the presence of banded killifish, mummichog, bluegill and American eel in the Main Channel, downstream of Hylan Boulevard. Additionally, banded killifish were found in Last Chance Pond downstream of Olympia Boulevard.

In addition, Lower Bay is an important marine fishery resource. Species common to the Bay include winter flounder, bluefish, Atlantic butterfish, Atlantic mackerel, summer flounder, black sea bass, Spanish mackerel, and sandbar shark, all of which are considered part of the Essential Fish Habitat designation for Lower Bay (see Appendix C).

MAMMALS

There is limited mammalian diversity within the watershed. Mammals primarily are found along the wooded edges of the proposed BMP locations. These species tend to be habitat generalists and would be expected in a variety of habitats within the New Creek watershed. These species may include raccoon, white-footed mouse, Norway rat, mole, opossum, groundhog, gray

squirrel, chipmunk, muskrat, eastern cottontail rabbit, little brown bat, and feral/domestic cat. Among the large mammals, white-tailed deer may be found throughout.

BMP SITES

BMP NC-1: MERRICK AVENUE

This proposed BMP site is located at the end of Merrick Avenue on a steep slope, which has eroded over time, causing a deep gully below which is swale in a wooded area that drains to NYSDEC-mapped wetland NA-5. The proposed BMP site itself is not mapped as either NYSDEC or NWI wetland. Due to the severe erosion in the gully, trees have fallen, and vegetation in and along the edges is minimal. The gully appears to receive high rates of stormwater flow as rocks and other debris are visible in the washout locations. The forest at this location is comprised of a red oak canopy with a black birch and red maple dominated subcanopy. A healthy stand of beech trees is also present in the vicinity of this proposed BMP location. While vegetation within the gully is minimal, spicebush, maple-leaved viburnum, Canada mayflower, and white-wood aster are present next to the gully edges. Downstream of the proposed BMP site, deeper into the park, the habitats are more characteristic of the Reeds Basket Willow Swamp Park stream communities (see also Appendix C). The drainage swale here receives runoff from the local streets and, therefore, flows intermittently (i.e., in periods of wet weather or seasonally).

Given the size, location and conditions at this site, it has limited wildlife habitat value for both terrestrial and aquatic resources. However, wildlife habitat quality would be expected to increase in the downstream reaches and within Reeds Basket Willow Swamp Park (see also Appendix C).

BMP NC-2: OCEAN TERRACE

This proposed BMP site is situated between privately-owned residences fronting along Ocean Terrace. Currently, the proposed BMP site has a concrete-lined ditch that serves to divert runoff from Ocean Terrace across a maintained lawn to a steep slope and into Reeds Basket Willow Swamp Park, located behind the residence. The proposed BMP site itself is not mapped as either NYSDEC or NWI wetland. However, below the proposed BMP site and within the park, the quality of the ecological community increases to a wooded canopy stream (see also Appendix C). The drainage swale here receives runoff from the local streets and therefore flows intermittently (i.e., in periods of wet weather or seasonally).

Given the size, location and conditions at this site it has minimal wildlife habitat value for both terrestrial and aquatic resources. However, wildlife habitat quality would be expected to increase in the downstream reaches and within Reeds Basket Willow Swamp Park (see also Appendix C).

BMP NC-3: ANNFIELD COURT

This proposed BMP site is along Annfield Court. The topography of this site is flatter than proposed BMPs NC-1 and NC-2, and stormwater presently runs off the street and into the park at this location, creating an eroded gully. Despite its location next to Annfield Court, invasive species are minimal, and the forest community is that of the tulip tree-red oak forest described above. Hayscented fern, white wood aster, jewelweed, and maple leaved viburnum are present in the herbaceous layer; beech, black birch, red oak, and black cherry, among other tree species, are present in the canopy and subcanopy strata. This proposed BMP site and the downstream reaches are mapped within NYSDEC Wetlands NA-5, but the proposed BMP site is not mapped as NWI wetlands (see also Appendix C). The drainage swale here receives runoff from the local streets and therefore flows intermittently (i.e., in periods of wet weather or seasonally).

Given the size of the site and its location along a built street (Annfield Court), it provides limited wildlife habitat for both terrestrial and aquatic resources. However, the quality of the habitat would be expected to increase in the downstream reaches and within Reeds Basket Willow Swamp Park (see also Appendix C).

BMP NC-4: WHITLOCK AVENUE

NYSDEC and NWI-mapped wetlands are not present on or adjacent to this proposed BMP location. This site can be characterized as having two primary ecological communities: a steep wooded slope and the maintained lawn of the Richmond County Country Club golf course at the toe of the slope. These communities are successional southern hardwoods and a mowed lawn (Edinger, et. al. 2002). The headwaters of the creek that runs through the golf course are found at this proposed BMP site. Flows across the proposed BMP are intermittent, depending upon the season and volume of rainfall. Disturbance to this site is evident by the presence of concrete and demolition debris and tires. The site is bordered to the west by a mature forest of pignut hickory and black cherry. Sweet gum and tulip tree are scattered within the canopy, although the majority of the vegetation is concentrated in the shrub layer. Non-native species and/or pioneer species are dominant in the shrub and herbaceous layers and include multiflora rose, blackberry, garlic mustard, Japanese honeysuckle, mugwort, Japanese knotweed, bittersweet nightshade, wineberry, and devil's walking stick. Other less dominant species include Norway maple, green ash, goldenrod, groundsel bush, joe-pye weed, and soft rush.

Due to the prior disturbances at this location, species composition, and surrounding land uses, this site has low ecological value and would not be expected to support a wide range of wildlife for both terrestrial and aquatic resources. Birds observed at the site include eastern wood-peewee, Carolina wren, and red-tailed hawk. Reptiles with the potential to occur at the site include those that can tolerate limited habitat in dry locations such as the Fowlers toad, milk snake, and garter snake. Mammals expected at this site would be small mammals such as eastern gray squirrel, groundhog, and white-footed mouse, although raccoon, opossum, chipmunk, and white tailed deer may occur as transient individuals.

BMP NC-5: TODT HILL ROAD

Wetlands mapped by NYSDEC and NWI are not present on or adjacent to this proposed BMP location. This proposed BMP site consists of a narrow sliver of upland woodland that transitions into a grassland located on the Richmond County Country Club golf course. The woodland is classified as successional southern hardwoods as it contains a mix of sassafras, white mulberry, box elder, eastern white pine, tree-of-heaven, black cherry, European black alder, black walnut, hackberry, and Virginia creeper in the canopy (Edinger et. al. 2002). A monotypic stand of Japanese knotweed is present in the understory. Flows across the proposed BMP site are intermittent, depending upon the season and volume of rainfall.

The golf course can be characterized as grassed lawn by Edinger et al., (2002) as it appears that this area is periodically mowed, but not on a regular basis. Species observed include deer-tongue grass, meadow fescue, orchard grass, switch grass, meadow garlic, and sorrel.

Due to the small size of the woodland at the edge of the site and the current land use as a golf course, there is limited wildlife habitat for both terrestrial and aquatic resources. For this reason, wildlife expected at this site would be limited to transient individuals. Birds noted during the field investigations included catbird, European starling, American robin, and Baltimore oriole.

BMP NC-6: BOUNDARY AVENUE

The habitats over the site of the proposed BMP NC-6: Boundary Avenue are shown on Figure 4.9-10 and are listed below (with their acreages) in Table 4.9-4. A more detailed description of the existing conditions at the site of this proposed follows.

Table 4.9-4
Vegetative Habitat Cover at the Site of the Proposed BMP NC-6: Boundary Avenue

Ecological Community	Key to Habitat Map (see Figure 4.9-10)	Estimated Acreage (Existing Condition)
Riverine (marsh headwater stream, culturally modified)	1	0.18
Red maple/hardwood swamp	2	1.37
Coastal Oak Hickory Woodland	3	1.79
Terrestrial (successional woodland street edge and vacant lot)	4	0.84
Successional southern hardwood (with red maple)	5	0.74
Successional southern hardwoods	6	0.94
Total		5.86

Notes: Habitat estimates were calculated based on aerial photographs, field observations, and site topographic and tree survey (May, 2012) Ecological communities based on Edinger, et.al. January 2002.
Terrestrial successional woodlands would encompass the upland portions of the site that have been more recently disturbed by a cultural/human intervention (i.e., containing features similar to a vacant lot) with a greater presence of exotic/invasive species. Successional southern hardwood is a mixed forest that may have been historically cleared, but has a greater presence of native woodland trees mixed with introduced species. At this site there is also an area of successional southern hardwoods where red maple are more present in the mix of trees.

Sources: AKRF, Inc. 2010; Hazen and Sawyer, January 2013.

There are no NYSDEC wetlands mapped at this proposed BMP site, although there are mapped NWI wetlands. NWI classifies the watercourse across this property and the adjacent flood zone as a palustrine broad-leaved deciduous forest that is seasonally flooded or saturated (PFO1E). This stream (which tends to have stream flow on the eastern, or downstream, side of the site, and is more dry in the upstream or western side) establishes a natural border between the ecological communities of this site, which includes a disturbed substrate with a vegetative cover of invasive and pioneer species north of the stream, while the southwestern portion of the site is more a mature woodland characterized by native species. The most notable features of the site are its mature woods and large trees (i.e., 50 inches diameter at breast height [dbh]) which are concentrated within the red maple/hardwood swamp and coastal oak/hickory forest (habitats as defined by Edinger et. al. 2002).

The red maple/hardwood swamp community generally parallels the existing watercourse across the property. Dominant trees species in this community include red maple, black gum, and pin oak within the canopy, with a subcanopy of black gum, sweetgum, pin oak, and few black cherry and hickory individuals. The substrate was observed as partly disturbed (e.g. fill, debris), and Japanese knotweed, poison ivy and common greenbrier are dominant in the herbaceous and shrub layers. Skunk cabbage, jewelweed, aster, smartweed, Japanese knotweed and other herbaceous species are also present.

The northern portion of the site, above the red maple/hardwood swamp, is primarily comprised of successional southern hardwood and urban vacant lot communities. These communities have an immature woodland cover, with a less developed canopy then is present over the southern portion. Here, box elder and Norway maple are the dominant tree species. The subcanopy is principally composed of box elder, black cherry, hickory, mulberry, and tree-of-heaven. Multiflora rose and greenbrier are also present in a dense layer within the shrub stratum. The urban vacant lot community contains black locust along with box elder and tree-of-heaven with a mugwort dominated understory. The soils within this community include mounds of fill soil, rubble, household trash, and construction debris.

A mature woodland cover characterizes the site southwest of the watercourse. Here, there is a more established and healthy ecological community with diverse native species in the canopy, subcanopy, shrub, vine, and herbaceous strata, with the presence of several large trees, including American elm. Understory regeneration with native species was observed within this habitat as the area was less colonized by invasive species. This habitat includes a coastal oak/hickory community, where oaks are the dominant tree with an equal distribution of red oak, pin oak, and white oak in the canopy layer. Other intermingled canopy species include sweet gum, red maple, hickory, American elm, and black gum. Some oak trees in the mature woods reach 50 inches dbh. In addition to these species, black birch, sassafras, and black cherry are present in the sub-canopy. Dominant shrub layer species include devils walking stick, arrowwood, poison ivy, Virginia creeper and catbrier, black raspberry, winterberry, and Japanese knotweed, which are clustered in pockets. Saplings of the canopy and subcanopy trees are also present within the shrub stratum. The herbaceous layer contains seedlings of all of the above-mentioned species along with a number of native forbs including white wood aster, false Solomon's seal, smooth Solomon's seal, bellflower, enchanter's nightshade, and ferns including cinnamon fern and hayscented fern.

The greatest concentration of larger trees (i.e., 13" diameter at breast height or greater) is in the more mature, native red maple/hardwood and coastal oak/hickory woodlands to the south of the watercourse. The highest density of smaller trees (i.e., 4" to 12") is in the terrestrial successional, successional southern hardwood, and coastal oak/hickory patches located north of the watercourse.

Although the proposed BMP NC-6 site is a pocket of mature woods in an otherwise developed neighborhood of residential and commercial development, the presence of higher quality woodlands along with a stream and wetlands habitats can provide important wildlife habitat in the New Creek watershed, particularly for birds. The denser woodland habitat on the southern portion of the site would be expected to provide stopover, breeding, and foraging habitat to migratory and resident birds and bats, while reptiles, amphibians, and insects would be attracted to the wetlands and woodland cover. Carolina wren, cardinal, blue jay, and a black duck mother and ducklings were observed during the field observations.

Although there is a stream across the site, its hydrology is generally limited to street inputs and it was observed to run both wet and dry during the course of the project field investigations. Given the limited volume of water and the size of the stream, this site would not provide fish habitat with limited use by other aquatic wildlife including aquatic macroinvertebrates. In addition, because Boundary Avenue is primarily surrounded by development, this site is not expected to provide an important habitat for mammals, other than those that would be expected in a suburban and urban setting.

WEST BRANCH (BMP NC-7: GRIMBSY STREET, BMP NC-8: FREEBORN STREET, BMP NC-9: GRAHAM BOULEVARD, BMP NC-10: JEFFERSON AVENUE)

This series of proposed BMP sites is along the West Branch of the New Creek system, which extends between Nugent Avenue on the north and its confluence with the Main Channel to the southeast (just west of Slater Boulevard). This reach of the New Creek system contains segments of open water perennial stream while other segments are constricted by sediment and overgrown with common reed such that the open water disappears; one segment is also piped. Outside of the stream corridor, this assemblage of sites is common reed-dominated emergent wetlands (although water plantain was also observed in the upper reaches). All of these wetlands are part of the NYSDEC mapped NC-9 Dongan Hills system and are also mapped by NWI as palustrine emergent wetlands (a common reed dominated wetlands), although some areas are also mapped as palustrine forested wetlands. There is some evident dumped trash and debris in the headwaters (near Nugent Avenue) and this reach was observed to have thick, blue-green algae (i.e., Cyanobacterial bloom) in the surface waters. Pockets of duckweed dominated open water were also present along these proposed BMP sites.

A section of the existing West Branch is also piped. This section, between Freeborn Street and Olympia Boulevard, was piped many years ago. Those pipes are clogged by sediment and are in poor condition.

In addition to the common reed, the site of the proposed BMP NC-7 also contains palustrine forested, temporarily flooded wetlands which are comprised of black gum (>18" dbh), sweetgum (>18" dbh), and pin oak (15 to 25"dbh) trees with regeneration of these species in the understory. Red chokeberry, pussy willow, silky dogwood, and arrowwood were also present in the shrub layers of these wooded areas; and soft rush, sensitive fern, cinnamon fern, spinulose woodfern, and royal fern were present in the herbaceous layer. There was also a red maple sweetgum wet woods observed in the vicinity of this proposed BMP during the field investigations.

In the interior portions of the proposed BMP NC-7 site are narrow north/south oriented berms that are the remnants of abandoned street construction projects though this area. These areas contain fill and upland vegetation is dominant on the fill. Species in this area included common milkweed, false indigo, silky dogwood, arrowwood, multiflora rose, and Canadian clearweed. Common reed is less dominant here, but reappears where the elevation drops by only a few inches. Elderberry, arrowwood, silver maple, and red maple were also observed in the adjoining common reed dominated marsh areas.

The upland border of these proposed BMP sites is a wooded successional southern hardwoods community.

The existing West Branch open channel and the associated common reed wetlands and woodland edges would provide habitat for migratory and resident wildlife common to the lower watershed (see Appendix C for the species inventory).

Birds that were observed during the field investigations included aerial foragers, such as flycatchers, and canopy birds, such as warblers. Passerines that are common in edge habitats include gray catbird, tufted titmouse, and American crow. Open water zones supported mallard, egret, black crowned night heron, and other herons. Flyovers of peregrine falcon, common grackle, robin, ovenbird, red winged blackbird, and green heron were also observed.

Given the presence of an open water stream channel across these BMPs, the potential for salamanders such as the red-backed salamander are also expected, along with a variety of frogs, toads and snakes such as green frog, Fowlers toad, along with the common garter snake and northern water snake (see also Appendix C).

Muskrat were observed in the channel during the field investigations and within one of the open water pockets a muskrat lodge was observed. Otherwise mammals that are common to the watershed would be expected to use the upland portions of the site.

BMP NC-11: LAST CHANCE POND

The proposed BMP NC-11 site is a diverse, higher quality wetland habitat. It has been documented as containing a broad-cross section of vegetation and wildlife compacted into a small area. Trees of a variety of sizes as well as standing dead trees, habitats of open water, standing water, flowing water, muck, and areas of dense vegetation are examples of the range of habitat at this site. The habitats over the site are shown on Figure 4.9-11 and are listed below (with their acreages) in Table 4.9-5. A more detailed description of the existing conditions at the site of the proposed BMP NC-11: Last Chance Pond follows.

Table 4.9-5

Vegetative Habitat Cover at the Site of the Proposed BMP NC-11: Last Chance Pond

Ecological Community	Key to Habitat Map (see Figure 4.9-11)	Estimated Acreage (Existing Condition)
Riverine (marsh headwater stream, culturally modified)	1	0.65
Terrestrial (modified street edge and dike impoundment)	2	3.37
Red maple/hardwood swamp (red maple/sweetgum dominated)	3	6.64
Terrestrial (Successional Old Field)	4	0.17
Shallow emergent marsh (arrow arum predominant see also Table 1.1-3)	5	0.67
Shallow emergent marsh (common reed predominant)	6	2.85
Red maple/hardwood swamp (silver maple swamp dominated)	7	0.88
Total		**15.2**

Notes: Habitat estimates were calculated based on aerial photographs, field observations, and site topographic and tree survey (May, 2012) Ecological communities based on Edinger. et.al. January 2002.

Sources: AKRF, Inc. 2010; Hazen and Sawyer, January 2013.

Much of the proposed site of BMP NC-11 is within a NYSDEC-mapped freshwater wetland NA-8, Last Chance Pond, and is also mapped as NWI-mapped palustrine seasonally flooded emergent wetlands (PEM5Eh0), palustrine permanently flooded ponded wetlands (PUBH), or palustrine forested wetlands (PFO1Eh). The hydrologic regime and wetlands here are diverse ranging from high quality, red maple/hardwood swamp and emergent marsh with arrow arum in the interior wetlands--including open water zones comprised of shallow ponds and streams fed by the existing storm drainage, such as that from the Stobe Avenue storm sewer. The water systems of the site ultimately converge to create the headwaters of the New Creek main channel. Numerous wetlands plants have been identified at the Last Chance Pond site. In addition, Last Chance Pond is reported to contain a freshwater spring which is rare for wetlands in New York City (Pehek 2009). This spring provides a high quality source that supports a suite of wetland functions with the associated biological productivity and nutrient cycling. The periphery of the site is bordered by built streets, so there are also areas of low quality street edge habitats and the southern portion of the site is

primarily a lower quality common reed dominated habitat. Common reed also characterizes the shallow emergent marsh in the northeastern portion of the site.

The interior of the site, particularly the northwest portion (i.e., south of Zoe Street and east of Stobe Avenue), is a higher quality, diverse, red maple-hardwood swamp. The canopy and subcanopy of this wetland contain large (>36 in dbh) pin oak and white oak trees. Pockets of black gum and black cherry are also present in the subcanopy. Regeneration of red maple, pin oak, black gum, white oak, and black cherry was also observed in the shrub and herbaceous strata. Spicebush is dominant in the shrub layer with some plants reaching into the subcanopy at more than 12 feet in height. Arrowwood, winterberry, and elderberry are also common in the shrub layer. Regeneration of these species was also observed in the herbaceous layer. The herbaceous layer is very diverse and the species composition appears to vary with soil moisture. Skunk cabbage and jewelweed co-dominate in the herbaceous layer under spicebush and arrowwood in wetter soils. In less wet areas, smooth Solomon's seal, cinnamon fern, whitewood aster, violets, cow parsnip, wild yamroot, Pennsylvania sedge, and other sedges are present. Although pockets of multi-flora rose and common reed are also found in the herb and shrub layers, this area has minimal intrusion by invasive species.

The emergent community in the interior portion of the site and the two shallow marshes are separated by a man-made berm that runs east to west. Dominant vegetation observed in these wetlands included spatterdock, arrow arum, buttonbush, rose mallow, elderberry, sweet pepperbush, and purple loosestrife. Blueflag iris, tussock sedge, fox sedge, skunk cabbage, and jewelweed are also common. In less wet areas, smooth Solomon's seal, bellflower, cinnamon fern, whitewood aster, violet species, wild yamroot, and numerous sedges are present.

North of Husson Street and west of Naughton Avenue (the eastern portion of the site) is a maturing silver maple dominated wetland. The understory of this wetland is sparse in places with muck soils indicating its regular inundation. Box elder, willow, arrowwood, black gum, clearweed, blueflag iris, arrowhead, and jewelweed are common in the understory of this habitat.

Vegetation along the street edges is representative of a terrestrial and successional southern hardwood community. It is dominated by non-native and successional upland species in the canopy, shrub, and herbaceous strata. Tree-of-heaven, black locust, white mulberry, Norway maple, winged sumac, and sycamore maple are dominant in the canopy and subcanopy. Non-dominant trees include sweet cherry, willow, and crabapple. Native trees observed in these edge habitats are upland species including black cherry, hackberry, and sassafras. Japanese knotweed, multi-flora rose, common reed, and mugwort are prominent in the shrub and herbaceous strata. Fox grape and multiflora rose are the predominant vines.

Tree density is greatest in the northeastern and northwestern portions of the site with a greater proportion of larger trees due to the more mature woods in these locations. Trees in the silver maple swamp habitat, along the stream corridors, and in the less mature red maple swamp in the north-central area are smaller (calipers of about 4 inches dbh), but these areas also have the highest tree density.

In sum, the overall habitat composition at the proposed BMP NC-11 site is diverse with a mix of open water shallow ponds and streams, emergent wetlands, wet woods and edge habitats. Along the street edges and in the common reed dominated wetlands plant species richness is low. Although these roadside edges are dominated by non-native species in all strata and multiflora rose and common reed are also present within the interior of the site, overall the BMP NC-11 site can be characterized as having a lesser presence of invasive species when compared with

other BMP sites in the New Creek watershed. In addition, the strong recruitment in the understory of native species within the red maple-sweetgum swamp areas indicates that the wetlands are in good biological condition. The stream that flows from the site (i.e., the New Creek Main Channel headwaters) crosses a large common reed marsh and then continues south to Hylan Boulevard.

Many songbirds have been documented at Last Chance Pond. Birds frequently observed during DPR investigations include bittern herons, pheasants, and saw-whet owls (DPR 2009). Red-winged blackbird, yellow warbler, robin, common grackle, and wood duck were observed during spring and fall 2009 and 2010 site investigations at the site. In addition, wood duck was observed in the silver maple swamp. Nesting habitat suitable for wood duck is also present, with abundant tree cavities, standing and fallen dead wood adjacent to open water, and flooded swamp.

Habitat is also present for a variety of reptiles and amphibians. Commonly sited species include painted turtles, bullfrogs, snapping turtles, and garter snakes (DPR 2009). Other species include northern water snake, northern brown snake, spring peeper, green frog, and all six terrestrial and pond dwelling salamanders identified as occurring within Staten Island. During the spring 2009 site reconnaissance, two snapping turtles were observed in the vicinity of Stobe Street and Hylan Boulevard.

With respect to fish, the NYSDEC wetland designation report for the proposed NA-8: Last Chance Pond wetlands identified potential fish habitat. The open water pools of the site are suitable for fish habitat. The fish that were identified in the Last Chance Pond designation report included bullhead catfish, gambusia, pumpkinseed goldfish and goldfish. Eels which are present in the Main Channel may also migrate to the site. Macroinvertebrate data collected for this site is also provided in Appendix C.

Mammals that have been documented within the site include cottontail rabbit, raccoon, skunk, muskrat (DPR 2009), and opossum (Wildlife Refuge Foundation Inc., undated). Since it is a sizable open space, the mammals that are known to be present in this watershed would be expected at this site. Gray squirrel individuals and raccoon tracks were observed during spring and fall 2009 and 2010 site investigations.

BMP NC-12: JOYCE STREET

This proposed BMP site can be characterized as a reed grass marsh (Edinger et. al. 2002). It is located off-line from the New Creek Main Channel and provides aquatic habitat only in its connection near the channel. Despite the dominance of common reed, arrowhead, buttonbush, rose mallow, awlfruit sedge, elderberry, and sweet pepperbush are also present nearer the Main Channel.

Although this proposed BMP site is dominated by common reed and is a small site (0.1 acres), wildlife use, in particular bird use, may be accessory to the diverse habitats at the proposed BMP NC-11, although this site is not as high quality. Limited habitat is available for reptiles and amphibians; however, common snapping turtle, bullfrog, and northern water snake may utilize this site in a limited way. A number of the mammals of the lower watershed have the potential to use the site in a transitory way, particularly muskrat and raccoon, although their presence is likely to be limited.

MAIN CHANNEL (BMP NC-13: HYLAN BOULEVARD, BMP NC-14: MEADOW PLACE, BMP NC-15: LACONIA AVENUE, BMP NC-16: OLYMPIA BOULEVARD, BMP NC-17 SLATER BOULEVARD)

This series of proposed BMP sites forms the Main Channel of the New Creek system, between Hylan Boulevard on the north and Slater Boulevard on south. This reach contains an open water flowing stream (the Main Channel) which widens beginning at the Hylan Boulevard culvert. The main channel below Hylan Boulevard is perennial with a slow moving stream that is generally open water through to the Naughton Avenue trunk sewer and outfall at its southern end. In addition to the stream, there is also a small existing pond at the proposed site of NC-14. The wetlands along the channel are part of the NYSDEC mapped NC-9 Dongan Hills system and are also mapped by NWI as palustrine emergent wetlands (in this case common reed dominated wetlands), while some areas are also mapped as palustrine (seasonally flooded) forested wetlands. The pond edges at the proposed BMP NC-14 site have concentrations of native wetland species such as cinnamon fern, sensitive fern, and rose mallow along with a border of wooded wetlands that create a transitional zone between the common reed dominated wetlands and the adjacent uplands (which as bounded by the adjoining residential properties). In the wooded wetlands, stands of red maple-sweetgum trees are present. There is also a remnant black gum woodland in the vicinity of NC-16.

Of all the proposed BMP sites along this reach of the Main Channel, the site of the proposed BMP NC-17 (located at the south end of the Main Channel, where it is joined by the West Branch) possesses the greatest habitat and plant diversity. While common reed still dominates, the creek channel contains groundsel bush and elderberry which are the dominant shrub in some locations. In standing water along the creek channels, yellow iris, jewelweed, and duckweed were also noted during the field investigations. The northwestern portion of the site also supports a number of other wetland plants such as sensitive fern, jewelweed, marsh fern, shallow sedge, soft rush, and goldenrods—including pockets of seaside goldenrod, with deer tongue grass in the adjacent upland. Common reed is also more dominant on the southern portion of the NC-17 site (near the Slater Boulevard Bridge) than the northern portion.

Upland wooded areas define the edges of the proposed BMP sites. In most cases these wooded edges can be classified as southern successional hardwood communities. Invasive species such as black locust and tree of heaven are found in the canopy along with box elder (and subcanopy) with Japanese knotweed common in the understory along with garlic mustard. In the vicinity of Olympia Boulevard, clusters of successional southern hardwood trees surround the common reed-dominated marsh. There is also tree-of-heaven and a variety of invasive species such as mugwort, garlic mustard, porcelain berry, and multiflora rose with Japanese knotweed in the understory. Woodland edges in the vicinity of the proposed NC-17 site are characterized by a successional southern hardwoods community, with black locust in the canopy and mugwort common in the understory. The western edges of this proposed BMP site are also home to larger pin oak and red oak trees (>18 inches dbh), along with willows, bigtooth aspen, and black cherry. Successional old field habitat dominated by grasses and forbs is also present along some upland edges.

The substrate of the uplands is also be characterized by pockets of fill material as well as concrete and demolition debris. There are also areas of observed illegal dumping (i.e., tires, shopping carts, trash).

Given that there is a flowing stream, common reed and other emergent wetland coverages, along with the adjacent wooded uplands, most of the wildlife species listed in Appendix C for the lower New Creek watershed would be expected along this assemblage of proposed Main

Channel BMP sites. This includes a variety of birds, reptiles, amphibians, and disturbance-tolerant mammals.

A limited fishery resource has been observed in the Main Channel, even though it is tide gate controlled in its connection to Lower Bay. Fish species listed in Appendix C would be expected to be found across this reach of the stream, given the consistent source of water. A greater population and diversity of fish have been observed in the open areas of the Main Channel that receive greater amounts of sunlight, just below the Hylan Boulevard culvert, where water clarity is better and the flow is swifter than in the Lower Reaches.

While the current wildlife habitat at these proposed BMP sites would provide typical wildlife species found within the watershed, the presence of major cross streets such as Hylan Boulevard (a heavily traveled road at the north end) and Olympia Boulevard in the center would diminish the value of habitat in the vicinity of these major streets would discourage use by certain species as these areas are not as secluded as the interior areas.

However, the lower reach of the Main Channel, near where the East Branch feeds with the Main Channel (the location of the proposed BMP NC-17), exhibited greater avian diversity during the field investigations as compared with the upstream locations. Among the observed species in the lower reach of the Main Channel were cardinal, Carolina wren, yellow warbler, red-winged blackbird, and barn swallow; a peregrine falcon was also observed. Double crested cormorant and glossy ibis were also observed within the creek channel.

The wetlands along the channel would offer habitat to reptiles and amphibians that are tolerant of more disturbed conditions (i.e., red-backed salamander) and a dense monoculture of common reed and invasive plants (e.g., Japanese knotweed). Snapping turtles were observed in the channel and green frog was seen along the shoreline during the field investigations. Fish would also be expected in the creek itself.

With respect to mammals, burrows and trails throughout the less dense areas of common reed were observed as used for deer bedding. Raccoon tracks were also observed.

EAST BRANCH (BMP NC-18: PATTERSON AVENUE, BMP NC-19: BUEL AVENUE)

These two proposed BMP sites are along the East Branch of the New Creek lower watershed, between Naughton Avenue on the west and Dongan Hills Avenue to the northeast. This reach contains a flowing perennial stream, (the East Branch) and is dominated by common reed wetlands. All of these wetlands are part of the NYSDEC mapped NC-9 Dongan Hills freshwater wetland system and are also mapped by NWI as palustrine emergent wetlands; however the eastern portions of both proposed BMP sites also contain NWI mapped as palustrine forested wetlands.

In addition to common reed, the proposed BMP NC-18 site also contains pockets of native wetland vegetation. In one location a concentration of jack-in-the-pulpit was observed. The woodland edge along Dongan Avenue is also dominated by hackberry in the canopy along with several successional southern hardwoods community tree species.

The open channel, common reed wetlands, and woodland edges along the East Branch proposed BMP sites would provide habitat for migratory and resident wildlife of the lower watershed (see Appendix C for the detailed inventory). Wild turkeys were also observed along street edges of this site. These species are presently known to be breeding in this part of Staten Island.

The East Branch is a slow moving stream comprised of a short segment of open water that flows west to the Naughton Avenue trunk sewer. The East Branch is also tide gate controlled at its connection to the bay and thus only a limited fishery resource would be expected at these proposed BMP sites. Fish species listed in Appendix C have a limited potential to be present in this stream reach.

LOWER BAY OUTFALL

Lower Bay is mapped by NYSDEC as a tidal wetland (littoral zone) and by NWI as estuarine subtidal waters with unconsolidated bottoms that are permanently flooded. The shoreline along the bay is mapped by NWI as an estuarine intertidal unconsolidated shore that is regularly flooded and irregularly flooded. The ecological community of the shoreline can be characterized as an estuarine shore, comprised of dredge material that is maintained by DPR as a portion of the Franklin D. Roosevelt Boardwalk and Beach Park. Spring and fall 2009 observations of this site confirm a groomed sand beach void of vegetation.

Wildlife expected at this site would include shorebirds [e.g., American sandpiper and willet], gulls [e.g., herring gull and great black-backed gull], and waterbirds [e.g., double-crested cormorant], mallard and brant may also be present. No reptiles, amphibians, or mammals would be expected at this site. For the submerged section, the benthic zone of Lower Bay would also be expected to include a variety of invertebrates and mollusks common to the Bay. Fish would also be present in the shallow near-shore waters of the Bay (see also Appendix C).

As identified by the National Marine Fisheries Service (NMFS), the site of the proposed outfall is within a portion of the Harbor identified for Essential Fish Habitat (EFH) for 18 species of fish. Table C-15 lists the species and life stages of fish identified as having EFH within these coordinates (see Appendix C).

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES AND COMMUNITIES

Information on endangered, threatened, special concern, and rare species was obtained from NMFS, the New York Natural Heritage Program (NYNHP) and the U.S. Fish and Wildlife Service (USFWS). A review of that data found that one maritime protected species, the shortnose sturgeon, is listed for the Lower Bay. There are also four species of federally threatened or endangered sea turtles that may be found seasonally. NMFS also identifies whales as seasonally in the offshore waters of New York, but concludes that the depths near the inshore waters (such as off the south shore of Staten Island) are too shallow to be used by any listed whales. Correspondence from NYNHP states that three state-listed plant species have also been observed in the watershed since 1987.

With the exception of the peregrine falcon, glossy ibis (a “species of greatest conservation need”) and three state-listed exploitably vulnerable plants, none of the species provided in these lists were observed within the New Creek watershed during the 2009 and 2010 reconnaissance efforts.

Table 4.9-6 lists the federally and state protected species of the watershed (such as endangered or threatened wildlife, or rare plants) along with their potential to occur at each proposed BMP site. **Appendix C** provides a brief description of these species along their ranking and status as well as description of other species that may be special concern species or species or habitats of interest. In addition, 15 state-listed species including dragonflies, damselflies, amphibians, and plants are historically known to occur in one or more locations within the watershed. Data on these species is also provided in Appendix C.

Table 4.9-6
Potential for Federal- and State-listed Protected Species within the New Creek Watershed

Species/Source	Source	NYNHP Status Rank	Habitat	Potential or Observed
Shortnose sturgeon	USFWS	E*	Marine waters	Low potential (outfall sites only)
Peregrine Falcon	Breeding Bird Atlas and field observations	E	Nests on ledges of rocky cliffs; human-made structures; wetlands for foraging	Potential flyover or foraging at NC-7 to NC-10, NC-11 to NC-19 (Observed in flyover at NC-7, NC-17)
Green Milkweed	NYNHP	T	Upland slopes of serpentine or calcerous rock, grasslands, mowed golf course, sands; old pasture; alkaline soils; cedar glades	Potential to occur at NC-5, NC-16, and NC-18
Jacob's Ladder	NYNHP	E	Rich woods, moist soil of open woods, roadsides, thickets, or moist to dry upland woods	Potential to occur at NC-1 to NC-3
Lowland Fragile Fern	NYNHP	E	Rich, open woods, borders, and thickets	Potential to occur at NC-1 to NC-3
Cinnamon fern	Observed	EV	Swamps, stream banks, and shores with subacid soils.	Potential to occur in wetter edges of NC-1 to NC-3, NC-6, NC-11, and NC-14. Potential to occur in NC-7 to NC-10; NC-13 to NC-19 (observed in Reeds Basket Willow Swamp
Royal Fern	Observed	EV	Stream edges, lakes shores, bogs, and wet meadows and soils	Potential to occur in wetter edges of NC-1 to NC-3, NC-6 to NC-19 (observed within the transitional community of NC-7)
Spinulose Wood Fern	Observed	EV	Moist or wet woods, swamps	Potential to occur in wetland area of NC-1 to NC-3, NC-6 to NC-19 (observed at NC-7)

Notes: (*) Also federally endangered. NYNHP ranks and codes: (E) Endangered; (T) Threatened: (EV) Exploitably Vulnerable; (R) Rare.
Observed=observed during the 2009/2010 BMP site surveys.
Sources: NYNHP (2009; 2010); DPR (2009) unless otherwise noted.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

HYDROLOGY

In the future without the proposed project it is assumed that stormwater flows will remain uncontrolled and regular storm-event flooding will continue within the watershed particularly in the streets and properties of the lower watershed.

In addition, no major changes in runoff patterns are expected in the future without the proposed project. Therefore, the issues of local street and property flooding are assumed to continue through the 2043 analysis year.

GROUNDWATER

Without the proposed project, groundwater elevations within the New Creek watershed are not anticipated to change. Driven largely by constant factors such as the low-lying nature of the watershed and the influence of the tide, the levels of the groundwater table in the area are not anticipated to change in the future.

WATER QUALITY

Water quality conditions are expected to most likely remain unchanged or decline as stormwater remains uncontrolled.

WETLANDS

In the future without the proposed project, wetlands that are now degraded with debris, erosion, and invasive plant species are assumed to remain in a similar condition and current native plant communities may decline as a result of the spread of invasive plants and uncontrolled runoff. There would also be only limited maintenance of the Bluebelt properties since they would not be adapted to the proposed BMPs.

In addition, the common reed dominated proposed BMP sites of the lower watershed have been the scene of many brush fires in recent years. Those fires have occurred as recently as fall 2010. In the future without the proposed project, these fires are expected to continue on a regular basis through the 2043 analysis year.

VEGETATION AND TREES

In the future without the proposed project, no major changes in vegetative cover are expected in the watershed. While the Bluebelt and public open space are protected from development, there could be some reduction in vegetative cover and trees due to development in the watershed; however, there is little remaining undeveloped land in the watershed.

WILDLIFE

No major change in wildlife cover or habitat are expected in the future without the proposed project. Under this condition, the wetland would remain unimproved and the current common reed dominated habitat of the lower watershed would remain.

ENDANGERED, THREATENED AND SPECIAL CONCERN SPECIES AND COMMUNITIES

No major changes in the habitats of protected species within the watershed are expected in future without the proposed project. Thus, it is assumed that the wetland would remain unimproved and the current common reed-dominated habitat of the lower watershed would remain intact.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

HYDROLOGY

UPPER WATERSHED

In the upper watershed and within Reeds Basket Willow Swamp Park, installation of storm sewers would reduce the time of concentration in some locations due to faster flow velocities within the pipes. At other locations, the time of concentration would increase compared to the future without the proposed project due to creation of a longer flow path for the stormwater in the sewer system than currently occurs under natural conditions. While the creation of detention at proposed BMP NC-3 would have the net effect of lowering stream, flooding is still a concern at the culverts downstream of the park. Therefore, the sizes of these culverts would be increased with the proposed project to avoid street flooding. Thus, the existing 24-inch culvert, under the private road along Ridge Loop, should be replaced with a 10-foot by 4-foot box culvert. Also, the existing 36-inch culverts under the second Ridge Loop and Hillview Place road crossings

should be replaced with larger 60-inch culverts. Under this condition, no flooding of the existing road would occur during the 5-year design storm.

The installation of storm sewers flowing into the stream at the Richmond County Country Club under the proposed project would decrease the time of concentration, which would result in stormwater flows converging more quickly at the stream across the golf course, though total storm volume would not increase. The proposed BMPs NC-1 through NC-5 have been designed to reduce impacts associated with increased stream velocities. Proposed BMP NC-3 proposed in Reeds Basket and the proposed BMPs NC-4 and NC-5 also provide stormwater detention, which in addition to providing velocity attenuation have water quality benefits, as well. Implementation of the proposed project in the upper watershed would not result in flooding. Therefore, the proposed project would not result in potential significant adverse impacts on the hydrology of the upper watershed.

Based on topographic maps and visual inspections, Priory Pond lies at a low point between a rise to the northwest and a ridgeline to the southeast. A channel to the southwest provides the outlet from the pond which is controlled by a concrete weir. Summer 2010 inspections found that the channel appears to be dry.

Investigations of the pond and its surrounding environs revealed no inlet structure, erosion gullies, or overland water flow entering the pond. This suggests that the pond is groundwater-fed and not reliant on stormwater recharge. In addition, stormwater runoff from the slope above the pond either infiltrates into the ground or is captured by the gutters of the St. Francis Seminary driveway and conveyed downhill along the road until eventually entering a catch basin or exiting the seminary property downhill of the pond. The proposed amended drainage plan would install storm collection sewers in Todt Hill Road, but would not affect any of the surface runoff patterns in the drainage area of the pond. In addition, it appears that the pond may be supported by groundwater. Therefore, the proposed project would not impact the hydrology of Priory Pond.

LOWER WATERSHED

In the lower watershed, proposed BMPs are predominately comprised of large, shallow, extended detention wetlands along the existing channels of New Creek. The results of watershed modeling with the proposed plan in place under the 10-year storm event are presented in **Figures 4.10-12** through **4.10-18**. These figures show the existing and proposed conditions during the 10-year event at seven locations: Hylan Boulevard and Olympia Boulevard, both along the Main Channel of New Creek; Naughton Avenue just downstream of the confluence of the Main Channel and the West Branch; Patterson Avenue along the East Branch of New Creek; and Cherokee Street; Freeborn Street; and Midland Avenue along the West Branch.

Table 4.9-7 shows a summary of peak water surface elevations for existing and proposed conditions during the 10-year storm event. As shown in the table, the proposed amended drainage plan would reduce peak water surface elevations in the New Creek watershed between one and two feet during this 10-year event. Most importantly, the peak water surface elevations would remain below -1.0 feet for all locations except the Main Channel upstream of Laconia Avenue (proposed BMPs NC-11 and NC-13) and Midland Avenue (proposed BMP NC-16), providing storage before reaching the flooding elevations in problem areas such as at Olympia Boulevard and Seaver Avenue. Areas around Patterson and Midland Avenues are both at higher elevations and relatively far from low-lying streets. Elevations of surface water in these areas would still be below flooding elevation (+3.45 around proposed BMP NC-11 as compared to -1.0 lower down the Main Channel of New Creek).

Table 4.9-7

Peak Water Surface Reductions During the 10-Year Event With the Proposed Project

10-Year Storm Peak Stage Reduction			
Location (Branch)	**Existing Peak Stage**	**Peak Stage with the Proposed Project**	**Reductions (ft.)**
Hylan Boulevard (Main)	0.76	-1.04	1.81
Olympia Boulevard (Main)	0.47	-1.08	1.55
Naughton Avenue (Main-West)	0.38	-1.10	1.48
Patterson Avenue (East)	0.33	-0.32	0.65
Cherokee Street (West)	0.39	-1.10	1.48
Freeborn Street (West)	0.78	-1.08	1.86
Midland Avenue (West)	1.88	1.19	0.96

Note: Elevations are in Staten Island Datum.
Source: Hazen and Sawyer, January 2011.

In addition, the Hylan Boulevard, Olympia Boulevard, Naughton Avenue, Cherokee Street and Freeborn Street trunk sewer water surface elevations would all improve. This reduction in peak water surface elevations of the streams and trunk sewers, combined with the installation of storm sewers in the streets, would dramatically improve the surface drainage of the lower New Creek watershed. Therefore, the proposed project would have a positive impact on flooding conditions and reduce flooding impacts on local streets and structures by significantly improving the detention and conveyance or runoff during the design storm events.

In addition to the 10-year storm event, the 100-year storm event was modeled at the same seven locations as the 10-year storm event. As shown in **Table 4.9-8**, the resulting water surface elevations under the 100-year storm remain well below the current 100-year floodplain under the proposed amended drainage plan with reductions at certain locations in the water surface elevations. (The analysis with the proposed project is for the rain event only and does not take into account the storm surge from the Lower Bay.) Therefore, the proposed project would not result in potential significant adverse impacts on hydrology in the lower watershed under the 100-year storm event.

Affects of Sea Level Rise

New York City has an extensive coastal zone with billions of dollars of private and public investments, making sea level rise an important long-term planning issue. The potential impacts of sea level rise on the City were a major focus of the City's PlanNYC report which recommended preparation of a comprehensive climate change adaptation study and examination of climate change resiliency options.

Warming global temperatures are considered extremely likely over the coming decades and through the course of the next century. It is anticipated that this warming will be at a faster rate than past trends which will have the effect of increasing the rate of global sea level rise. Given the long-term nature of sea level rise effects and the variables intrinsic to predicting global carbon emissions, global climate conditions, and the resulting effects on sea level, there are ranges in sea level rise projections that take into account various scenarios. In February 2009, the City's Panel on Climate Change released its report "Climate Risk Information" which was prepared with the assistance of the Mayor's Office of Long Term Sustainability. That report presents sea level rise projections that take into account the predicted ranges of both global climate change and local land subsidence. The central range of these projections are sea level increases of 2 to 5 inches by the 2020's, 7 to 12 inches by the 2050's, and 12 to 23 inches by the 2080's. Impacts of sea level rise as identified in the report include the risk of increased coastal flooding and precipitation. A report released by the New York State Sea Level Rise Task Force—Report to the Legislature (December 31, 2010) accepts similar sea level rise projections.

The proposed BMPs are the type of infrastructure design and investment for the City that is climate change resilient and reduces expansion and reliance on hard infrastructure, which is less adaptable to increasing sea level and more susceptible to the effects of submersion under higher tides. In contrast, the proposed BMPs can adapt to sea level rise while preserving and restoring coastal floodplains as wetlands (there are approximately 94 acres of permanently preserved Bluebelt property in the New Creek Watershed) and the limited structural elements that are necessary (e.g., weirs or valves) are more adaptable to changes in surface water elevations that may result from increasing sea levels. For example, the proposed BMP weir structures or valves are designed with flexible weir plates or adjustable valves so that discharge rates can be modified in response to changes in BMP surface water elevations. Thus, the proposed project would be more adaptable to changing tidal conditions than the conventional stormwater piped systems, which cannot be adjusted. It is projected that the proposed BMP designs can accommodate a 9-inch increase in sea level--which is within the central range of the City and State projection and is used by DEP at the direction of the New York City Panel on Climate Change. The BMP weirs are sized to drain the extended detention storage volume in about 6 hours (under current sea level conditions). However, assuming a 9-inch increase in sea level and the associated effects of groundwater inflow to the BMP, the weirs or valves can also be adjusted to drain the BMP in as little as 4 hours—which is the estimated reduced duration of drainage assuming that the tide gates are closed longer due to higher tides.

While increasing the rate of drawdown may reduce BMP detention time, it would preserve the BMP function of flood protection and would address both the potential effects of rising sea levels on the outfall operations (such as a shorter duration that the tide gate is open) and the higher local groundwater levels that may also result from increase in sea level. Finally, the proposed BMPs are designed to maximize stormwater management effectiveness in an existing low-lying developed coastal area where the street and property grades are essentially fixed and cannot be modified. The alternative to the proposed BMPs is either hard infrastructure, which is almost inflexible to increasing sea level because the pipes are fixed in-place, or no storm water management system, which would leave the developed lower watersheds of Mid-Island facing greater flooding impacts with no remedy.

In sum, the proposed project would reduce flood levels during the 10 year storm event and operation of the proposed BMPs would not be impacted by sea level rise. Therefore, the proposed project would not result in any significant adverse impacts on hydrology in the New Creek watershed.

Table 4.9-8
100-Year Storm Water Surface Elevations Under the Proposed Amended Drainage Plan

Location (Branch)	Existing Peak Stage Water Surface Elevation (FEMA)	Peak Stage Water Surface Elevation with the Proposed Project (1)
Hylan Boulevard (Main)	6.80	1.91
Olympia Boulevard (Main)	7.80	-0.04
Naughton Avenue (Main-West)	6.80	-0.05
Patterson Avenue (East)	7.80	-0.04
Cherokee Street (West)	6.80	-0.05
Freeborn Street (West)	7.80	0.31
Midland Avenue (West)	6.80	4.04

Notes: Elevations are in Staten Island Datum. (1) For rainfall event only. Does not take into account the effect of high tide storm surges in a 100-year storm
Source: Hazen and Sawyer, January 2011; FEMA and FIRM maps, September 2007.

MODIFIED STREET GRADES

The proposed project would include modifications of the existing street grades along certain segments of the streets in order to ensure proper cover over the proposed storm sewers and to provide positive drainage. Chapter 4.1 "Project Description" shows the locations of the proposed street grade modifications

It is standard procedure to raise streets in low-lying areas in order to provide proper cover over the proposed storm sewers, and the City has done this on many projects. As part of the capital project design, site specific survey will be performed to determine the actual street elevation conditions for each individual project and all design techniques will be utilized to limit the raising of street grades to the maximum extent possible. During this process, DEP and DDC, the agency that would manage the project through design and construction, will meet with each individual homeowner prior to construction to limit the impacts of street grade changes and to assist homeowners in developing the best drainage solution possible.

Therefore, the proposed modified street grades would not result potential significant adverse impacts on hydrology.

PROPOSED BERMS

As part of the proposed drainage plan amendments for the New Creek watershed, DEP is proposing to install berms along certain lower watershed proposed BMPs to provide protection of adjacent properties during large storm events. These berms would be installed predominantly along the Quincy Avenue side of NC-17, with smaller berms that may be required in the BMPs proposed along the West Branch of New Creek between Nugent Avenue and Father Capodanno Drive, as well as along the Main Channel of New Creek at the downstream end of proposed BMP NC-11 and BMP NC-13. The berms would be between 6 and 36 inches in height and would be constructed along the perimeters of the proposed BMPs. The berm would be designed and constructed with careful attention. The proposed berms may have the potential to block drainage coming from adjacent private properties. Possible techniques for addressing any water accumulating inside the private property against the berms may include drain tiles, French drains, swales, or yard outlets through/to the wetlands, as appropriate to convey runoff parallel to or from the berm to the closest storm sewer inlet.

The berms would be classified as "dams" under NYSDEC regulations and would be constructed according to NYSDEC standards. However, since the berms would be less than six feet in height, no permits would be required for construction and maintenance of the berms.

Therefore, the proposed project would not result in potential significant impacts on hydrology due to the proposed berms.

STREAM VELOCITIES

Existing stream velocities and those under the proposed amended drainage plan for the upper watershed are shown in **Table 4.9-9** for the 1-year storm event. A frequent, small-sized storm is used in this analysis because such a storm is considered the channel-forming storm. The stream velocities in Reeds Basket would decrease slightly. At the Richmond County Country Club, while the overall runoff volume from the watershed is not expected to increase as a result of the proposed project, peak flows would potentially be higher due to the reduced time of concentration in the upper watershed. BMPs NC-4 and NC-5 are proposed to provide additional detention and peak attenuation to reduce runoff rates in this stream; however, a slight increase in stream peak flows is predicted. As the design process progresses, DEP, in coordination with NYSDEC and the

Richmond County Country Club, will continue to evaluate alternatives including expansion of the proposed BMP footprint and widening of the channel at constricted locations, which would reduce velocities at these proposed BMP sites to zero net change.

Table 4.9-9
Stream Velocities With the Proposed Project

Location	Existing (fps)	Proposed (fps)
Reeds Basket Upper Main Channel	9.1	9.0
Reeds Basket Tributary Channel	10.8	10.7
Reeds Basket Confluence	11.6	11.4
Richmond County Country Club between Whitlock Avenue and Charter Oak Road	10.3	10.5
Richmond County Country Club between Charter Oak Road and Flagg Road	6.4	6.6

Source: Hazen and Sawyer, January 2011.

Since upper watershed existing velocities are considered erosive, the need for bank stabilization measures downstream of the proposed BMP outlet would be assessed as part of the final BMP design. These measures could include re-vegetation, and in-stream check dams as determined in coordination with DPR and NYSDEC (see Appendix B, "Streambank Stabilization Techniques"). Therefore, the proposed project would not result in potential significant adverse impacts on stream velocities or the resulting sedimentation and erosion issues.

GROUNDWATER

The proposed BMPs would require excavation below the shallow groundwater table. Therefore, groundwater inflow is expected to generate a constant baseflow that would slowly enter the proposed BMPs during high tide, before the water surface elevation would return to the permanent pool elevation during low tide.

In order to understand the potential effects of groundwater on the proposed BMP functions, groundwater inflow rates and volumes were projected. These results are presented in **Table 4.9-10** as a percentage of the proposed BMP low-flow discharge rate and storage capacity that could be consumed by groundwater inflow. BMPs NC-8, NC-10, and NC-17 do not have percent of low flow discharge numbers in the table because there are no outlet control structures at those BMPs which allow for low flow discharges. The ranges in the estimates reflect the uncertainty of data regarding soil conductivity and hydraulic gradient at each proposed BMP site. For example, the more conservative estimate (i.e., the higher percentage) presents a worst-case scenario in which the hydraulic conductivity of the soils is assumed to be high (i.e., porous sandy soil) with a high hydraulic head gradient, thereby producing large inflow rates to the proposed BMPs. The less conservative estimate (i.e., the lower percentage) assumes a sand/silt mixed soil with less of a hydraulic gradient.

As shown in the table, under the less conservative assumptions, groundwater inflow consumes only a small fraction of the proposed BMP storage capacity. However, in the more conservative assumption, higher groundwater inflow rates would have the potential to reduce proposed BMP storage capacity (particularly during a high-tide event). In the less conservative case, the BMP proposed orifices are sized with adequate conveyance capacity to accommodate both the groundwater baseflow plus the proposed BMP storage of flood waters. However, if field data gathered during final design indicate that a higher rate of inflow may occur at a proposed BMP, then the hydraulic structures may need to be upsized during final design for the purposes of enlarging the low-flow orifices. The soils surrounding the proposed BMP may also need to be

amended as well to reduce the hydraulic conductivity, thereby acting similar to the less conservative assumptions. Flow rates during final design would be determined using test pits and soil borings and monitoring of groundwater movement would also be conducted during the dewatering and construction of the proposed BMPs.

Table 4.9-10
Characteristics of Groundwater Baseflows into BMPs Under the Proposed Amended Drainage Plan

BMP	Percent of Low-Flow Discharge	Percent of Storage Capacity
NC-6	2 to 76%	1 to 23%
NC-7	2 to 34%	5 to 44%
NC-8	N/A	6 to 53%
NC-9	2 to 32%	6 to 47%
NC-10	N/A	4 to 22%
NC-11	14 to 100%	7 to 28%
NC-13	3 to 22%	9 to 36%
NC-16	2 to 25%	5 to 40%
NC-17	N/A	7 to 50%
NC-18	2 to 28%	5 to 38%

Note: BMPs NC-8, NC-10 and NC-17 do not have outlet control structures which allow for low flow discharges.
Source: Hazen and Sawyer, January 2011.

The proposed amended drainage plan was also examined for potential impacts on the groundwater table in the immediate vicinity of the proposed BMPs. With the proposed BMPs, some groundwater would inflow to the proposed BMPs to become surface water. Because the proposed BMPs would provide a less restrictive hydraulic path for groundwater to leave the watershed, this hydraulic affect was examined for potential impacts on the groundwater table. Based on a preliminary worst case analysis, the magnitude of the impact would be the difference between the proposed BMP permanent pool water surface elevation and the existing water table elevation, which generally ranges between 1 and 3 feet, but up to a maximum of over 6 feet at proposed BMPs NC-11 and NC-13. However, the actual effect the groundwater table is expected to be less than this range. This is due to several factors, including the hydraulic conductivity of the soils and the proximity of the BMPs proposed to the Lower Bay, where the bay elevation ultimately controls the groundwater table. Any impact to the vertical groundwater table elevation would also decrease with increasing distance from the proposed BMPs. Therefore, the proposed project would not result in potential significant adverse impacts on the groundwater table.

In extreme cases, a lowered water table can lead to the consolidation of soils and ground subsidence, which on large scales can cause damage to property and infrastructure. Based on available data about the types of soils in the watershed and the anticipated minor changes in the groundwater table, ground subsidence with the proposed project is estimated to be negligible. Under the worst-case assumptions, subsidence in the immediate vicinity of proposed BMPs NC-6, -7, -8, -9, -10, -16, -17, and -18 is calculated to be an average of 0.5 inches. In the areas directly surrounding NC-11 and -13, where the maximum subsidence is projected to be about 1 inch. Consequently, land subsidence is not anticipated to cause any damage to neighboring structures. Also proposed is the collection of additional groundwater data to inform the design of the lower watershed BMPs (see also Chapter 8.1, “Mitigation”).

Therefore, the proposed project would not result in potential significant adverse impacts on groundwater volumes, the groundwater table, or land subsidence.

WATER QUALITY

The proposed project is expected to result in improved water quality in the watershed over the condition in the future without the proposed project condition. This conclusion is supported by a literature review and data collected for the South Richmond Bluebelt projects. Supporting data are provided in Appendix D.

In the future without the proposed project, runoff is not collected and directed to the proposed BMPs. In contrast, the proposed BMPs function as wetlands that provide physical, chemical, and biological treatment of pollutants contained within runoff; flow rates into wetlands are attenuated, allowing sediment and organic debris to settle. During this process, nutrients undergo both chemical and biological transformation in a wetland. Nitrogen can be naturally altered into forms that are more favorable to uptake by wetland plants and phosphorus is readily precipitated out of water in many of its chemical forms, depending on the pH of the water and is also utilized by plants. Extended detention at the proposed BMPs can also reduce fecal coliform concentrations by detaining water, allowing for die-off of microorganisms. Pollutant removal efficiencies of up to 77 percent for certain pollutants are reported with the proposed BMPs in place.

As presented in the appendix, data gathered by the American Society of Civil Engineers (ASCE), the U.S. Environmental Protection Agency (USEPA), Water Environment Research Foundation (WERF), the American Public Works Association (APWA), and the Federal Highway Administration (FHWA) indicate that pollutant concentrations are reduced by storm flows filtered through wetlands. A Center for Watershed Protection (CWP) report on updated proposed BMP removal efficiency also shows reduction in pollutant loading with proposed BMP wetlands.

In addition, analyses of BMPs previously constructed and operating on Staten Island (in the South Richmond Bluebelt) show general water quality improvement resulting from BMPs. Data from a 2003 water quality study of three Staten Island BMPs installed in the South Richmond Bluebelt (including two extended detention wetlands and one wetland retrofit BMP) show that extended detention wetlands are performing as a typical stormwater wetland, achieving good pollutant removal efficiencies. In addition, in the Richmond Creek watershed of South Richmond, it has been found that outlet stilling basins and other velocity attenuating structures can provide a 10 to 20 percent pollutant removal efficiency that is attributable to velocity reductions that allow sediment and other debris present in the water to settle instead of being transported downstream.[1]

The wetland BMPs also include a vegetated buffer as part of the design. In addition to being planted with flood-tolerant species, the buffer zone helps filter overland flow into the BMP from neighboring properties. This helps reduce nutrient loads from adjacent properties such as ball fields or lawns from directly entering the wetlands as currently occurs in most BMP proposed locations, thereby improving the water quality over the existing conditions.

[1] O'Connor, T.P., and Rossi, J. "Monitoring of a Best Management Practice Before and After Maintenance," *American Society of Civil Engineer's Journal of Environmental Engineering*, November 2009, Vol. 135, Issue 11.

Therefore, the proposed project would not result in potential significant adverse impacts to water quality.

WETLANDS

The objective of the proposed project is to protect and use freshwater wetlands and their adjacent areas to improve stormwater management, reduce flooding and erosion, and improve the overall ecology of the watershed through the proposed amended drainage plan and its BMPs. To that end, the larger proposed BMPs of the lower watershed, specifically NC-8 through NC-10 along the West Branch, NC-12 through NC-17 along the Main Channel, and NC-18 through NC-19 along the East Branch of the New Creek drainage system would improve and diversify wetland habitats transforming the existing common-reed-dominated wetlands into a variety of open water, emergent periodically inundated wetlands and upland buffer areas (see **Table 4.9-11**). As shown in the table, there is one area with a reduction in freshwater wetlands due to a proposed diversion of water that would occur along a segment of stream channel in the vicinity of Mason Avenue and that impact is due to a proposed storm sewer (see **Table 4.9-11**). This diversion is necessary to relieve local property owners of a flooding condition along this stream corridor. With the proposed amended drainage plan this impact on wetlands is limited to about -0.2 acres along the Mason Avenue stream segment of the West Branch, which would have its stormwater diverted to a piped system to relieve local flooding. There would also be some reductions in wetland acreage at certain BMPs due to the proposed berms. However, even with this reduction the proposed project provides a net increase in wetland acreage in the watershed with the increased DEC wetland acreage at the proposed BMPs of an estimated 4.23 acres. These increases include expansion of wetlands in the proposed extended detention BMPs of the upper watershed (e.g., proposed BMPs NC-4 and NC5), the proposed widened stream channel and expanded open water and emergent wetlands of proposed BMP NC-6: Boundary Avenue, and the removal of fill in the lower watershed at the proposed BMP NC-18: Patterson Avenue where the proposed project would remove illegal fill placed by prior owners.

The proposed BMPs that comprise the New Creek proposed amended drainage plan also have the ecological objective of creating and expanding open water (low-flow channels and ponds) and permanent pools (emergent wetlands) habitats. These features have the hydrologic objective of storing and detaining stormwater periodically inundated wetlands and upland buffer areas storage of runoff during storm events, the proposed BMPs would provide extended detention that would alternately flood during storm events and gradually release stormwater afterwards. All portions of the proposed BMPs excavated for permanent pools and extended detention would be planted with wetland appropriate plants to support nutrient uptake and provide wildlife habitat. In addition, wetland buffers located on Bluebelt properties that currently protect higher-quality existing (or proposed) wetlands from adjacent uses would be preserved as part of the proposed BMP designs (see also “Water Quality” above regarding the buffer protections) The proposed project would also have no impacts on wetland NA-12 St. Francis Woodlands or Priory Pond.

BMP designs also require the relocation/creation of stream channels as well as stabilization of some existing channels. In addition to the natural systems within the proposed BMPs, structures to be constructed within the proposed BMPs include new stormwater outlets to convey storm flows to the proposed BMPs, outlet stilling basins to minimize erosion at the sewer discharge locations, micropools to control flows at the proposed BMP outlets and access maintenance corridors. These would be minor structural systems within the individual proposed BMPs. Overall, the proposed project would result in an increase in freshwater wetland acreage in the watershed (primarily due to new proposed extended detention BMPs in the upper watershed) along with improvements in wetland quality (see **Tables 4.9-11a** and **4.9-11b**).

Table 4.9-11a
Freshwater Wetland Habitat Impacts: New Creek Watershed (in acres)

BMP	Name/ Location	BMP Type	BMP Size (Acres)	Existing Conditions				Conditions with Proposed BMP					Wetland Acreage Impacts
										Extended Detention[3]			
				Water Area (ponded or stream corridor)	Emergent Common Reed wetlands or previously disturbed	Wooded Wetlands (a)	Upland edge (a)	Open Water[1]	Permanent Pool[2]	Wooded wetlands	Emergent Wetlands	Buffers[4]	
NC-1	Merrick Avenue	Velocity attenuator and drop pipe	0.1	0.0	0.0	0.1	-	0.1	0.0	0.0	0.0	0.0	No change in wetland acreage or habitat quality
NC-2	Ocean Terrace	Velocity attenuator and drop pipe	0.1	0.0	0.0	0.1	-	0.1	0.0	0.0	0.0	0.0	No change in wetland acreage or habitat quality
NC-3	Annfield Court	Extended detention wetland and stream stabilization	0.3	0.0	0.0	0.3	-	0.1	0.1	0.0	0.1	0.0	-.01 wetland acres/No change in wetland quality
NC-4	Whitlock Avenue	Extended detention wetland and detention chamber	0.3	0.0	0.16	0.14	-	0.1	0.1	0.0	0.1	0.0	+0.12 acres NYSDEC wetlands (+.04 acres for NWI wetlands) with redirection of stormwater from existing drainage swale)
NC-5	Todt Hill Road	Extended detention wetland	0.8	0.0	0.1	0.0	0.7	0.1	0.1	0.0	0.3	0.2	+0.72 acres NYSDEC wetlands (+.67 acres for NWI wetlands) with redirection of stormwater from existing drainage swale
NC-6	Boundary Avenue	Extended detention wetland	3.0	0.2	0.0	1.6	1.6	0.9	0.3	0.0	1.1	0.7	+3.0 acres NYSDEC wetlands (+1.6 acres for NWI wetlands)
NC-7	Nugent Street	Extended detention wetland, flood plain creation and stream realignment	4.7	0.1	3.5	0.0	1.1	0.5	1.0	0.0	2.7	0.5	Stream relocation (-0.54 existing NYSDEC wetland acreage)/wetland habitat improvements
NC-8	Freeborn Street	Extended detention wetland, flood plain creation and stream realignment	0.7	0.0	0.2	0.0	0.5	0.1	0.2	0.0	0.3	0.1	Stream relocation (-0.34 NYSDEC wetland acreage)/ wetland habitat improvements
NC-9	Graham Boulevard	Extended detention wetland, flood plain creation and stream realignment	4.4	0.1	3.5	0.0	0.8	0.5	1.3	0.0	2.2	0.4	Stream relocation (-1.08 NYSDEC wetland acreage)/ wetland habitat improvements
NC-10	Jefferson Ave	Extended detention wetland and new ocean outfall	4.5	0.2	2.3	0.0	2.0	0.4	1.0	0.0	2.5	0.6	Stream relocation (-0.84 NYSDEC wetlands acreage)/ wetland habitat improvements

Table 4.9-11a
Freshwater Wetland Habitat Impacts: New Creek Watershed (in acres)

BMP	Name/ Location	BMP Type	BMP Size (Acres)	Existing Conditions				Conditions with Proposed BMP					Wetland Acreage Impacts
										Extended Detention [3]			
				Open Water (ponded or stream corridor)	Emergent Common Reed wetlands or previously disturbed	Wooded Wetlands (a)	Upland edge (a)	Open Water[1]	Permanent Pool[2]	Wooded Wetlands	Emergent Wetlands	Buffers[4]	
NC-11	Last Chance Pond	Extended detention wetland	10.0	1.3	2.3	3.75	2.65	3.2	1.4	0.53	2.8	2.07	Modification of existing wetland/No change in existing NYSDEC or NWI wetland acreage
NC-12	Joyce Street	Outlet stilling basin	0.1	0.0	-0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	-.01 wetland acres/No change in wetland quality
NC-13	Hylan Boulevard	Extended detention wetland	2.9	0.2	1.35	0.0	1.35	0.4	0.7	0.0	1.0	0.8	Stream relocation (-0.10 wetland acreage)/ wetland habitat improvements
NC-14	Meadow Place	Outlet stilling basins	0.2	0.1	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	No change in acreage or habitat
NC-15	Laconia Avenue	Outlet stilling basin	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	No change in acreage or habitat
NC-16	Olympia Boulevard	Extended detention wetland	12.0	0.7	8.3	0.0	3.0	1.1	3.4	0.0	5.9	1.6	Stream relocation -.02 wetland acres/ wetland habitat improvements
NC-17	Slater Boulevard	Extended detention wetland flood plain creation and stream realignment	9.7	0.6	6.7	0.0	2.4	1.0	2.9	0.0	4.4	1.4	Stream relocation (-0.42 wetland acreage)/ wetland habitat improvements
NC-18	Patterson Avenue	Extended detention wetland	8.4	0.1	5.6	1.0	1.7	0.6	1.3	1.0	3.9	1.6	Stream relocation (+3.82 NYSDEC and NWI wetlands) with habitat improvements
NC-19	Buel Avenue	Outlet Stilling Basin	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	No change in acreage or habitat
N/A	Mason Avenue Stream Segment (to be replaced by storm sewer)	Piping of existing stream flow	N/A	0.2				--	--		N/A	--	-0.2 acres (NYSDEC) and -0.2 (NWI)
												Total	**+4.10 acres (NYSDEC)/with habitat improvements (see Table 4.9-11b)**

Notes: This table presents the existing conditions as well as the created and enhanced wetlands and upland habitats at each proposed BMP sites. Definitions include the following:

(a) Wooded wetlands are palustrine forested wetlands. Upland edge is where the wetlands have transitioned to upland, which at many BMP sites is identifiable by changes in grade and vegetation such as filling at street edges and yards.

(1) Open water includes low-flow channels and ponds that would be permanently inundated with no vegetation.

(2) Permanent pool habitats are always inundated and have emergent wetland vegetation.

(3) Extended detention wetlands are the zones that are flooded in storms and would be occasionally inundated and planted with species that can tolerate periodic inundation/saturation.

(4)Buffers are defined as the upland perimeters of the BMP sites. Upland buffer zones have trees and shrubs and are typically drier than the extended detention zone.

Assumptions made when calculating potential DEC wetland impacts include the net effects of installing berms at the proposed BMPs NC-7, NC-8, NC-9. NC-10, NC-13, and NC-17. The net increase shown above is conservative in that the assumed dimensions for the proposed berms is based on the worst case largest berm in all cases, when there are three possible berm types, two of which would be smaller in size than that assumed in determining these impacts (see also Chapter 1.1. for a description of the proposed berms).

Source: Hazen and Sawyer and AKRF, DEP July 2013.

Table 4.9-11b
Freshwater Wetland Acreage Impacts: New Creek Watershed

BMP	BMP type	Total BMP Size	Portion of BMP within DEC Mapped Wetlands (existing conditions)	Wetland Reductions for Proposed BMP Berms and Structures	Wetland Expansion with Proposed BMP (fill removal or conversion of upland)	Net change in Wetland Acreage (1)	Acreage of Existing Wetlands to be Enhanced with BMP (2)
NC-1: Merrick Avenue	Velocity attenuator and drop pipe	0.1	0.1	N.A.	N.A.	0.0	0.0
NC-2: Ocean Terrace	Velocity attenuator and drop pipe	0.1	0.1	N.A.	N.A.	0.0	0.0
NC-3: Annfield Court	Extended detention wetland and stream stabilization	0.3	0.3	-0.01	N.A.	-0.01	0.0
NC-4; Whitlock Avenue	Extended detention wetland and detention chamber	0.3	0.16	0.0	+0.12	+0.12	0.16
NC-5: Todt Hill Road	Extended detention wetland	0.8	0.03	N.A.	+0.75	+0.72	0.0
NC-6: Boundary Avenue	Extended detention wetland	3.0	0.0	N.A.	+3.0	+3.0	0.0
NC-7: Nugent Street	Extended detention wetland, flood plain creation and stream realignment	4.7	4.7	-0.54	N.A.	-0.54	4.2
NC-8: Freeborn Street	Extended detention wetland, flood plain creation and stream realignment	0.7	0.7	-0.34	N.A.	-0.34	0.36
NC-9: Graham Boulevard	Extended detention wetland, flood plain creation and stream realignment	4.4	4.4	-1.08	N.A.	-1.08	3.3
NC-10: Jefferson Avenue	Extended detention wetland and new ocean outfall	4.5	4.5	-0.84	N.A.	-0.84	3.6
NC-11: Last Chance Pond	Extended detention wetland	10.0	10.0	0.0	N.A.	0.0	+6.22
NC-12: Joyce Street	Outlet stilling basin	0.1	0.1	-.01	N.A.	-.01	0.0
NC-13: Hylan Boulevard	Extended detention wetland	2.9	2.65	-0.35	+0.25	-0.10	2.5
NC-14: Meadow Place	Outlet stilling basins	0.2	0.2	N.A.	N.A.	0.0	0.0
NC-15: Laconia Avenue	Outlet stilling basin	0.1	0.1	N.A.	N.A.	0.0	0.0
NC-16: Olympia Boulevard	Extended detention wetland	12.0	12.0	-.02	N.A.	-.02	11.3
NC-17: Slater Boulevard	Extended detention wetland flood plain creation and stream realignment	9.7	9.7	-0.42	N.A.	-0.42	9.1
NC-18: Patterson Avenue	Extended detention wetland	8.4	4.6	-.01	+3.83	+3.82	4.4
NC-19: Buel Avenue	Outlet Stilling Basin	0.1	0.1	N.A.	N.A.	0.0	0.0
Mason Avenue Stream Segment (to be replaced by storm sewer)	Piping of existing stream flow	N/A	Stream Corridor	-0.20	N.A.	-0.20	N.A.
					Total	**+4.10** acres **(NYSDEC)**	

Notes:: **(1)** Does not take into account the wetland enhancement. **(2)** Improvements in common reed dominated (*phragmites*) or otherwise degraded wetlands and exclusive of berms and structures. Does not include portion of BMP currently occupied by stream channel.
Sources: Hazen and Sawyer, AKRF, DEP, April, 2013.

The proposed project would also have a limited impact on tidal wetlands due to the proposed outfalls. Impacts on tidal wetlands would be minimized in final design and a wetland restoration plan would be developed at that outfall, as necessary. DEP has also identified potential sites for tidal wetland restoration as part of the proposed project (**Table 4.9-20** provides the quantitative impacts relative to tidal wetlands in the New Creek Watershed and Chapter 8.1 "Mitigation" provides a description of the potential tidal wetlands restoration program).

VEGETATION AND TREES

Under the proposed amended drainage plans, impacts on vegetative cover, in particular woodlands and trees of the watershed is limited with the exception of two woodland stands in the central portion of the watershed, at the proposed site of proposed BMP NC-6: Boundary Avenue and proposed BMP NC-11: Last Chance Pond. (Most of the lower watershed proposed BMPs are sited in common reed marshes that have few trees.) Together, using a reasonable worst-case assumption with respect to clearing at these sites, these two proposed BMPs would require clearing of about 9 acres of wet woods within the watershed with the associated clearing of trees in order to transform the sites into the open water and emergent wetland proposed BMPs that would also provide the hydrologic functions of stormwater management and flood control. While this is a substantial area of woodland, there would remain large areas of extant and protected woodlands within the watershed. For example, in the upper watershed, there is the 48 acres of protected open space that is primarily woodlands within the Reeds Basket Willow Swamp Park and the 27 acres of protected open space in the St. Francis Woodlands. There are also large tracts of woodlands in the nearby Staten Island Greenbelt including High Rock Park (about 90 acres) that would continue to provide wooded cover for both the watershed and adjacent areas.

Nonetheless, DEP has the objective of minimizing the clearing of woodland and trees at these two sites (and all proposed BMP sites requiring tree clearing) in the final design of all proposed BMPs. To that end, DEP would coordinate with DPR in the final design of sites located within DPR parkland for the purposes of both minimizing the total extent of woodland cover and tree impacts and to develop a tree mitigation plan for all impacted areas (see also Chapter 8.1, "Mitigation").

WILDLIFE

As is the case throughout the region, Staten Island has lost much of its historic freshwater and tidal wetlands and the Mid-Island watersheds are no exception. Therefore, the preservation of remaining wetlands under the Bluebelt Program, coupled with the created and enhanced wetlands of the proposed project, provides an opportunity to protect and reinvigorate important natural resources habitats in the Mid-Island region, including the New Creek watershed. To achieve the goal of habitat enhancements, natural features and wildlife attractors have been designed into the proposed BMPs for the purposes of providing ecological diversity in addition to (and in support of) the BMP proposed functions of stormwater management. The objective of these diverse design elements is to enhance the overall habitat complexity and ecological values at each proposed BMP site. For example, irregularly shaped wetland edges with coves and peninsulas have been included in the lower watershed proposed BMPs in order to create a more complex shoreline edge. Irregular shorelines increase the linear footage of edge habitats available for feeding and provide smaller secluded areas preferred by more reclusive species (see the discussion below). Small islands have also been included in the proposed BMP designs as ecological features called hummocks, aimed at diversifying the otherwise permanent pool habitat.

Wildlife observed during field surveys as well as the current literature and survey data suggests that the proposed BMPs could provide habitat to a wide range of avian species. It is the objective of the proposed project to build upon the opportunities created by the current ecology of the watershed, by expanding and diversifying these habitats and wildlife attractors. To this end, proposed BMP designs would provide, for example, habitat attractors for coastal nesting and feeding birds (once prey populations such as invertebrates and fish colonize the proposed BMPs).

There are also species, including rails and secretive marsh birds, migratory waterfowl species, and a variety of passerines (particularly marsh-obligate species) that require structure for nest construction and inhabit the Bluebelt properties during breeding, migratory, and overwintering periods. Additionally, existing wetlands provide habitat for reptiles and amphibians. Since some portion of the approximately 94 acres that comprise the large Bluebelt properties of the lower watershed would remain as a buffer area of protected Bluebelt property, the common reed habitat would continue to provide this wildlife function, thereby supplying an overall mix of beneficial habitats on DEP Bluebelt property.

Since the New Creek watershed lies within the Eastern Flyway migration route it presents an opportunity to enhance habitat for migratory birds and other avifauna. Several of the critical stormwater wetland design elements currently employed by the Staten Island Bluebelt program for flood control and water treatment are similar to the restoration criteria used in waterfowl habitat creation projects around the region. These include deep water zones, shallow water zones with emergent vegetation and fluctuating water levels. Shallow water zones with a diverse native wetland plant community are preferred feeding areas for dabbling ducks, herons, and egrets. Other species prefer to forage along the edge of the deep and shallow water areas, such as wood ducks. These proposed “nesting islands” provide predator-free nesting, resting, and feeding sites for mallard ducks and other waterfowl. The incorporation of wildlife habitat improvement techniques such as these would increase the habitat value of the stormwater detention wetlands in these otherwise heavily altered watersheds. Given that the lower watershed proposed BMP sites are along the migratory flyway, there is the potential to attract to these habitats some of the 325 species of waterfowl and other bird species that are reported in the Jamaica Bay wetlands to the east.

Lastly, a variety of other wildlife species, including reptiles and amphibians (spring peeper, green frog), migratory passerines (warblers, sparrows, etc), mammals (including water-dependent species), and insects are also present in various populations within these wetlands under existing conditions. Assuming suitable vegetative cover with complexity in understory/overstory is integrated into the proposed BMPs, and with the proposed open water, wooded island, and other ecological enhancements of the proposed BMP designs, the project would support and enhance native habitat values for terrestrial wildlife species, along with open water habitat for water-dependent mammals, reptiles and amphibians, and insects.

As shown in the BMP proposed conceptual designs as summarized in Table 4.9-11, the proposed project would widen and improve the overall hydrologic functions of the Lower New Creek watershed streams, which is the portion of the watershed where fish have been identified, and would also improve water quality and aquatic habitats because of increased stormwater inputs that would be filtered by the proposed BMPs. The proposed project would also provide widened, deepened, and enhanced shoreline habitat and a greater variety of aquatic habitats, including extended shorelines and deep pools, for fish that have been reported in the New Creek watershed and the Mid-Island area as a whole. This enhancement would also support wading birds that may

feed upon these fish. Therefore, the proposed project would provide multiple benefits for aquatic resources in the New Creek watershed by converting degraded wetlands and highly stressed streams into enhanced habitats for aquatic resources. In the absence of the proposed project, hydrology and water quality conditions in the Mid-Island watersheds would be expected to further decline.

A more detailed description of potential impacts at each proposed BMP site follows.

IMPACTS AT INDIVIDUAL BMPS

BMP NC-1: MERRICK AVENUE

This proposed BMP would formalize and control stormwater flow into the downstream wetlands at this site. In terms of stormwater quality, the velocity attenuator and spot stabilization design features that are part of this proposed BMP would be used to dissipate flow intensity, thus reducing erosion and improving the quality of the stormwater that would be diverted to wetland NA-5. Therefore, the proposed BMP is expected to result in an improvement over the "no build" condition along this stream corridor and ultimately the runoff delivered to wetland NA-5. The maintenance access to the proposed BMP would extend from the developed end of Merrick Avenue and would not be expected to have a significant adverse impact on natural resources.

With respect to vegetation and trees, the proposed BMP would be in an area that has been previously disturbed. Under the proposed project, the disturbed community would be cleared and graded for the proposed BMP. This would involve the removal of vegetation characteristic of disturbed areas. Subsequently, the proposed BMP would be planted with native grasses, herbaceous plants, shrubs, and trees.

In the vicinity of the downstream swale, some trees within Reeds Basket Willow Swamp may need to be cleared in the event that streambank stabilization is agreed to between DEP and DPR. Assuming some streambank stabilization is proposed, during final design site specific survey data would be used to minimize clearing and avoid the clearing or larger specimen trees. In addition, as a design objective, this proposed BMP would stabilize the downstream slopes, thus reducing future indirect impacts and loss of trees and understory vegetation due to gully erosion. As a result, the proposed BMP would be an improvement over conditions in the future without the proposed project.

While birds and mammals that are known or expected to occur within Reeds Basket Willow Swamp Park may use this site on a transient basis, the proposed BMP site and its upland edges would not be heavily utilized by amphibians and reptiles given its degraded condition, but would be found in other higher quality habitat would use this site. As stated above, the proposed design objectives would reduce erosion and downstream sedimentation, which should enhance the potential long term use of the site for wildlife. This would be a positive wildlife impact. There are also no fish or aquatic resources habitats at this site that would be adversely impacted. Therefore, the proposed BMP would not have significant adverse impacts on wildlife.

BMP NC-2: OCEAN TERRACE

This proposed BMP would require limited clearing of trees and understory and overall, given the limited area that would be impacted (0.1 acres) and given the fact that the site is situated between two existing residences, this impact is not expected to be significant. In addition, areas not occupied by the proposed velocity attenuator would be re-landscaped as part of the proposed BMP design. The potential downstream bank stabilization would be installed for the purposes of reducing erosion and potential downstream indirect impacts of sedimentation in Reeds Basket

Willow Swamp Park. Any proposed tree clearing or proposed BMP elements associated with bank stabilization within Reeds Basket Willow Swamp Park would also require the review and approval of DPR for activities within the park. Final design for a proposed BMP would also include coordination with DPR and tree clearing would require a tree mitigation plan in coordination with DPR. Therefore, the proposed BMP would not result in potential significant adverse impacts on vegetation and trees.

The site of the proposed BMP provides limited wildlife habitat value, primarily because of its small size and location adjacent to built residential sites. However, the reach of the stream below the proposed BMP outlet does provide habitat within Reeds Basket Willow Swamp Park. The proposed project may install bank stabilization downstream of the proposed BMP for the purposes of reducing erosion and the potential downstream adverse effects of sedimentation. If so, the proposed project would coordinate these activities with DPR in order to avoid or minimize impacts. There are also no fish or aquatic resources habitats at this site that would be adversely impacted. Therefore, the proposed BMP would not result in potential significant adverse impacts on wildlife.

BMP NC-3: ANNFIELD COURT

The proposed project would require a limited clearing of trees and understory but overall, given the limited area that would be impacted (0.3 acres) and given the fact that the site is parallel to an existing developed road edge (Annfield Court) and across from residences, impacts to ecological communities and habitats are not expected to be significant. In addition, the proposed BMP would include small permanent pools (about 0.1 acres) and extended detention (about 0.1 acres). Any proposed tree clearing or BMP proposed construction activities within Reeds Basket Willow Swamp Park would require the review and approval of DPR. Final designs for the proposed BMP would also include coordination with DPR and tree clearing would require the development of a tree mitigation plan in coordination with DPR (see also Chapter 8.1, "Mitigation"). Therefore, the proposed BMP would not result in potential significant adverse impacts on vegetation and trees.

The site of the proposed BMP provides limited wildlife habitat, primarily because of its location adjacent to a built road and across from residential properties (thus it is not a high value interior woodland). There are also no fish or aquatic resources habitats at this site that would be adversely impacted. The proposed BMP would also be designed as a natural feature and would provide a regular flow of water to and across the proposed BMP with finished landscaping that would, after of period of establishment, integrate with the adjoining wetland habitats. This would be a positive impact for aquatic resources. In addition, bank stabilization, as necessary, would further reduce downstream erosion and the adverse affects of sedimentation.

Therefore, the proposed BMP would not result in potential significant adverse impacts on wildlife.

BMP NC-4: WHITLOCK AVENUE

The location of the extended detention component of this proposed BMP is primarily within an area of maintained lawn on the Richmond County Country Club golf course. As such, the proposed BMP would not disturb habitat or existing mapped wetlands. Overall, this proposed BMP is expected to enhance plant and animal diversity at the site while also providing an additional 0.14 acres (estimated) of freshwater wetland acreage.

Installation of the storm sewer conveyance from the end of Whitlock Avenue to the proposed BMP would be sited through habitat characterized as "successional southern hardwoods." Due to past disturbances (debris/clearing), species composition, and surrounding land uses, this sewer corridor has low ecological value and would not be expected to support a wide range of wildlife. Some loss of incidental sweet gum, black cherry, and tulip trees greater than 4 inches in diameter at breast height is expected. However, the forest understory at this site is predominantly non-native species. A proposed BMP landscaping plan comprised of native tree and shrub species would enhance floral richness and improve upland habitat value on the site. This would be a positive impact of the proposed BMP.

In addition to the proposed BMP, a storm sewer is proposed in Whitlock Avenue to convey flows from Todt Hill Road and to collect flows from an existing south flowing unnamed drainage swale across private property to the south of Whitlock Avenue. With the proposed sewer and proposed BMP improvements, this swale would no longer receive any significant runoff. This drainage swale (or intermittent stream) currently runs through existing domestic yards and is subject to significant erosion and incising. This site is not a mapped NYSDEC or NWI wetland and provides low quality habitat. Therefore, the diversion of runoff from this swale is not a significant impact of the proposed project. There are no fish or aquatic resources habitats at this site that would be adversely impacted. In addition, the proposed project would expand wetland acreage as part of the proposed BMP. Therefore, this proposed BMP would not have a potential significant adverse impact on vegetation and trees.

Wildlife with the potential to use this site would include those that can tolerate urban/suburban environments. Given the current conditions, the proposed BMP is expected to result in an overall improvement of habitat at this site both within the permanent pool and the extended detention basin as well as the reclaimed upland habitat. Impacts on wildlife habitat at this proposed BMP are concluded to be positive as it would provide for added nesting and foraging opportunities with created aquatic features.

Therefore, the proposed BMP would not result in potential significant adverse impacts on wildlife.

BMP NC-5: TODT HILL ROAD

There are no NYSDEC and NWI mapped wetlands at this proposed BMP location, nor were any wetland indicators observed during the field investigations. However, with the proposed BMP, an increase of about 0.77 acres of additional freshwater wetland acreage is expected through the grading of upland and the added hydrologic inputs, coupled with the proposed planting program of the proposed BMP.

This proposed BMP site consists of a narrow strip of upland woodland that transitions into the maintained lawn/grassland of the golf course. The lawn/grassland area is located in a wet depression within the golf course, and consists primarily of a "rough" along the edge of the golf course. Although several trees greater than 4 inches in diameter at breast height may need to be cleared to create the proposed BMP, including black cherry, white pine, and hackberry, the bulk of the proposed BMP would be constructed within the existing lawn/grass habitat. This existing condition, therefore, exhibits low vegetative diversity and low ecological value and with the proposed BMP this site would be planted with native herbaceous species and the expanded wetlands. Therefore, it is expected that the habitat values at this proposed BMP would improve with the proposed project.

In addition to the proposed BMP, an un-named drainage swale currently conveys surface water through wooded portions of the residential neighborhood just upstream from the proposed BMP site. One stretch of that swale flows dangerously close to the foundation of a house that fronts on Todt Hill Road. With the construction of this proposed BMP and the associated sewers, this swale would no longer be necessary to convey runoff. Habitat values along the swale are limited given the eroded conditions and the alignment between existing yards and built residences. By diverting stormwater flows from this watercourse, and redirecting it to the proposed BMP via the proposed storm sewer network of Todt Hill Road, there would be less water flowing to this swale, however, given its low ecological value, no significant impacts are expected from this diversion. There are also no fish or aquatic resources habitats at this site that would be adversely impacted. In addition, there would be the benefits of the added functional wetlands of the proposed BMP. Therefore, this proposed BMP would not result in potential significant adverse impacts on vegetation and trees.

As stated above, the majority of the proposed BMP footprint is previously disturbed with the golf course's maintained grass. Thus, there is currently limited wildlife habitat value at this proposed BMP site. As stated above, the proposed BMP would be expected to improve and diversify the overall ecological community at this location with created aquatic features. Therefore, no adverse impacts to resident or migratory wildlife are expected as a result of the proposed BMP. Rather, proposed BMP NC-5 is expected to provide additional wildlife attractors that would improve the value of the site for wildlife habitat over the current condition. Therefore, this proposed BMP would not result in potential significant adverse impacts on wildlife.

BMP NC-6: BOUNDARY AVENUE

Conceptual BMP Design Objectives

The current design concept for proposed BMP NC-6 (see Figure 4.1-8) is the result of an iterative process of evaluating the hydrology needs and objectives of the proposed New Creek drainage plan coupled with the natural resources baseline condition of the site, with the objective of creating a proposed BMP design that meets the project stormwater management objectives of the project with the least impact to natural resource habitats. For example, the proposed orientation of the proposed BMP has been shaped to avoid (to the extent possible) important woodlands stands in the southern portion of the site while clearing and using the less valuable successional southern hardwood and urban vacant lot communities in the northwestern portion of the site for floodwater storage. In this way, the proposed BMP conceptual design avoids the more important mature woodland stand in the southwest corner of the site. In addition, the proposed BMP conceptual design incorporates preservation of mature woodlands along the site periphery, including the Midland Avenue frontage, where there are stands of larger trees. The proposed BMP conceptual design also calls for a buffer of trees to be preserved along the Boundary and Lincoln Avenue frontages. The excavation proposed as part of the proposed BMP construction would also remove mounds of fill material and construction debris at the site, which would be a benefit with respect to improving the understory vegetation and wetland conditions.

In the habitats to be created by the proposed BMP, there would be an estimated 2.46 acres of open water and emergent wetland. These habitats would be achieved through expanded open water with a permanent pool and emergent vegetation and an area of extended detention that would be expanded and new wetland habitats types for this site that would be supported by the proposed stormwater inputs of the proposed drainage plan. With the proposed BMP designs,

these wetlands would be revegetated with a variety of native wetland herbaceous plants comprised of grasses, vines, shrubs, and trees.

The currently proposed BMP design is conceptual. It is expected that the proposed BMP final design would be further refined in coordination with DPR and based on survey data that would include detailed tree survey and topographic information (see the discussion below under "Final BMP Design, Habitat Protection and Tree Mitigation").

Changes in Habitat Cover

The proposed site of BMP NC-6 is largely a mature woodland surrounded by built City streets and development comprised of residential, commercial and community facility uses. Although it is isolated, it provides one of the few remaining stands of high quality woodland wildlife habitat in the New Creek watershed above Hylan Boulevard. The mature woodland communities of this BMP would therefore continue to provide stopover, breeding, and foraging habitat to numerous wildlife species attracted to woodland habitats (particularly migratory and resident birds).

Table 4.9-12 presents the changes in vegetative habitat cover at NC-6: Boundary Avenue based on the proposed BMP conceptual design presented in Figure 4.1-8 and assuming the reasonable worst-case clearing and grading impacts.

Table 4.9-12

Changes in Vegetative Cover with the Proposed BMP NC-6: Boundary Avenue

Ecological Community	Estimated Acreage (Existing Condition)	Acreage with Proposed BMP
Riverine (marsh headwater stream, culturally modified)	0.18	0.00
Terrestrial (successional woodland street edge an vacant lot)	0.84	0.00
Terrestrial (Successional Woodland)	0.94	0.74
Successional Southern Hardwood (Red Maple)	0.74	0.35
Red maple/hardwood swamp	1.37	0.79
Coastal Oak Hickory Woodland	1.79	1.61 (1)
Ephemeral Pools (with wetland grasses)	0.00	0.14
Open water (with aquatic plants)	0.00	1.06
Shallow Emergent Marsh	0.00	1.17
Total	**5.86**	**5.86**

Notes: Habitat estimates were calculated based on aerial photographs, field observations, site survey (May, 2012) and proposed impact figures. Ecological communities based on Edinger. et.al. January 2002.
(1) BMP buffer area proposed for restoration including removal of debris, invasive brush and new herbaceous, shrubs and tree plantings.

Sources: AKRF, Inc. 2010; Hazen and Sawyer, February 2013

With respect to habitat clearing, an estimated 1.6 acres of successional southern hardwood and urban vacant lot communities, primarily in the northwestern portion of the site, would be cleared for the installation of the proposed BMP. These communities are present along Boundary Avenue and have a woodland composition that is representative of immature forest that does not have as strongly a developed canopy as is present in the mature forest of the southern portion of the Boundary Avenue open space.

Under the proposed project, removal of box elder and Norway maple trees in the canopy, box elder, black cherry, hickory, mulberry, and tree-of-heaven in the sub-canopy, and multiflora rose and greenbrier in the shrub stratum of this area would not represent a significant habitat loss, nor would the removal of the vegetation within the urban vacant lot community.

Tree Clearing

As shown in **Table 4.9-13a**, it is estimated that 239 trees may be cleared to create the proposed BMP. (This is a conservative worst case based on the current preliminary design for the proposed BMP as well as the detailed tree survey for the site.) Of this total, approximately 36 percent of the trees at the proposed BMP site are non-native species including sweet cherry, Norway maple, white mulberry, tree of heaven and black locust. Of the native trees, it is estimated (based on a percentage basis from the baseline data) that about 8 box elder, 9 black birch, 12 sassafrass, 12 American elm, 21 red maple, 38 sweet gum, and 52 oaks including black, pin, white, and scarlet oaks, would comprise the trees that may need to be cleared. A breakdown of the estimated tree composition at this proposed BMP site is provided in **Table 4.9-13b**. The majority of this clearing total would be in coastal oak, urban vacant lot and successional southern hardwood habitats communities and the majority of these trees are 24 inches dbh or less. With respect to larger trees (greater than 24 inches dbh) that may be removed in these two habitats, this is estimated to total about 10 trees in the successional southern hardwoods and red maple swamp communities. Final design for the proposed BMP would provide site-specific survey information that would be used to identify large trees such as these and preserve them as well to the extent possible by integrating the large and specimen trees into the preservation areas of the proposed BMP design (see the discussion below).

Table 4.9-13a
Estimated Tree Clearing: Proposed BMP NC-6 Boundary Avenue

Ecological Community		Acres of Impacted Habitat (cleared)	Trees 4 to 6" dbh/ Impacted Habitat	Trees 7 to 12" dbh/ Impacted Habitat	Trees 13 to 24" dbh/ Impacted Habitat	Trees per Impacted Habitat 24+ dbh	Total Trees per Impacted Habitat
Coastal Oak/hickory forest		0.33	8	19	8	0	35
Terrestrial (successional woodland of street edge and vacant lot)		0.74	36	37	5	0	78
Successional southern hardwoods		0.47	20	22	1	0	43
Successional southern hardwoods (with red maple)		0.58	6	16	25	4	51
Red maple/hardwood swamp		0.65	2	8	16	6	32
Riverine (marsh headwater stream, culturally modified)		0.18	0	0	0	0	0
Total		2.95	72	102	55	10	239

Notes: Tree clearing estimates are based on site survey (May 2012) and BMP schematic design (March 2013).
Source: Hazen and Sawyer, February 2013.

Table 4.9-13b
Boundary Avenue: Tree Composition

Tree Type	Percent of Total
Invasive	36.1
Oaks (pin, black, scarlet, white)	22.0
Sweet gum	16.1
Red maple	8.9
American elm	5.3
Sassafras	5.3
Black birch	3.5
Box elder	2.8
Total	100

Source: AKRF, January 2011.

Habitat and Tree Preservation

With respect to preservation areas at the Boundary Avenue site, as shown in **Table 4.9-14**, approximately 2.2 acres of predominantly coastal oak/hickory forest and red maple/hardwood swamp would remain with the proposed BMP in-place along with an estimated 0.6 acres of successional southern hardwood communities. Within the southern portion of the Boundary Avenue open space, an estimated 1.7 acres of red-maple/hardwood swamp and coastal oak/hickory forest would remain.

Table 4.9-14
Estimated Trees Remaining: Proposed BMP NC-6: Boundary Avenue

Ecological Community	Acres of Existing Habitat (protected)	Trees 4 to 6" dbh	Trees 7 to 12" dbh	Trees 13 to 24" dbh	Trees 24+ dbh	Total Trees Protected
Coastal Oak/hickory forest	1.46	16	50	59	8	133
Successional southern hardwoods	0.48	20	74	45	5	144
Successional southern hardwoods/red maple swamp	0.16	0	10	9	0	19
Urban vacant lot	0.10	13	18	3	0	34
Red maple/hardwood swamp	0.71	4	18	42	10	74
Riverine (marsh headwater stream, culturally modified)	0.00	0	0	0	0	0
Total	2.91	53	170	158	23	404

Notes: Tree clearing estimates are based on survey data (May 2012) and BMP schematic design (March 2013).
Source: Hazen and Sawyer, February 2013.

In total, an estimated 404 trees would be preserved in this undisturbed portions of the open space, which have been avoided through the shaping of the proposed BMP design as presented in Figure 4.1-8 which has avoided the key habitats (such as the mature woodlands in the southwestern portion of the site, as discussed above). In addition, the proposed BMP conceptual design calls for a buffer of trees to be provided along the frontages of both Boundary and Lincoln Avenues.

Impacts on Avian Habitat

As stated above, the proposed BMP would modify the ecological communities at BMP NC-6: Boundary Avenue by removing a portion of woodland coverage. To minimize this impact, the currently proposed BMP conceptual designs have been developed with the objective of preserving the southerly portion of the Boundary Avenue site, targeting the proposed BMP clearing on the less valuable successional southern hardwoods and urban vacant lot habitats to the north and replacing these habitats with wetland features such as open water pools, channels, and an extended detention wetland that would bordered by mature woodland stands. However, the projected clearing of red maple/hardwood swamp and coastal oak/hickory habitats would reduce the acreage of habitat that currently attracts woodland canopy birds such as warblers and flycatchers. The avian wildlife that may currently use this site for its woodland cover is presented in **Table 4.9-15**.

Table 4.9-15
Avian Species Potentially Impacted By Habitat Changes at Proposed BMP NC-6: Boundary Avenue

Common Name	Scientific Name
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Willow Flycatcher	*Empidonax traillii*
Eastern Kingbird	*Tyrannus tyrannus*
White-eyed Vireo	*Vireo griseus*
Carolina Wren*	*Thryothorus ludovicianus*
Gray Catbird	*Dumetella carolinensis*
Yellow Warbler*	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Eastern Towhee	*Pipilo erythrophthalmus*
Baltimore Oriole	*Icterus galbula*

Note: (*) Breeding bird observed during spring and fall 2009 and 2010 field reconnaissance.
Source: NYS Breeding Bird Atlas (2000-2005).

Although the woodland habitat at the site would be reduced in size, the approximately 2.9 acres of remaining mature woodland would continue to provide suitable habitat for woodland avian species. In addition, while reducing this woodland may diminish the attractiveness of the site to a limited number of forest interior breeding birds, such as hairy woodpecker, it would conversely increase site use by edge species (i.e., northern flicker) that nest or forage along open water and emergent wetland habitats. In addition, the proposed BMP would increase site use by waterfowl such as dabbling ducks (mallard/black) and wading birds as the open water habitats of the proposed BMP are created. Other avian species that may benefit from the increased habitat diversity would include species such as willow flycatcher, eastern kingbird, yellow warbler, and common yellowthroat.

The proposed BMP final design could also incorporate dead or collapsed trees, snags, and logs as wildlife attractors for the purposes of providing nesting, foraging, or cover opportunities for species such as woodpecker and other cavity dwellers, wood ducks, and other waterbirds. The proposed BMP would also include a substantial number of native wetland trees, shrubs, herbaceous plants and grasses. Over time, these habitats would mature, increasing habitat attractiveness for birds in the tree borders around the open water and wetlands.

Impacts on Reptiles and Amphibians

The created open water and added stormwater inputs to the BMP with the proposed drainage plan would increase wetland acreage at this site and its attractiveness to water-dependent reptile and amphibian species. Currently the open water and wetland habitats are limited to the existing watercourse (which is an intermittent stream; i.e., mostly dry in low rainfall periods), while the proposed BMP would provide a low flow channel, a permanent pool and extended detention zones. Thus, with the proposed BMP, increased wetland acreage increases potential use by water-dependent amphibian and reptile species that are present within the watershed and along South Staten Island. For example, the expanded open water habitats would provide the opportunity to increase on-site populations of frogs, snakes, toads, and salamanders that are

attracted to freshwater wetlands and their adjacent areas (see Appendix C). While some salamander species may utilize the ponded and saturated open wetlands, and ephemeral pools, others including the dusky salamander, northern red salamander, and northern two-lined salamander, would see some reduced habitat as the existing forested watercourse is replaced by the open water and emergent wetlands of the proposed BMP. While none of these species was observed during the field investigations, the proposed BMP NC-6: Boundary Avenue site would continue to provide woodland habitats that would support reptiles and amphibians that are attracted to forest floor habitats with the support of the adjacent open water wetlands.

Fish and Aquatic Resources

Because this site is at the headwaters of the New Creek West Branch and the stream is intermittent and shallow (particularly on the west side of the site), this site does not currently provide any viable fish habitat. The proposed BMP, however, would expand potential habitat for fish and other wildlife including aquatic-dependent macroinvertebrates that could migrate to the site.

Final BMP Design, Habitat Protection and Tree Mitigation

The impact analyses above are based on the current preliminary design for proposed BMP NC-6: Boundary Avenue (see **Figure 4.1-8**). Final design of this BMP is not expected for several years. During the BMP final design process, tree and topographic survey would be used for the purposes of further refining the BMP site design and identifying any additional opportunities that may exist to further avoid or minimize clearing of important habitats such or dense stands of trees and large specimen trees while providing a BMP that meets the hydrologic design objectives of the proposed New Creek Drainage Plan. As the first step in this process, as stated above, the conceptual proposed BMP design presented in this GEIS has avoided the important woodlands stands on the southerly portion of the proposed BMP site and along Midland Avenue. As final designs are developed, additional BMP design details would be coordinated with DPR using site survey with tree and topographic information that would be the basis for further identify any additional opportunities for "fingerprinting" the proposed BMP design to further minimize impacts while meeting the necessary flood storage requirement of the project. This final design would then be used to determine the final clearing acreages and the affected trees that would need to be addressed by a DPR-approved tree mitigation plan.

DEP would coordinate with DPR and DEC in that final BMP design, including the limits of habitats and trees and habitats to be cleared and trees to be preserved, particularly with the objective of preserving important woodland habitats and individual large and specimen trees and integrating those preserved trees into the final BMP design.

DEP would coordinate with DPR in developing a tree mitigation plan for the tree impacts at proposed BMP NC-6. The tree mitigation plan would be consistent with the City's Million Trees initiative and PlaNYC, and would ensure compliance with City rules and regulations governing the removal of trees within the City (including the requirements of Local Law 3 of 2010). DPR's planting guidelines would also be consulted and tree mitigation plans would be provided to DPR's Olmsted Center (capital projects) and Natural Resource groups as well as the borough offices. This tree mitigation plan may include the planting of replacement trees and/or other natural resource enhancing measures within the watershed or elsewhere in the area, depending on the site availability and overall ecological benefits. Tree mitigation may consist of the planting of trees along the upland borders of the created wetlands in order to provide natural vegetated edges. (Trees cannot be planted in proximity to the proposed wetlands zones of the proposed BMPs as the trees, once they mature, can shade out the wetlands). Tree mitigation

could also include planting at other proposed BMP sites within the New Creek watershed. In addition, the DEP Bluebelt Unit has a maintenance and monitoring program that is used to ensure the success of its planted ecozones at each proposed BMP. This program would reduce the potential effects of invasive species from colonizing the newly planted areas. Thus, this ongoing monitoring would support the tree mitigation plan implementation.

Implementation measures for the proposed BMP that would be implemented as part of the pre-design and final design process are presented in Chapter 8.1, "Mitigation."

WEST BRANCH BMPS (BMP NC-7: GRIMBSY STREET, BMP NC-8: FREEBORN STREET, BMP NC-9: GRAHAM BOULEVARD, BMP NC-10: JEFFERSON AVENUE)

With the proposed West Branch BMPs, approximately 14.3 acres of existing wetlands would be enhanced including 4.7 acres at proposed BMP NC-7, 0.7 acres at proposed BMP NC-8, 4.4 acres at proposed BMP NC-9, and 4.5 acres at proposed BMP NC-10. With respect to wetland changes, the proposed project would not create any new wetland acreage along this stream system, but would relocate the existing West Branch for the purposes of improving conveyance, reducing flooding impacts on adjoining properties and streets, providing additional storage for large storm events (in particular at NC-10) and supporting ecological restoration through wetland enhancements. Under the proposed BMP designs, extended detention planting zones would provide the opportunity for revegetating previously disturbed areas and for enhancing wetlands with the objectives of diversifying the wetland vegetation and communities along the West Branch. To meet this objective, where the current wetland conditions include substantial acreages of common reed with a narrow channel, the proposed project would expand the channel and open water habitats as well as improve and diversify the functions of the emergent wetlands. This provides both improved hydrology as well as enhanced wetland ecology. Moreover, at the site of the proposed BMP NC-10, the proposed project would establish a significantly improved wetland over current disturbed conditions. In addition, an existing piped segment of the West Branch at NC-8 (between Freeborn Street and Olympia Boulevard) would be re-created as a stream channel and floodplain in the center of the Bluebelt property with a mix of native wetland vegetation.

Also proposed at NC-10 are upstream improvements in the stream corridor east of Jefferson Avenue. Under existing conditions, the direction of flow in this channel is from west to east (and away from the East Branch). With the proposed project that flow would be reversed (towards the East Branch) so that the low-lying streets in this area can be drained. In addition, the reach of this stream would be fed by these proposed storm outlets that would support the newly vegetated wetland channel. Under the proposed project, new forebays would be installed with the storm sewer outlets proposed at Quincy Avenue, Iroquois Street and Jay Street to formalize the drainage system and reduce the current impacts of the uncontrolled runoff into existing wetlands. A proposed new culvert under Jefferson Avenue would also carry the flow westward to the proposed BMP NC-10 where it would continue through a newly vegetated low flow channel (or collect in the extended detention during storm events before overflowing the proposed Lower Bay outfall). These are positive impacts of the proposed project.

With respect to trees that are primarily found in the successional hardwood woodlands along the proposed BMP perimeters and some interior hummocks, final designs for the proposed BMPs would incorporate the concept of protecting these wooded edges to the extent possible. Where tree clearing is necessary, DEP would develop a tree mitigation plan. Therefore, the proposed BMPs would not result in potential significant adverse impacts on vegetation and trees.

The objective of the proposed project is to expand and diversify the wildlife attractors along the West Branch. To this end, the proposed West Branch BMPs would create and expand open water and provide greater diversity in the emergent wetland habitats that would support greater populations and diversity of water-dependent wildlife such as coastal nesting and feeding birds. The natural areas created by the proposed BMP and the proposed wildlife habitat, once planted and after a suitable grow-in period (and once prey populations such as invertebrates and fish have colonized the proposed BMPs), would provide habitat for many of the species one would find in the lower coastal watershed of the Mid-Island area. This would include perching and wading birds, urban tolerant reptile and mammal species such as the painted turtle, snapping turtle, and muskrat that have been observed in the lower watershed.

The proposed West Branch BMPs would also incorporate a series of special wildlife attractors into the proposed BMP design specifically for the purposes of enhancing wildlife habitat values. For example, proposed BMP NC-7 includes two deep ponds and irregularly shaped wetland edges with coves and peninsulas. Although NC-8 is one of the smaller BMPs proposed along the West Branch, with the creation of an open stream channel replacing a piped segment, it too has the potential to attract perching and wading birds, and urban tolerant reptile and mammal species such as the painted turtle, snapping turtle, and would serve as an important new stream connection between with larger proposed BMPs NC-7 and NC-9. At proposed BMP NC-10 proposed wildlife attractors include a deep pond and wooded island. Moreover, since the existing stream has limited open water and is interrupted by filling or piping and is constricted along many segments by common reed, the expanded water area with the proposed BMPs (including the stream realignment and proposed perched pools) would expand habitat for fish and other aquatic resources including macroinvertebrates that could then migrate from the more open waters of the Main Channel where fish species have been identified. The installation of the proposed storm sewers and proposed BMPs and the resultant increase in water quality are expected to benefit the macroinvertebrate community with respect to total population and diversity. The proposed BMP system includes more diverse aquatic habitats such as deep pools, vegetated shallow wetlands, and ephemeral pools which have the potential to support different macroinvertebrate species and communities. Stream stabilization and restoration is also planned in the watersheds with stone substrates that have the potential to support additional species. Thus, the realigned and enhanced stream corridor that would be created by the proposed series of BMPs proposed along the West Branch would benefit a range of wildlife resources.

Therefore, these proposed BMPs would not result in potential significant adverse impacts on wildlife.

BMP NC-11: LAST CHANCE POND

Conceptual BMP Design Objectives

Given the intensive need for upstream floodwater storage at this location—which is at the headwaters of the New Creek Main Channel--the conceptual design first proposed for BMP NC-11 required clearing and re-grading much of the site with the exception of the street edges. That design would therefore have required clearing much of the Last Chance Pond wetlands and the full clearing of all habitats. To minimize the natural resources impacts of the proposed BMP, DEP (as part of a design coordination effort with DEC) has modified the proposed BMP design to the current concept (see **Figure 4.1-11**), which has been shaped to avoid, to the extent feasible, important ecological features at the Last Chance Pond property such as the wet woods (silver maple swamp) northwest of Husson Street and west of Naughton Street and a mature wet woods with high quality understory (red maple swamp) south of Zoe Street and east Stobe

Avenue. These areas are avoided to the extent feasible in the BMP conceptual design. In addition to avoiding more sensitive areas, the proposed BMP footprint has been shifted southward into a currently common reed dominated wetland (to include a mapped, but unbuilt, segment of Joyce Street) and storage capacities were increased at several downstream BMPs, including NC-12, NC-13, and NC-14, with the objective of minimizing the storage need and the associated clearing and grading at Last Chance Pond. It is also proposed in this design to expand an existing silver maple swamp through the proposed BMP planting plan and to restore the woodland edge habitats that would provide a border around the interior wetlands.

The proposed drainage plan and BMP design includes four storm outlets with forebays at the periphery of the BMP that would be installed in the street edge habitats with two other outlets proposed at locations already disturbed by outfalls. These proposed outlets would be located primarily in areas of lesser ecological value and the partial removal of a storm sewer from Stobe Avenue would allow restoration with expanded stream and open water. The proposed storm outlet and forebay from Cletus Street would also be sited at a location that is currently dominated by common reed. The storm outlets and forebays at Seaver Avenue and Husson Street would require clearing in higher quality wetlands near silver maple swamp and emergent marsh communities. However, these proposed BMP features would provide the necessary stormwater inputs to the proposed permanent pool and extended detention systems which would support emergent marsh and higher quality red-maple hardwood swamp.

The current design for the proposed BMP is conceptual. The BMP final design would be further refined in coordination with DPR and DEC during the final design process using detailed tree inventories and topographic information (see the discussion below under "Final BMP Design, Habitat Protection and Tree Mitigation").

Changes in Habitat Cover

Table 4.9-16 shows the changes in vegetative cover at this site with the proposed BMP. To achieve the necessary floodwater storage, the proposed BMP would require clearing and grading within some higher quality interior habitats to create the expanded open water and emergent wetland habitats of the proposed BMP. The habitat changes over the 15.2 acre parcel (which includes the BMP footprint and the surrounding buffer area, all of which is City-owned land) show limited clearing of some ecologically significant cover types; this clearing is also offset by increases in other habitats with an overall greater diversity of wetland types in the proposed BMP. The proposed BMP has been designed so that the majority of the clearing is within cover types of limited natural resource value, such as previously disturbed terrestrial habitats (characterized by fill piles and invasive trees and understory with little vertical structure), common reed dominated wetlands, and stream channels that have eroded due to uncontrolled stormwater inputs.

With the proposed BMP, the existing shallow emergent marsh of the Last Chance Pond wetlands, including all of the common reed-dominated habitats (which together total about 2.85 acres) would be cleared and graded, primarily to create the open water habitats of the proposed BMP. In addition, the existing small ponds and streams (which total about 0.65 acres) would be integrated into the proposed BMP as part of the permanent pool. A portion of the existing red maple hardwood swamp (about 3.7 acres) would be also cleared and graded to become part of the BMP's extended detention wetland. The existing arrow arum dominated emergent wetland (0.67 acres) would also be cleared, but then replaced in part as part of the BMP (arrow arum restoration area about 0.48 acres). **Figure 4.1-11** presents the current preliminary design for the proposed BMP NC-11: Last Chance Pond and **Table 4.9-16** shows the changes in habitat at thus site with the current conceptual design.

Table 4.9-16
Changes in Vegetative Cover with the Proposed BMP NC-11: Last Chance Pond

Ecological Community	Estimated Acreage (Existing Condition)	Acreage with Proposed BMP
Riverine (marsh headwater stream, culturally modified)	0.65	0.00
Terrestrial (modified street edge and dike impoundment)	3.37	0.00
Terrestrial (Successional Old Field)	0.17	0.00
Red maple/hardwood swamp (silver maple swamp dominated)	0.88	1.41
Red maple/hardwood swamp (red maple/sweetgum dominated)	6.64	2.73 (1)
Shallow emergent marsh (arrow arum predominant)	0.67	0.70 (2)
Shallow emergent marsh (with wetland emergent plants)	0.00	0.27
Ephemeral Pools (with arrow arum and wetland grasses)	0.00	0.41
Shallow emergent marsh (common reed predominant)	2.85	0.00
Open water (with aquatic plants, primarily water lily)	0.00	3.37
Shallow Emergent Marsh (swamp rose mallow predominant)	0.00	2.78
Successional southern hardwoods (oak dominated)	0.00	3.53
Total	15.2	15.2

Notes: Habitat estimates were calculated based on aerial photographs, field observations, site survey (June 2012) and proposed impact figures. Ecological communities based on Edinger. et.al. January 2002.

(1) BMP buffer area proposed for restoration including removal of debris, invasive brush and new herbaceous, shrubs and tree plantings.

(2) Includes plant rescue and new plantings.

Sources: AKRF, Inc. and Hazen and Sawyer, February, 2013.

One higher-value habitat that would be cleared by the proposed project is red maple/hardwood swamp (red maple/sweet gum dominated). The clearing and grading of about 3.9 acres of this habitat (about 40 percent of the total on-site habitat) is offset by a number of improvements proposed with the BMP. For example, with the proposed project, the successional southern hardwoods habitat (about 3.9 acres) would be created by converting the terrestrial street edge and successional old field habitats into a more densely wooded buffer to the interior wetlands. This would be achieved through removal of debris, fill, and invasive trees and understory shrubs coupled with an intensive planting program of native canopy and understory trees, shrubs, and groundcover to create a full vertical woodland structure out to site boundary. A small portion of the successional southern hardwoods cover type (0.36 acres) results from clearing and grading a narrow piece of red maple/hardwood swamp (red maple/sweet gum dominated) for the proposed extended detention basin and then aggressively replanting this zone.

With the proposed BMP, the red maple/hardwood swamp habitat (silver maple dominated) north of Husson Street (between Seaver and Naughton Avenues) would be expanded by 0.21 acres. This increase would be the result of the clearing the common reed cover type adjacent to the existing silver maple swamp, then grading and planting silver maple (and other trees) to expand this habitat. The

proposed BMP design would also unify the existing hydrologic regimes at the site (i.e., its streams and ponds), to create about 3.1 acres of permanent pool open water that would have an average depth range of 6 inches to about 3 feet--up to 5 feet when flooded during storm events.

The ecological value of a site is not based solely on its tree density, but also its habitat types and diversity. A variety of birds, reptiles, and amphibians currently use the microhabitats at the proposed BMP NC-11: Last Chance Pond site, including its different live and standing dead trees, pocket of ponded and water, muck, and thick protective stands of vegetation. The proposed BMP would modify habitats, but would retain the current composition of ponds (open water), wet woods, emergent wetlands and buffer areas that currently characterize the Last Chance Pond wetlands. The proposed BMP design would also expand and bring new ecological zones to the Last Chance Pond property including:

- Ephemeral pools (with arrow arum and wetland grasses);
- Shallow emergent marsh (with arrow arum and swamp rose mallow predominant); and
- Open water (with deeper zone and aquatic plants).

These three zones would provide significant ecological benefits, diversifying the wetland vegetation and increasing wetland functions and values. With the shallow emergent marsh cover type (arrow arum predominant), the limited reduction in habitat at the two existing arrow arum dominated wetlands (currently separated by a narrow man-made berm), would be more than offset by removal of the berm (artificial fill) and the creation of new shallow emergent marsh planted with arrow arum that would be salvaged from the existing ponds along with newly planted arrow arum both in the BMP's wetland shelves around the extended detention zone and in the ephemeral pools. Currently the arrow arum-dominated marsh is 0.67 acres; with the proposed project arrow arum marshes would total 1.11 acres (0.70 acres in the new shallow emergent marshes and 0.41 acres in the ephemeral pools.)

In sum, the proposed BMP NC-11: Last Chance Pond plan effectively offsets losses in ecologically important habitats through habitat enhancement, expansion, and diversification. A more detailed description of the this habitat change follows.

Tree Clearing

As shown in **Table 4.9-17a**, based on the current preliminary design and detailed tree survey for the site, it is estimated that 617 trees may need to be cleared to create the proposed BMP. The majority of these trees (about 448) would be removed in the red maple-hardwood swamp (in habitats dominated by red maple and sweet gum) and most of these trees are less than 24 inches dbh in size. Based on the tree survey data collected for the site, approximately 26.4 percent of the tree species are also non-native including black locust, white willow, white mulberry, and tree of heaven. Of the native trees, it is estimated (based on a ratio developed from the baseline data) that about 26 black gum, ash or pin oak, 26 box elder, 44 black cherry, 55 sweet gum, and 304 maples, including both red and silver maple but predominantly red maple) would comprise the trees to be cleared. A breakdown of the estimated tree composition based on the site survey data is provided in **Table 4.9-17b**. As discussed above, part of the proposed BMP final design, a final tree survey would be conducted in order to determine the final number of trees to remain and trees to be cleared as was well as the opportunities that may be available to further avoid particular habitats and the dense stands of trees (see also the discussion below).

Table 4.9-17a
Estimated Tree Clearing: Proposed BMP NC-11 Last Chance Pond

Ecological Community		Acres of Impacted Habitat (clearing and grading)	Trees 4 to 6" dbh / Impacted Habitat	Trees 7 to 12" dbh / Impacted Habitat	Trees 13 to 24" dbh / Impacted Habitat	Trees 24+ dbh per Impacted Habitat	Total Trees per Impacted Habitat
Red maple/hardwood swamp (red maple/sweet gum dominated)		4.8	87	238	108	15	**448**
Terrestrial (modified street edge and successional fields)		1.14	24	57	26	1	**108**
Red maple/hardwood swamp (silver maple dominated)		0.17	0	21	1	6	**28**
Shallow emergent marsh (common reed dominated)		2. 56	5	16	1	0	**22**
Riverine (marsh headwater stream, modified)		0.64	4	5	1	0	**10**
Shallow emergent marsh (arrow arum dominated)		0.67	0	0	0	0	**0**
Terrestrial (successional old field)		0.17	0	1	0	0	**1**
Total		**10.04**	**120**	**338**	**137**	**22**	**617**

Notes: Tree clearing estimates are based on survey data (June 2012) and BMP schematic design (March 2013).
Source: Hazen and Sawyer, February, 2013.

Table 4.9-17b
Last Chance Pond: Tree Composition

Tree Type	Percent of Total
Invasive	26.4
Red maple	24.6
Silver maple	24.7
Sweet gum	8.7
Black cherry	7.1
Box elder	4.2
Green ash/Black gum/Pin oak	4.3
Total	100

Source: AKRF, January 2011.

In addition to the removal of trees greater than 4 inches dbh, several small trees and shrubs (< 4 inches dbh), including large specimens of spicebush (2 inches dbh) within the red maple-hardwood swamp, along with the herbaceous layer would be cleared. Where possible, final design for the proposed BMP would utilize the interior wetlands at Last Chance Pond for plant salvage and replanting in the proposed wetlands (i.e., existing wetland plants, such as arrow arum would be transplanted from this location). Thus, some of the transplantable specimens would be preserved for planting in the wetland detention basin of the proposed BMP. Although it is not expected that there would be full survival of the transplanted vegetation, the DEP Staten Island Bluebelt Unit has a monitoring and maintenance program that supports its BMP ecological zones, monitors, and replaces both transplanted and planted species within each BMP as needed (see the discussion below).

Habitat and Tree Preservation

As shown in **Table 4.9-16** and **Table 4.9-18**, approximately 5.1 acres, including an estimated 1.8 acres of red maple/hardwood swamp and 0.57 acres of silver maple swamp, would remain at proposed BMP NC-11: Last Chance Pond. There would also be the approximately 2.3 acres of

upland habitat along the site periphery that would be restored and planted with trees that would reflect an oak-dominated successional hardwood community. The proposed planting and restoration plan would provide a dense tree buffer to the proposed interior open water and emergent wetland habitats of the proposed BMP. Within the area of the site to be protected there are an estimated 602 existing trees that would be supplemented by the additional trees to be planted as part of the proposed BMP design. (As stated above in the original design scenario for the proposed BMP there was essentially full clearing of the site from street line to street line and all of these trees were proposed to cleared. The proposed and currently proposed BMP design as presented in this GEIS has been shaped around these habitats and these trees are now preserved.)

Table 4.9-18
Estimated Trees to Remain: Proposed BMP NC-11: Last Chance Pond

Ecological Community		Acres of Existing Habitat (protected)	Trees 4 to 6" dbh	Trees 7 to 12" dbh	Trees 13 to 24" dbh	Trees 24+ dbh	Total Trees Protected
Red maple/hardwood swamp (red maple/sweet gum dominated)		1.83	49	147	61	6	**263**
Terrestrial (modified street edge) [(1)]		2.30	27	119	48	18	**212**
Red maple/hardwood swamp (silver maple dominated)		0.71	40	44	29	1	**114**
Terrestrial (successional old field)		0.11	0	0	0	0	**0**
Emergent Marsh (common reed dominated)		0.19	5	8	0	0	**13**
Total		**5.13**	**121**	**318**	**138**	**25**	**602**

Notes: Tree clearing estimates are based on survey data (April 2012) and BMP schematic design (March 2013)..
[(1)] This terrestrial habitat would also be restored at part of the proposed BMP planting program.
Source: Hazen and Sawyer, February 2013.

Impacts on Avian Habitat

Trees at this site currently provide perching opportunities for aerial foragers (i.e., flycatchers) and canopy birds (i.e., warblers) as well as cover and foraging opportunities for ground feeders (i.e., brown thrasher, American robin, wood thrush). The removal of the interior trees would reduce this habitat for songbirds, aerial foragers (i.e, fly catchers), canopy birds (i.e., warblers) and ground feeders (i.e., brown thrasher, American robin, wood thrush), but would increase habitat for water-dependent species in the created open water wetland habitats.

Some of the avian wildlife that may currently be attracted to the site's wet woods and small ponds are listed in **Table 4.9-19**. For some of these species there would be a reduction in habitat with the proposed BMP. These species include willow flycatcher, white-eyed vireo, black-capped chickadee, yellow warbler, common yellowthroat, Eastern towhee, and song sparrow. For other species, there would be an expansion and enhancement of habitats, particularly those that are attracted to open water. For example, the proposed permanent pool and open water features of the BMP would provide new foraging opportunities for mallard, gadwall, American black duck, herons, and egrets.

Table 4.9-19
Avian Species Potentially Affected by Habitat Changes at Proposed BMP NC-11: Last Chance Pond

Common Name	Scientific Name
Gadwall	*Anas strepera*
American Black Duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Cattle Egret	*Bubulcus ibis*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Yellow-crowned Night-Heron	*Nyctanassa violacea*
American Woodcock	*Scolopax minor*
Saw-whet Owl**	*Aegolius acadicus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Willow Flycatcher	*Empidonax traillii*
Great Crested Flycatcher	*Myiarchus crinitus*
White-eyed Vireo	*Vireo griseus*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee	*Poecile atricapillus*
Marsh Wren	*Cistothorus palustris*
Brown Thrasher	*Toxostoma rufum*
European Starling	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
Yellow Warbler*	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Eastern Towhee	*Pipilo erythrophthalmus*
Chipping Sparrow	*Spizella passerine*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Boat-tailed Grackle	*Quiscalus major*
Brown-headed Cowbird	*Molothrus ater*

Notes: (*) Breeding bird observed during spring and fall 2009 and 2010 field reconnaissance; (**) Observed by DPR, but not listed as a breeding bird for Block 5749C and not observed during field reconnaissance.
Sources: NYS Breeding Bird Atlas (2000-2005); AKRF field surveys, DPR survey data.

"Wildlife attractors" could also be incorporated into the proposed BMP by leaving certain trees to naturally die and decay. For example, final BMP design could incorporate dead or collapsed trees, snags, and logs to provide nesting opportunities sites for species such as woodpecker and other cavity dwellers. Logs generated from tree removal could be placed in the proposed BMP to provide habitat. As discussed above, the proposed BMP would be extensively planted with a number of native trees, shrubs, herbaceous species and grasses. Over time, these communities would mature, thereby restoring habitat for woodland birds. In addition, the added stormwater inputs and expanded open water wetlands would increase shoreline and water edge habitats that increase prey opportunities for waterbirds.

Impacts on Reptiles and Amphibians

The diverse habitats at Last Chance Pond provide refuge from the surrounding developed neighborhood for a range of reptile and amphibian species known to be present in the Mid-Island watersheds (see Appendix C), including a variety of snakes, turtles, and frogs. Some of these species would not be expected to relocate to other habitats within the watershed, given the general physical isolation of this site and the adjoining roads and developed neighborhood of the watershed and site perimeter. Thus, the conversion of wet woods and emergent wetlands and their replacement with open water would reduce habitat acreage for certain reptiles and amphibians that do not propagate, forage, or otherwise use open water habitats, but rather prefer moist or damp substrates for most of their life cycle. Proposed BMP NC-11: Last Chance Pond would, however, continue to provide these habitats in its emergent and wet wood zones (e.g. silver maple swamp) that would support the reptile and amphibian species attracted to moist forest floor habitats with the support of the adjacent open water wetlands.

Fish and Aquatic Resources

Last Chance Pond is known to support and contain fish and aquatic macroinvertebrates in its small ponds and shallow streams. The proposed BMP would expand habitat for aquatic species at Last Chance Pond through the proposed aquatic zones supported by new hydrologic inputs that would increase both water depth and volume at the site (average depth of 6 inches to 3 feet and up to 5 feet due to storm events). The proposed project would also include mitigation measures that would be implemented as part of the pre-final design process for the purposes of minimizing impacts to aquatic resources and enhancing aquatic habitat as part of the final BMP design (see also Chapter 8.1, "Mitigation").

Final BMP Design, Habitat Protection and Tree Mitigation

The impact analyses above are based on the current conceptual design for proposed BMP NC-11: Last Chance Pond. Final design for this project is not expected to commence for several years. During final design, detailed tree and topographic surveys will be used for the purposes of identifying any additional opportunities for further avoiding or minimizing clearing of key wetland or woodland habitats while meeting the design objectives of the proposed BMP NC-11: Last Chance Pond and the New Creek Drainage Plan. As the first step in this process, the conceptual design proposed for this BMP has avoided, to the extent feasible, much of the important habitat at Last Chance Pond. As final designs for the proposed BMP are developed, a more detailed site-specific BMP design would be coordinated with DPR and DEC based on site survey and topographic information that would be used to further identify any additional opportunities for avoiding or minimizing clearing and grading while providing the necessary flood storage at Last Chance Pond. DEP would coordinate with DPR and DEC in the final design of the proposed BMP and the identification of habitats and trees to be cleared and habitats and trees to be preserved, particularly with the objective of preserving important tree stands and habitats, as well as individual large trees and specimen trees and integrating those preserved trees into the BMP design. That final design would then be used for determining the final clearing acreages, the affects on habitats, and the number of impacted trees that would need to be addressed a part of a DPR-approved tree mitigation plan.

The tree mitigation plan would be consistent with the City's Million Trees initiative and PlaNYC, and would ensure compliance with City rules and regulations governing the removal of trees within the City (including the requirements of Local Law 3 of 2010). DPR's planting guidelines would also be consulted and tree planting plans would be provided to DPR's Olmsted Center (capital projects) and Natural Resource groups as well as the central borough office. This

tree mitigation plan may include the planting of replacement trees and/or other natural resource enhancing measures within the watershed or elsewhere in the area, depending on site availability and overall ecological benefits. Tree mitigation may involve planting trees along the upland borders of the created wetlands in order to provide vegetated buffers. (Trees cannot be planted in proximity to the proposed wetlands zones of the proposed BMPs as the trees, once they mature, can shade out the wetland vegetation). Tree mitigation could also include plantings at other BMP sites proposed within the New Creek watershed. In addition, the DEP Bluebelt Unit has a maintenance and monitoring program that is used to ensure the success of its planted ecozones at each proposed BMP. This program would reduce the potential effects of invasive species from colonizing the newly planted areas. Thus, this ongoing monitoring would support the tree mitigation plan implementation.

Implementation measures for the proposed BMP that would be implemented as part of the pre-design and final design process are presented in Chapter 8.1 "Mitigation."

BMP NC-12: JOYCE STREET

The proposed project would require some clearing of trees and understory; but overall, given the limited area that would be impacted (0.1 acres), and the generally disturbed conditions at this location, impacts on vegetation and trees at this proposed BMP site are limited. In addition, areas not occupied by the proposed outlet stilling basin structure would be revegetated with native species as part of the proposed BMP design. Therefore, this proposed BMP would not result in a potential significant adverse impact on vegetation and trees.

The proposed site of BMP NC-12 possesses limited wildlife habitat value, primarily in the interior sections away from the existing road. However, because of its small size, its location near an existing built street, and given the goals of proposed BMP design, which would properly manage stormwater runoff contributions into the site and would also revegetate the area around the proposed BMP, impacts on wildlife at this proposed BMP are expected to be positive. Since this site is off-line from the Main Channel, the proposed BMP would not impact any fish or aquatic resource habitats. Therefore, this proposed BMP would not result in potential significant adverse impacts on wildlife.

MAIN CHANNEL (BMP NC-13: HYLAN BOULEVARD, BMP NC-14: MEADOW PLACE, BMP NC-15: LACONIA AVENUE, BMP NC-16: OLYMPIA BOULEVARD, BMP NC-17 SLATER BOULEVARD)

Currently, the Main Channel is an open water stream channel (although sections are filled with sediment) along with a common reed dominated monoculture of emergent wetlands while the adjoining upland perimeter is successional woodlands. The BMPs proposed along the Main Channel would reduce flooding impacts, improve flow conveyance, and provide substantial ecological restoration as part of the overall proposed BMP designs by establishing expanded open water wetlands that would improve the quality and functions of the currently degraded stream channel along with ecological landscaping in the extended detention zones. Along the proposed Main Channel proposed BMPs, approximately 24.6 acres of existing wetlands would be enhanced including 2.9 acres at proposed BMP NC-13, 12.0 acres at proposed BMP NC-16 and 9.7 acres at proposed NC-17 (proposed BMPs NC-14 and NC-15 are outlet stilling basin that would provide conveyance and flow attenuation only). These proposed BMPs would reconstruct the Main Channel for the dual purposes of improving the hydrology of the lower watershed (e.g., conveyance and storage that reduces flooding) while providing wetland restoration with wetland planted extended detention zones that would diversify the wetland

habitats. Under the proposed BMP designs, the Main Channel would continue as an open water channel during times of regular flow: during times of higher flow (i.e., storm events), the wetland shelves of the proposed BMPs would flood the created emergent wetland floodplains. Given that these sites are wetlands under existing conditions, no change in wetland acreage is expected with the proposed BMPs. However, the proposed project would provide qualitative improvements with expanded open water and improved ecological landscapes while reconfiguring the existing channel for the purposes of reducing flooding while providing ecological restoration. This would be a positive natural resources impact of the proposed project.

The proposed BMPs would require limited clearing in the adjoining uplands, but overall given the small upland areas that would be impacted and the generally disturbed habitats, which include successional hardwood communities dominated by black locust and Japanese knotweed, impacts on upland vegetation habitats are not expected to be significant. In addition, disturbed upland areas around the proposed BMPs would be revegetated with native species as part of the final design.

Construction of the proposed BMP NC-13: Hylan Boulevard would also involve removal of fill illegally dumped on the site along Hylan Boulevard by the previous private owner. That dumping was a violation of NYSDEC wetland regulations; therefore, the removal of that fill and the restoration of the wetland would not constitute an increase in wetland acreage in a regulatory sense. Hence, the wetland acreage figures for the future with the project do not increase; however, removal of the fill and the restoration of the site would be a substantial improvement in wetland quality at the site. In addition, the schematic design for proposed BMP NC-17 includes the relocation of the existing channel away from the nearby low lying residential properties and into the Bluebelt property.

While some tree clearing is expected to be necessary at these proposed BMP sites, overall the clearing of trees is expected to be limited to the proposed BMP upland borders and the limited interior hummocks. During final design for the proposed BMP, DEP would develop a tree mitigation plan for trees that would need to be cleared. Therefore, the proposed BMP would not result in a potential significant adverse impact on trees.

The added expanded water zones of the proposed Main Channel BMPs coupled with the greater planting diversity is expected to enhance use of the Main Channel by water-dependent wildlife that are common to the lower watershed. As described above, the existing conditions include substantial common reed habitat, although some interspersed open water, emergent wetland vegetation and mature hardwood trees. It is the objective of the proposed project to build upon the opportunities created by this current ecology, by expanding and diversifying the habitat attributes and wildlife attractors. To that end, the proposed BMPs would expand open water acreages and emergent wetland habitats that would support the presence of water-dependent species including the fish and aquatic resources that are found along the Main Channel thereby providing additional fish population and habitat attractors for coastal nesting and feeding birds (once the prey populations re-colonize the proposed BMP sites). This would also include habitat for perching and wading birds, and urban-tolerant reptile and mammal species such as the painted turtle, snapping turtle, and muskrat.

The proposed BMP designs also include specific wildlife features to be preserved or enhanced at the proposed BMP sites. For example, the proposed project would formalize drainage and provide managed stormwater inputs to an existing small pond that would be protected at proposed BMP NC-14 (outlet stilling basins would provide controlled stormwater inputs) along with a wetland planting program that would support species diversity at this proposed BMP. In

addition, the proposed BMP NC-17 would include a wooded island to provide habitat diversity within the overall extended detention area as well as a deep pond. (These features would be provided where the West Branch and the Main Channel converge.) There would also be irregularly shaped wetland edges with coves and peninsulas to create a more complex shoreline edge. Irregular shorelines increase the edge of linear footage available for feeding and provide smaller secluded areas preferred by more reclusive species (see the discussion below). Since this proposed BMP does not result in any changes in wetland acreage, these habitat quality improvements would be a substantial benefit of the proposed BMP for both the watershed and local ecology.

It is expected that the installation of the proposed storm sewers and proposed BMPs and the resultant improvement in water quality would also benefit the aquatic fish and macroinvertebrate community with respect to both population density and diversity. The proposed BMP system would include more diverse aquatic habitats such as deep pools, vegetated shallow wetlands, and ephemeral pools which have the potential to support a wider range of macroinvertebrate species and communities than is currently known to populate the lower New Creek watershed. Stream stabilization and restoration is also planned in the watersheds with stone substrates that have the potential to support additional species. Thus, the realigned and enhanced stream corridor that would be created by the proposed series of BMPs proposed along the Main Channel would benefit a range of fish and other aquatic resources.

Therefore, the proposed Main Channel BMPs would not result in potential significant adverse impacts on wildlife.

EAST BRANCH (BMP NC-18: PATTERSON AVENUE, BMP NC-19: BUEL AVENUE)

Currently, the East Branch is a short open water stream channel along with a common reed dominated monoculture of emergent wetland while the adjoining upland is successional hardwoods. The proposed East Branch BMPs would reduce flooding impacts, improve flow conveyance, and provide ecological restoration as part of the overall BMP proposed designs including expanded open water wetlands that would improve the quality and functions of the current stream channel along with ecological landscaping within the extended detention zones of the proposed BMP. Under the proposed BMP designs, approximately 7.4 acres of existing wetlands would be enhanced at proposed BMP NC-18 (proposed BMP NC-19 is an outlet stilling basin that would provide conveyance and flow attenuation only). These proposed BMPs would not adversely impact wetland acreage, but would substantially improve wetland quality and functions. Planting zones within the extended detention areas of the basin would provide the opportunity for new wetland habitats that would diversify the ecological communities of the site; this would be a natural resources benefit of the proposed project. Construction of the proposed BMP would actually involve the removal of large quantities of construction and demolition debris, illegally dumped by a private company along Dongon Hills Avenue. That dumping was a violation of NYSDEC wetland regulations; therefore, the removal of that fill and the restoration of the wetland would not constitute an increase in wetland acreage in a regulatory sense. Hence, the wetland acreage figures for the future with the project do not increase; although there would be a substantial qualitative improvement with the proposed project. In addition, the proposed BMP would support and build upon an existing wetland mitigation site located to the north of Olympia Boulevard.

While some limited tree clearing is expected at the borders of the proposed BMP, overall the clearing of trees at this site is expected to be limited. As part of the final design for the proposed BMPs, DEP would develop a tree mitigation plan for trees that would need to be cleared as part

of the final design. Therefore, the proposed BMP would not result in potential significant adverse impacts on vegetation and trees.

It is expected that the wildlife habitat provided by the proposed BMP, once planted and after a suitable grow-in period, would provide enhanced habitat for many of the species expected to in the lower New Creek watershed. The expanded water zones of the proposed East Branch BMPs coupled with the greater planting diversity is expected to enhance habitat opportunities for water-dependent wildlife that are common to the lower watershed. To that end, the proposed BMPs would expand open water acreages and emergent wetland habitats that would support the presence of water-dependent species including the fish and aquatic resources that are found along the Main Channel to the west, thereby providing additional habitat attractors for coastal nesting and feeding birds (once prey populations such as invertebrates and fish re-colonize the site of the proposed BMP). This would also include habitat for perching and wading birds, and urban-tolerant reptile and mammal species such as the painted turtle, snapping turtle, and muskrat. This would also support perching and wading birds, and urban tolerant reptile and mammal species such as the painted turtle, snapping turtle, and muskrat.

Therefore, these proposed BMPs would not result in potential significant adverse impacts on wildlife.

LOWER BAY OUTFALLS

There would be one new outfall to the Lower Bay from the New Creek watershed. That outfall would be constructed within a narrow corridor (about 40 feet wide and 1,000 feet long, for a total of about 40,000 square feet (0.95 acres). About 500 linear feet of that total would cross sandy beach, and about 500 linear feet would be upland from the beach and cross recreational areas and road (Father Capodanno Boulevard). Only a small segment, about 50 feet, would be below water line and out to the bulkhead line. In addition, a second barrel would be constructed to augment the existing outfall from Seaview Avenue. This outfall would be 14 feet wide and would be built adjacent to and the same length as the existing outfall.

Upland of the water line, post construction, the outfall structures would be buried and the outfall corridors would be restored to preconstruction conditions. For the in-water segment, **Table 4.9-10** shows the potential area of impact of the proposed outfalls on tidal wetlands within the Lower Bay. Temporary impacts (as shown in the table) would only occur during construction; this area would then be restored to pre-construction conditions. The area occupied by the proposed outfall structure would be a permanent impact of the structure. As shown in the table, the portion of the proposed outfall structure within tidal wetlands is estimated to be about 3,900 square feet (about 0.09 acres) and the associated temporary work area (i.e., within the easement area) is estimated to be about 7,000 square feet. No salt marsh vegetation would be permanently or temporarily affected by the proposed outfall, and the impacted area is essentially a limited area of sandy beach and benthic habitat. Assuming a wetland restoration ratio of two to one for sub-tidal habitat, the proposed project would then incorporate approximately 7,800 square feet (about 0.18 acres) of tidal wetland restoration for the impact of the proposed outfall structure.

Table 4.9-20
Areas of Tidal Wetland Impacts for Proposed Outfalls

Outfall	Linear Feet Below the Water Line	Width of Pipe (feet)	Estimated Area of Permanent Impact From Outfall Structure (square feet)	Potential Width of Outfall Easement/ Corridor (feet)	Estimated Area of Temporary Wetland Impact From Construction Easement Area) (square feet)
BMP NC-10	50	8	400	40	2,000
Seaview Avenue (expanded outfall)	250	14	3,500	Within existing outfall corridor	5,000

Notes: Areas determined based on proposed drainage plan designs and aerial photographs for the watershed with new outfalls extended to bulkhead line and supplemental outfalls extended to length of existing outfall. Area of wetland impact not adjusted for depth of water greater than six feet. For work within existing outfall corridors the work area is assumed to be 20 feet wide.

The primary impacts to wildlife and wildlife habitat due to the proposed outfall would be the direct impact to benthic habitat for the length of the proposed outfall seaward of the shoreline and out into Lower Bay. No significant adverse impacts would occur with respect to wildlife that may use the beach because of the limited area of impact, since most of the outfall would be buried post-construction and the area is highly accessible to the public as a beachfront park. Thus its current wildlife habitat is limited to shorebirds common to the south shore.

Installation of the proposed outfall segment below the high water line and within the Lower Bay would impact a limited area of aquatic habitat. This impact is expected to amount to about 3,900 square feet and the proposed project would include a tidal wetland restoration plan for this structural impact to tidal wetlands and aquatic habitat. Since the area of impact is primarily along the shoreline, the proposed outfall structure would have a limited and insignificant impact on fish habitat of Lower Bay with no significant adverse impacts on the essential fish habitat. In addition, no indirect impacts on aquatic habitat are expected as no adverse water quality impacts would occur with the proposed project (see "Water Quality" above).

Therefore, the proposed outfall would not result in a potential significant adverse impact on natural resources.

Shoreline Erosion

As stated above, the proposed project would extend an outfall into the Lower Bay and across (perpendicular to) the shoreline. Therefore, the proposed outfall raises the potential for indirect impacts on beaches and shorelines, particularly with respect to the littoral drift of sand. A prevailing east to west littoral drift of sand is a known pattern on the South Shore of Staten Island. However, the proposed outfall is not expected to significantly alter or interrupt these drift patterns since there are already multiple existing outfall structures immediately updrift to the east (e.g., extending out into the bay from approximately the end of Slater Boulevard, see **Figure 4.9-1**) and to the west (e.g., extending out into the bay from approximately the end of Midland Avenue, see **Figure 4.9-1**) that have already altered the natural littoral drift pattern. The USACE's Storm Reduction Impact Techniques would also be referenced and applied during the design of this outfall in order to minimize impacts.

Therefore, the proposed outfall would not result in potential significant indirect impacts on shoreline conditions and littoral drift.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES AND COMMUNITIES

With respect to the marine related species, shortnose sturgeon is not expected within the New Creek watershed streams. Although it may use Lower Bay in some way during the migratory seasons, given the limited nearshore area that would be directly impacted by the proposed outfall and that it would be located in shallow habitat, no significant adverse impacts on this species would be expected with the proposed project. Similarly, the proposed outfall (construction and operation) would not result in a significant adverse impact on Kemp's ridley sea turtles, loggerhead sea turtles, green sea turtles, or leatherback sea turtles as all four species are not likely to occur in the vicinity of the proposed outfall site. Similarly, no significant adverse impacts are expected on marine mammals.

Because peregrine falcon has the potential to forage or flyover occur throughout the New Creek watershed, a pre-construction survey would be conducted for these species at the larger BMP proposed sites.

Because there are as number of protected or exploitably vulnerable plant species that were observed or are suspected at a number of proposed BMP sites (see **Table 4.9-6**, above), the proposed project would also include pre-construction surveys for green milkweed and Jacob's ladder as well as a variety of ferns including lowland fragile fern, and three exploitably vulnerable ferns including royal fern, cinnamon fern, and spinulose wood fern.

If protected species are identified during the final design/pre-construction stage, DEP would explore the possibility of refining the proposed BMP design to avoid these species or their habitats and, with respect to plants, plant salvage may also be implemented as a technique for relocate plants to avoid impacts. Additional details on mitigation for the protection of rare, threatened and endangered species is presented in Chapter 8.1, "Mitigation."

E. CONCLUSIONS

The proposed amended drainage plan would not result in potential significant adverse impacts on surface or groundwater hydrology. Rather, the proposed project is expected to reduce local stream flooding that currently affects streets and private properties. Modeling of storm events has disclosed that the proposed project would not adversely impact the 10-year or 100-year floodplain (in fact, reductions in water surface elevations and reduced flooding are projected), nor would it have any adverse impacts on local surface drainage due to the proposed BMP berms or modified street grades. The proposed project would also not result in any erosive stream velocities downstream of the proposed BMPs. In addition, the proposed project would not adversely impact local groundwater flows or the local water table. Also proposed is the collection of additional groundwater data to inform the design of the lower watershed BMPs (see also Chapter 8.1, "Mitigation").

The proposed amended drainage plan would also not result in potential significant adverse water quality impacts. Rather, it would provide water quality improvements through the proposed BMPs that would otherwise not occur under the "no action" condition. The proposed BMPs of the amended drainage plan are anticipated to provide water quality benefits through the partial removal of contaminants such as total suspended solids and phosphorous from the runoff along with reductions in runoff velocity and uncontrolled runoff that can cause scouring and erosion in the watershed with the resulting sedimentation in local water bodies. Therefore, through the use of proposed BMPs, the proposed amended drainage plan would not result in any direct or

indirect significant adverse water quality impacts on either the local streams or the ultimate receiving waters of the Lower Bay.

The proposed BMPs in the upper watershed, particularly NC-1 through NC-5, would not have negative impacts on wetlands. These proposed BMPs are all less than 1 acre in size and are proposed for the principal purpose of reducing flow velocities from the proposed storm sewers; extended detention wetlands would also be provided at proposed BMPs NC-3, NC-4 and NC-5. Two of these sites, proposed BMP NC-4: Whitlock Avenue and proposed BMP NC-5: Todt Hill Road would expand freshwater wetland acreage with a projected increase of about 0.9 acres. Although these two proposed BMPs would also divert flows away from existing drainage swales, these swales are currently eroded and heavily stressed due to existing uncontrolled erosion through developed yards. Therefore, the diversion of stormwater away from these swales to the proposed BMP is not expected to be a significant adverse impact on wetlands.

The proposed BMPs in the lower watershed (NC-6 through NC-19) are generally larger (from 3 to 12 acres in size). Since these proposed BMP sites are already mostly wetlands, the resulting proposed BMP designs would not result in either a gain in wetland acreage with two exceptions: proposed BMP NC-6: Boundary Avenue where clearing and grading for the proposed extended detention would be expected to increase emergent wetlands (this site has NWI mapped wetlands, but is not mapped on the NYSDEC sketch maps) and proposed BMP NC-18 where fill would be removed to expand wetlands. While at some proposed BMP sites there may be some reduction in wetlands due to the proposed berms (assuming the worst case scenario in berm design), overall there is a gain in wetland acreage in the watershed as a whole. Moreover, in the common reed dominated wetlands of the lower watershed, the proposed project would result in improvements in habitat quality through the proposed BMP designs (particularly for fish and other aquatic resources). The proposed BMP designs would also incorporate measures to protect and maintain fisheries of the watershed and movement along the channel (see also Chapter 8.1, "Mitigation"). In addition to managing stormwater and reducing flooding, the ecological objective of these proposed BMPs is to diversify ecological habitats by relocating and restoring streams, creating wider streams and ponds, and improving the ecological diversity of the Bluebelt properties and lower watershed as a whole. For example, the proposed BMPs would provide enhanced wetland habitats through modified grading, changes in hydrology, and diversified ecological landscapes that would provide new open water, deep water, and wooded island wetlands and habitats. In order to minimize impacts to existing contributing ecological habitats, final design for the proposed BMPs would also incorporate or expand existing higher value habitats of the Bluebelt properties (such as existing ponds or open waters, wooded edges and hummocks) that would add positively to a proposed BMP's natural resource values.

With respect to vegetation and trees in the upper watershed, the general habitat cover is primarily woodlands (e.g., Reeds Basket Willow Swamp Park), but the proposed project would have a minimal impact on woodlands and trees of the upper watershed. Since the BMPs proposed in the upper watershed are smaller and sited primarily outside of wooded areas, clearing impacts on woodlands and trees are limited. In addition, final design for the proposed BMPs would be developed in conjunction with DPR and NYSDEC for BMPs that are proposed within the jurisdiction of these agencies (all of the upper watershed proposed BMP sites are in the jurisdiction of one of these two agencies). Final design for proposed BMPs would also seek to avoid specimen trees as well as important woodland habitats as much as possible(see also Chapter 8.1, "Mitigation").

Woodland stands in the central portion of the watershed include two large wooded properties proposed for BMPs: NC-6: Boundary Avenue and BMP NC-11: Last Chance Pond. At these sites, based on a reasonable worst case assumption with respect to clearing and estimated tree impacts, the clearing and grading of approximately 9 acres of upland and wet woods would be necessary in order to create the proposed BMPs and to provide the upstream detention of stormwater that would, in turn, reduce flooding in the lower watershed. The importance of these sites to providing these stormwater management functions is critical since the lower watershed is largely flat and at a very low elevation. Given that a sizable area of woodland and trees would need to be cleared at these sites, and that both sites include DPR properties, DEP would coordinate with DPR in the final design of these sites for the purposes of both minimizing the total extent of tree impacts and to develop a tree mitigation program and to minimize impacts on key habitats at these sites (see also Chapter 8.1, "Mitigation").

The lower watershed, below Hylan Boulevard, contains limited woodland coverage the majority of which is found along the fringes of large common reed dominated wetlands. To protect as many of the trees and woody patches as possible at these locations, final designs for the proposed BMPs would be based on detailed site surveys for the purposes of minimizing tree impacts, particularly at those sites where the woodland borders could support the overall ecology of the proposed BMPs as well as habitat diversity both at the proposed BMP site and in the watershed as a whole. Since the proposed BMP footprints would occupy about 55.5 acres of the approximately 94 acres of Bluebelt property in the lower watershed, there would also be additional Bluebelt protected lands (mostly wetlands) that, in addition to the proposed BMPs, would support the ecological benefits of the proposed project.

Impacts of the proposed BMPs, while analyzed in one analysis year (2043), would actually be phased in over a 30 year period, thereby allowing for the created habitats of some of the proposed BMPs to become established, as other proposed BMPs enter into a design and construction phase. Moreover, once completed, the proposed BMPs are expected to provide ecological benefits at a watershed level.

Regarding any protected wildlife or plant species that have been identified at the proposed BMP sites, the proposed project would include a preconstruction survey that would determine the presence or absence of such species at the proposed BMP sites where these species have been identified. Based upon that preconstruction survey, the final design for the proposed BMPs may also be modified to avoid particular habitats, or plant rescue could be used as a technique to avoid impacts to protected plant species.

The proposed BMP planting programs would include ongoing maintenance and monitoring by the Staten Island Bluebelt Unit (see Chapter 1.1 "Overall Description of the Proposed Program") for the purposes of maintaining the BMP hydrologic functions and the habitat benefits. This would include monitoring of new plantings, replacement and transplanted vegetation, as necessary.

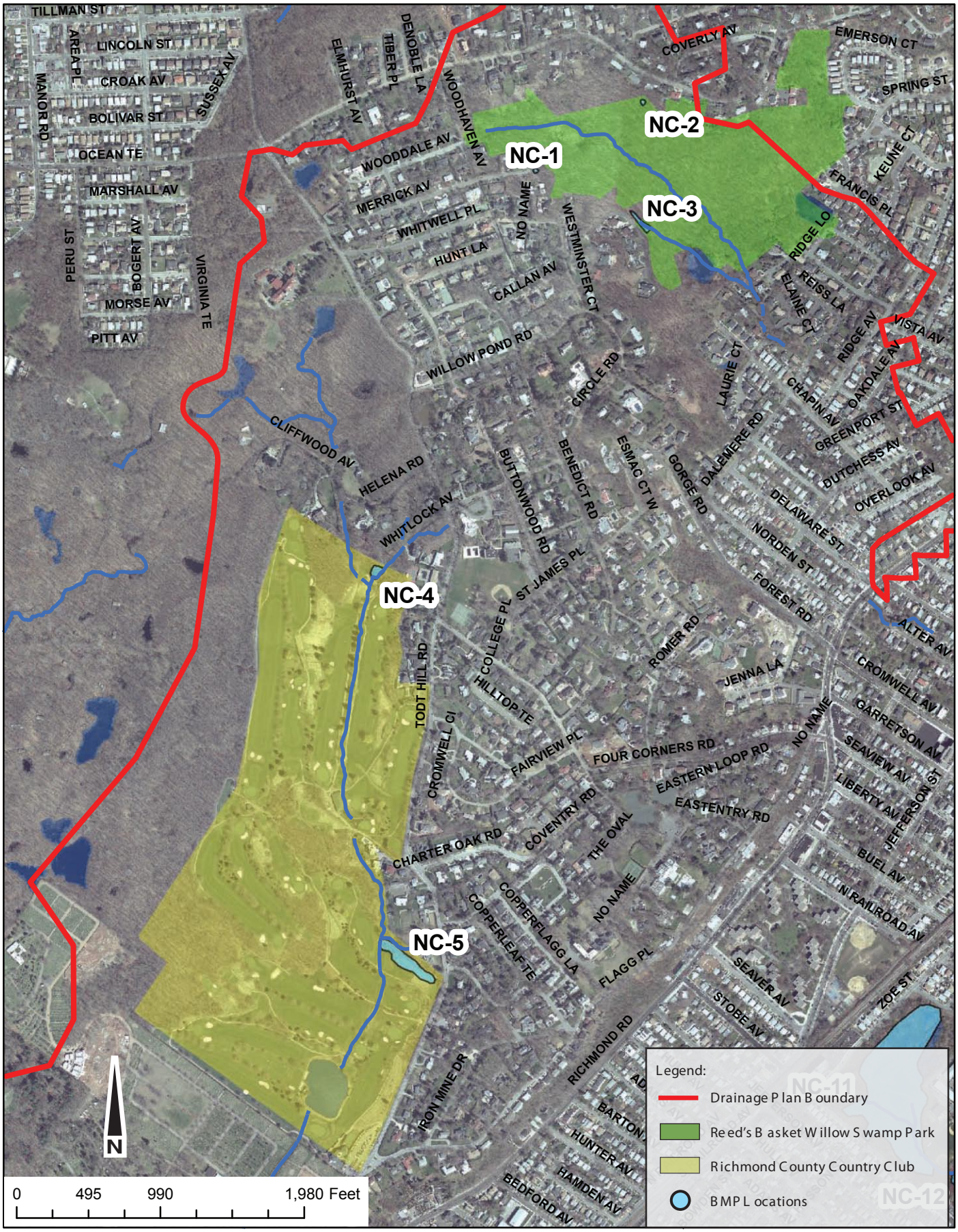
Finally, as stated above, the proposed lower watershed BMP sites have historically experienced brush fires. By removing the large stands of common reed that have been prone to brush fires in the Mid-Island area and replacing it with open water, maintenance corridors and maintained berms, the proposed project would provide firebreaks against the spread of brushfires at these sites, along with access in the event of emergency, which would be a beneficial impact of the proposed project.

The proposed project would also include a tidal wetlands restoration plan for the proposed new and expanded outfalls. DEP would identify additional potential sites for expanded tidal wetlands in the Mid-Island area, including Great Kills Park, if necessary.

Thus, the proposed project would not result in potential significant adverse impacts on hydrology, groundwater, wetlands, vegetation and trees, or wildlife. Therefore, the proposed project would not result in potential significant adverse impacts on natural resources. ✷

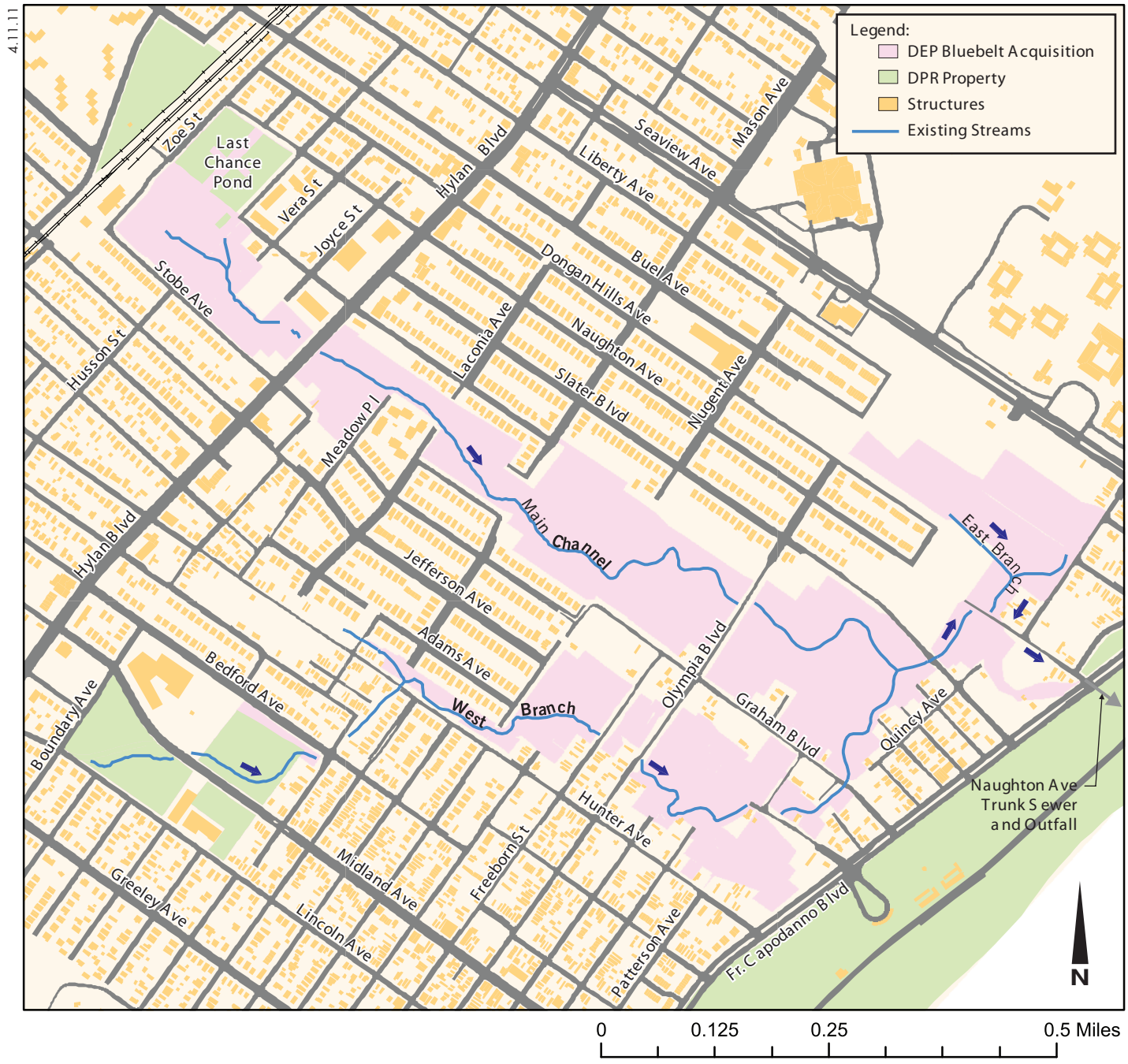
Aerial Photograph — New Creek Watershed

Figure 4.9-1

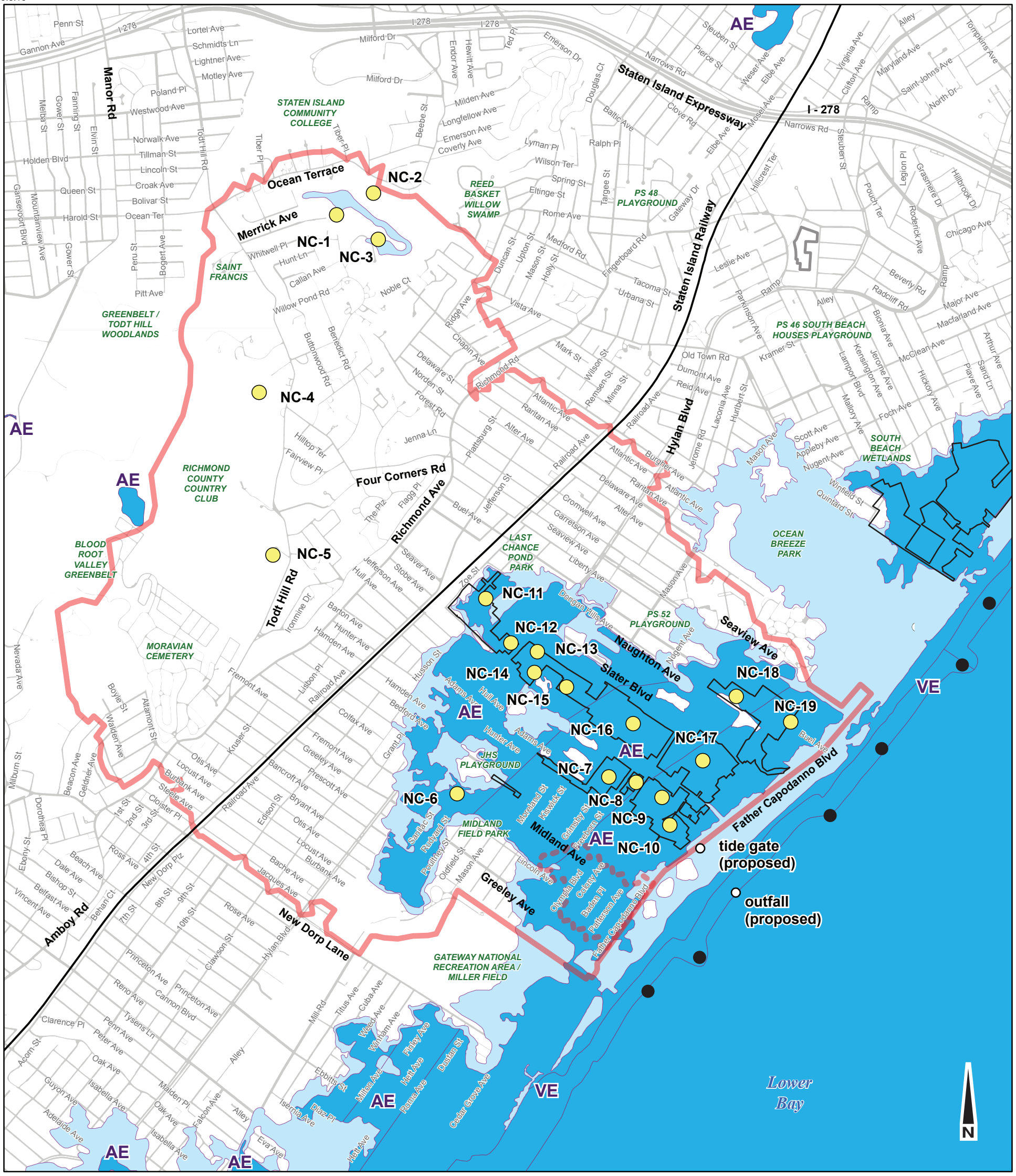


Existing Upper Watershed Drainage System:
New Creek Watershed

Figure 4.9-2



Existing Lower Watershed Drainage System:
New Creek Watershed



Flood Data source: Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) 2007

Proposed BMP Site

Existing Outfall *Proposed Outfall*

Drainage Area Tributary to New Creek Bluebelt

Proposed Drainage Plan Area Tributary to Existing Ocean Outfalls

DEP Bluebelt Property (Acquired or in the Process of Being Acquired)

100 Year Flood Zone (1 % Annual Chance Flood Risk Zone)

500 Year Flood Zone (0.2 % Annual Chance Flood Risk Zone)

Flood Codes:

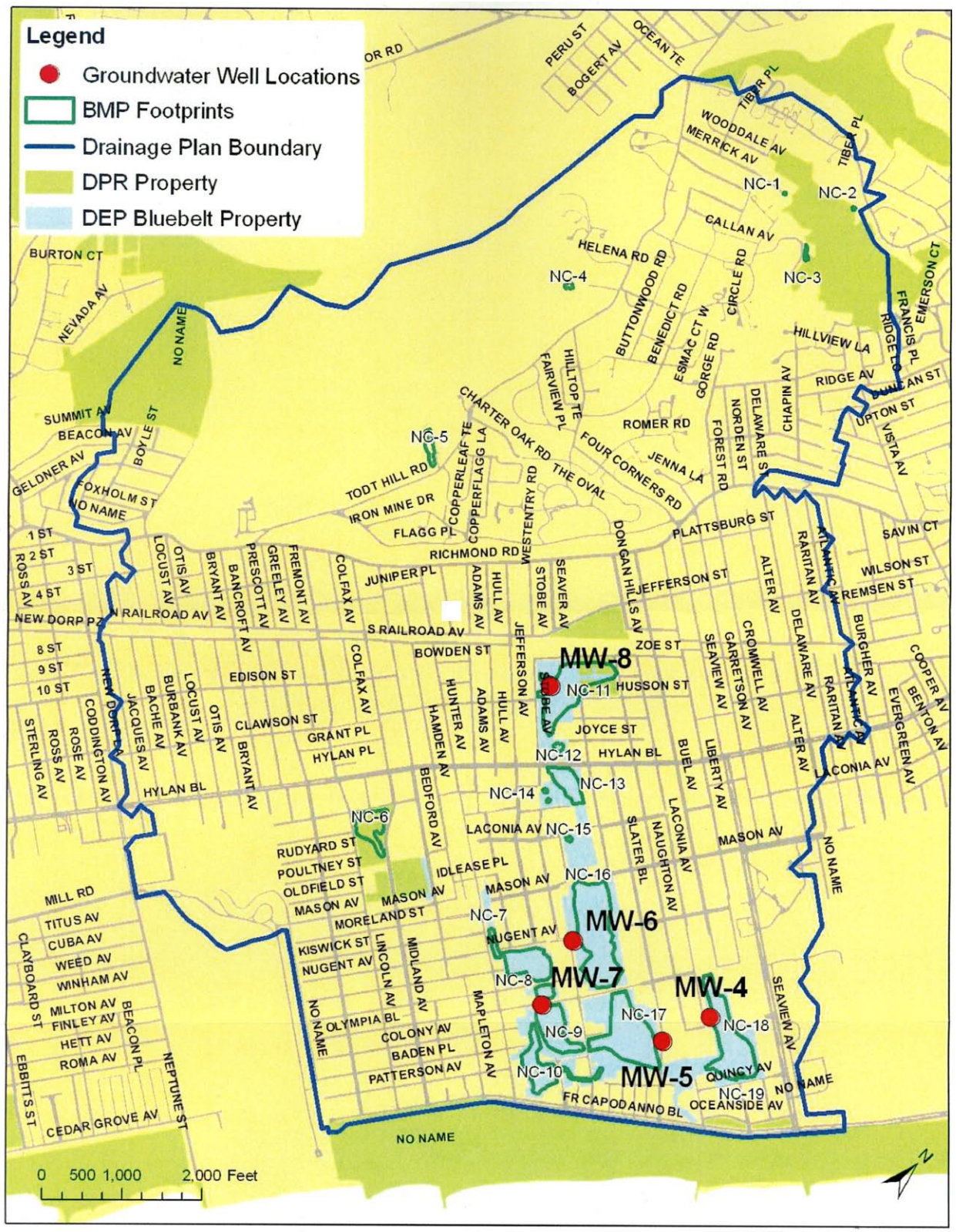
VE *An area inundated by 100-year flooding with velocity hazard (wave action); BFEs (Base Flood Elevations) have been determined.*

A *An area inundated by 100-year flooding, for which no BFEs have been determined.*

AE *An area inundated by 100-year flooding, for which BFEs have been determined.*

NOTE: This map is based on the current Flood Insurance Rate Maps (FIRM) that FEMA is currently in the process of reevaluating for the New York City area. Since the issuance of the DEIS (September 2011), FEMA has released Advisory Base Flood Elevation (ABFE) Maps that reflect the effects of Hurricane Sandy in October 2012. The information presented on the ABFE Maps will be incorporated into official updates to the FIRMs that FEMA expects to release at a later date.

FEMA Flood Zones
Figure 4.9-4

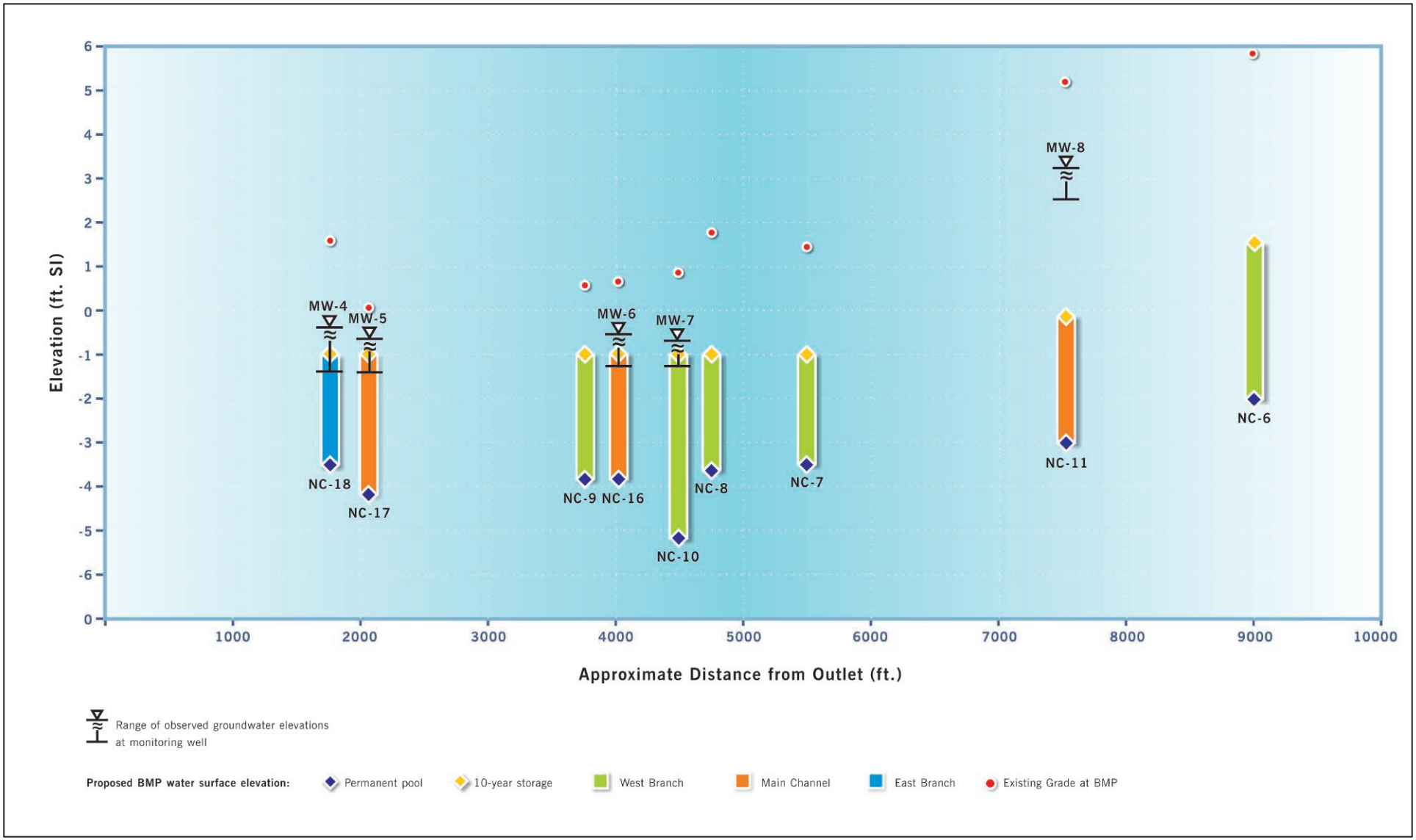


SOURCE: Hazen & Sawyer, 2010

Groundwater Well Locations:
New Creek Watershed

Figure 4.9-5

4.11.11



SOURCE: Hazen & Sawyer, 2010

NOTE: Average of high of low tides during the April/May 2010

Comparison of the Lower Watershed New Creek BMP Elevations with the Observed Groundwater Table Elevations (Average of High and Low Tides) During the Spring - Fall 2010 Monitoring Period

Figure 4.9-6

Proposed BMP Site

Existing Outfall *Proposed Outfall*

Drainage Area Tributary to New Creek Bluebelt

Proposed Drainage Plan Area Tributary to Existing Ocean Outfalls

I / C *Classified Streams*

Parks Property (City, State & Federal)

DEP Bluebelt Property (Acquired or in the Process of Being Acquired)

SB / SA, B, I / C **NYSDEC Water Quality Standard Rating (2007)**

(Note: NYSDEC 2007 Stream Quality Rating Database includes streams since piped and diverted to new outfalls)

Class B waters - primary and secondary contact recreation and fishing.These waters shall be suitable for fish propagation and survival.

Class C waters - best usage is fishing. These waters shall be suitable for fish propagation and survival.

Class SB waters - primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class I waters - best usages are secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

NYSDEC Water Use Classifications
Figure 4.9-7

9.21.11

Proposed BMP Site

Existing Outfall *Proposed Outfall*

Drainage Area Tributary to New Creek Bluebelt

Proposed Drainage Plan Area Tributary to Existing Ocean Outfalls

DEP Bluebelt Property (Acquired or in the Process of Being Acquired)

Tidal Wetlands

Littoral Zone

Freshwater Wetlands

Class I

Class II

0 1000 2000 FEET
SCALE

Staten Island Bluebelt Mid-Island Watersheds

NYSDEC Wetlands
Figure 4.9-8

3.7.11

Proposed BMP Site

Existing Outfall

Proposed Outfall

Drainage Area Tributary to New Creek Bluebelt

Proposed Drainage Plan Area Tributary to Existing Ocean Outfalls

DEP Bluebelt Property (Acquired or in the Process of Being Acquired)

Wetland Types

- *Estuarine and Marine Deepwater*
- *Estuarine and Marine Wetland*
- *Freshwater Emergent Wetland*
- *Freshwater Forested/Shrub Wetland*
- *Freshwater Pond*
- *Lake*

NWI Wetlands
Figure 4.9-9

4.3.13

Key to Habitat Map

Habitat No.	Habitat Type
1	Riverine (marsh headwater stream, culturally modified)
2	Red Maple/Hardwood Swamp
3	Coastal Oak Hickory Woodland
4	Terrestrial (successional woodland)
5	Successional Hardwood (Red Maple)
6	Successional Woodland

LEGEND

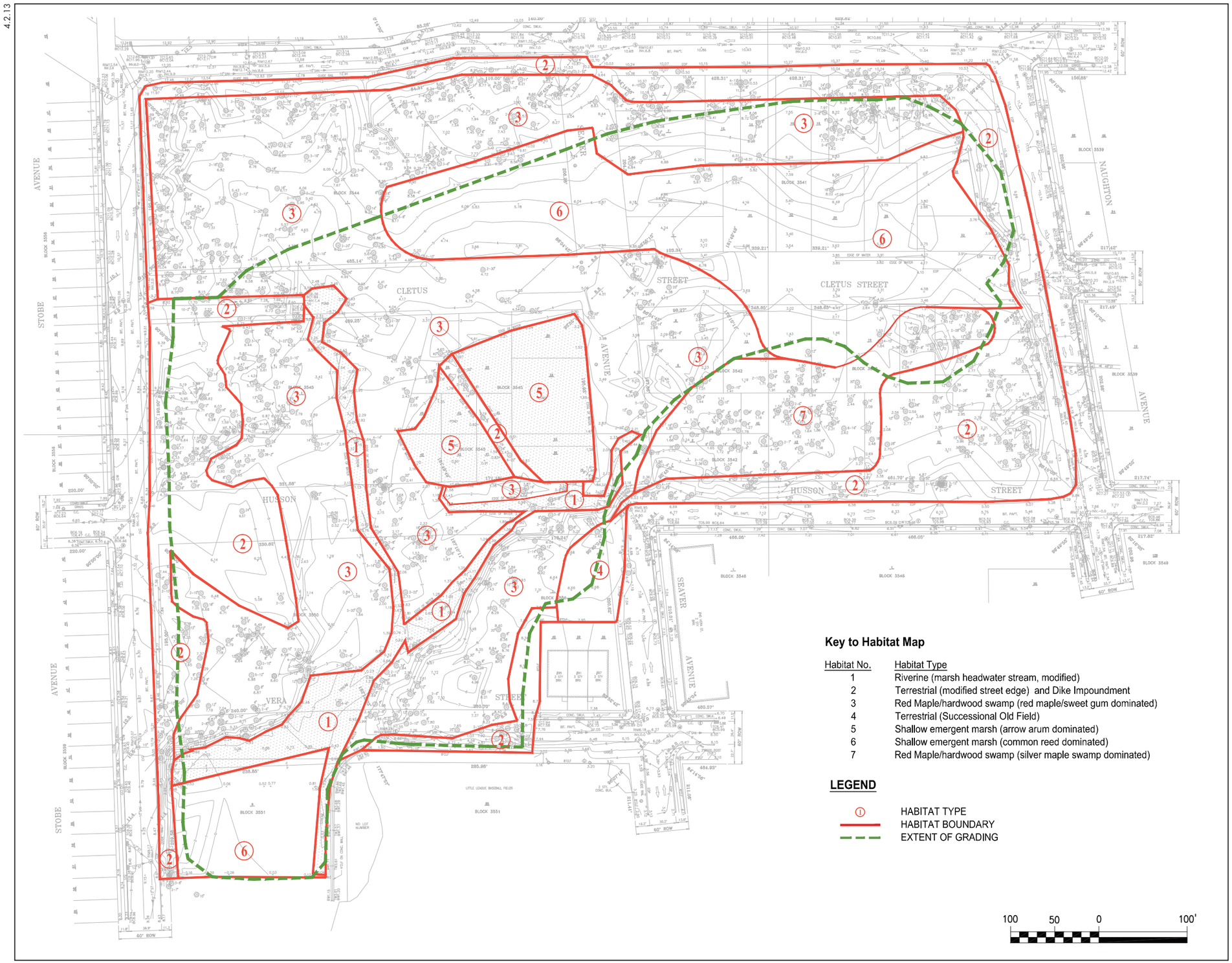
- HABITAT TYPE
- HABITAT BOUNDARY
- EXTENT OF GRADING

60 30 0 60'

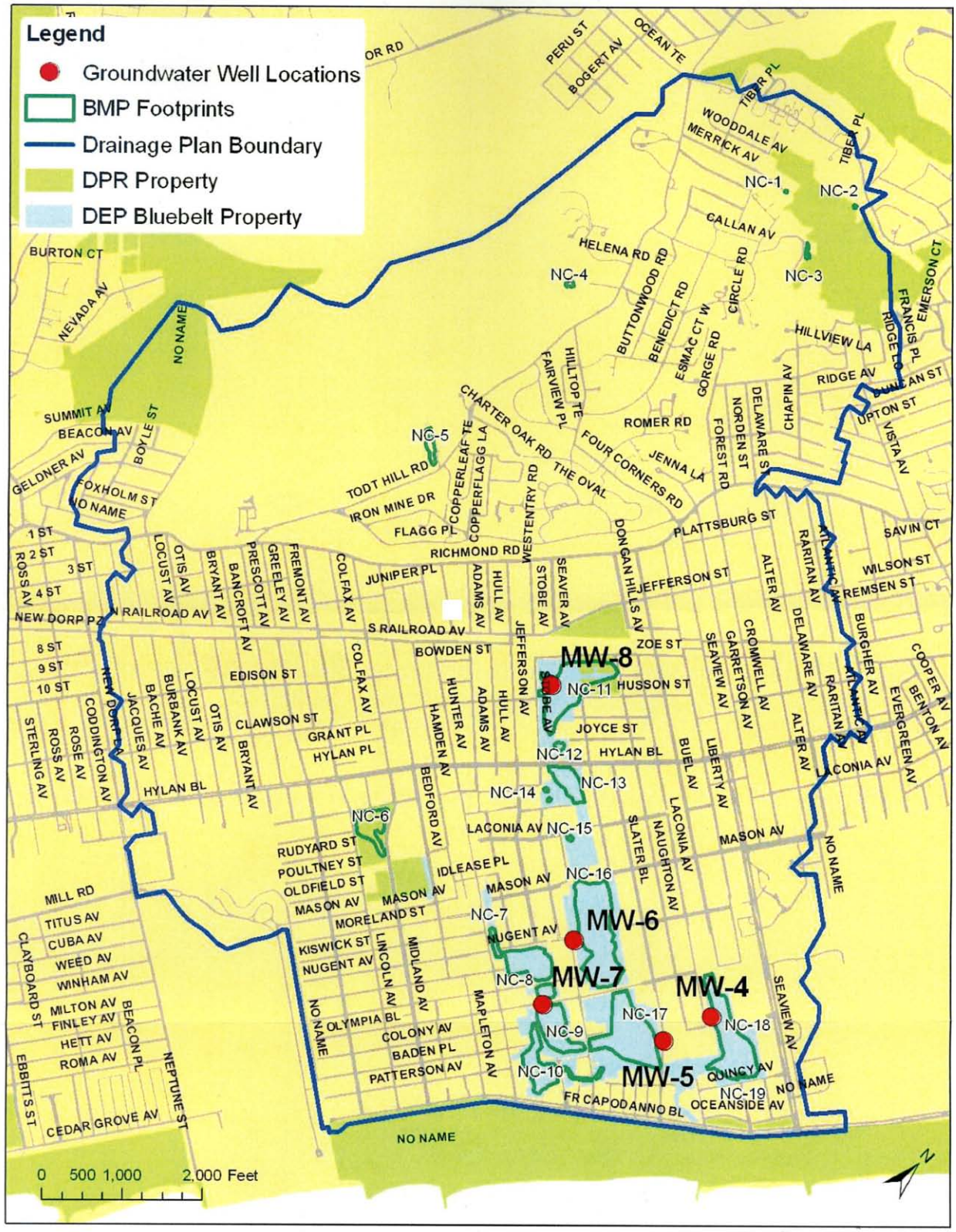
BLOCK 3732

BLOCK 3696

Existing Habitats
at Proposed BMP NC-6:
Boundary Avenue
Figure 4.9-10



Existing Habitats
at Proposed BMP NC-11:
Last Chance Pond
Figure 4.9-11

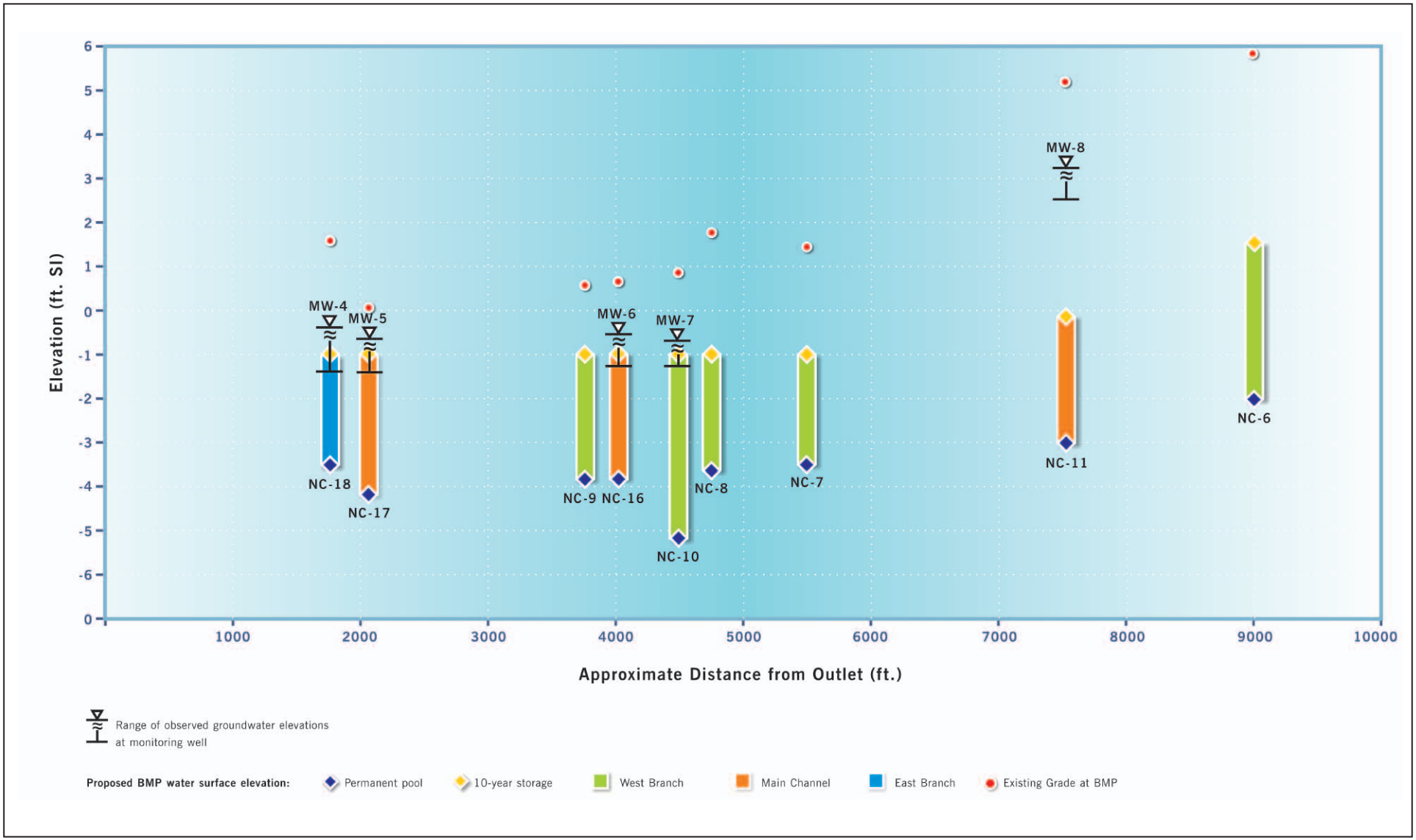


SOURCE: Hazen & Sawyer, 2010

Groundwater Well Locations:
New Creek Watershed

Figure 4.9-5

4.11.11

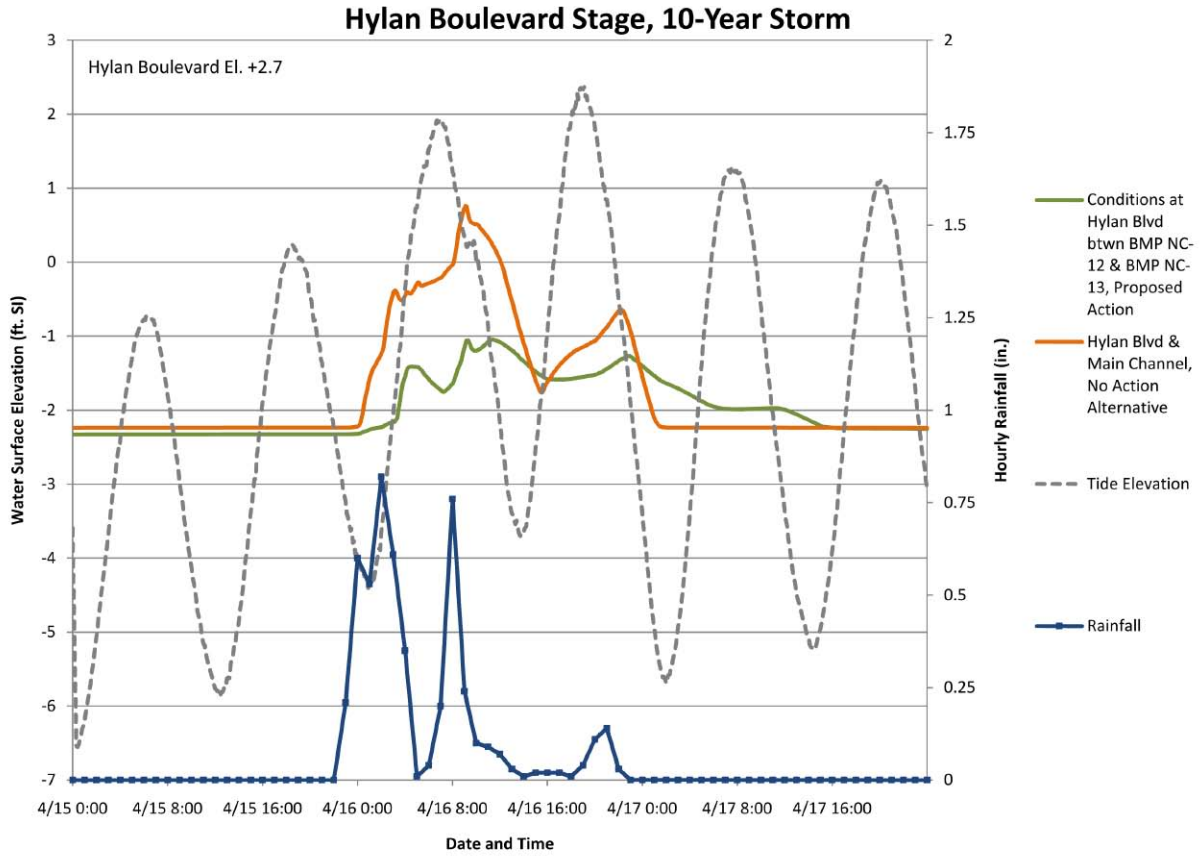


SOURCE: Hazen & Sawyer, 2010

NOTE: Average of high of low tides during the April/May 2010

Comparison of the Lower Watershed New Creek BMP Elevations with the Observed Groundwater Table Elevations (Average of High and Low Tides) During the Spring - Fall 2010 Monitoring Period

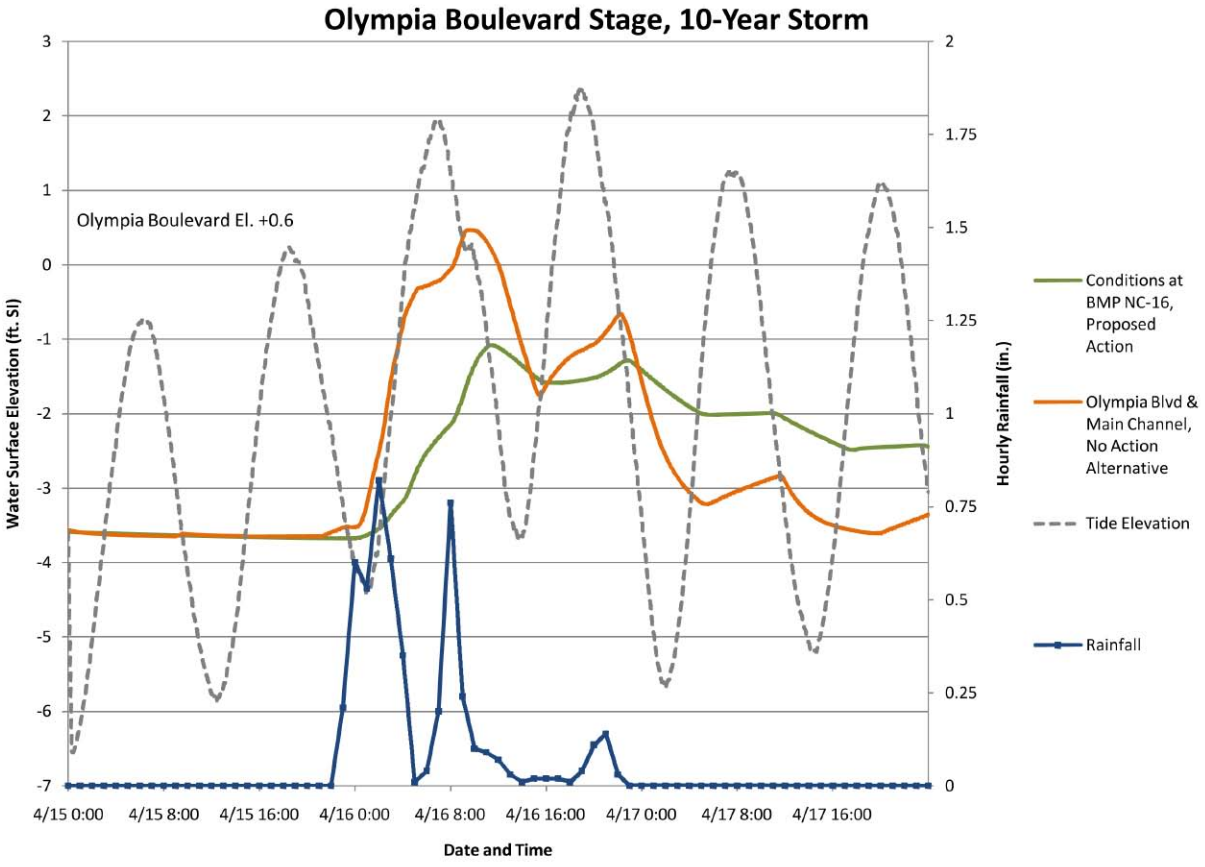
Figure 4.9-6



SOURCE: Hazen & Sawyer, 2010

Main Channel of New Creek at Hylan Boulevard: Existing and Proposed Water Surface Elevations for the 10-Year Storm

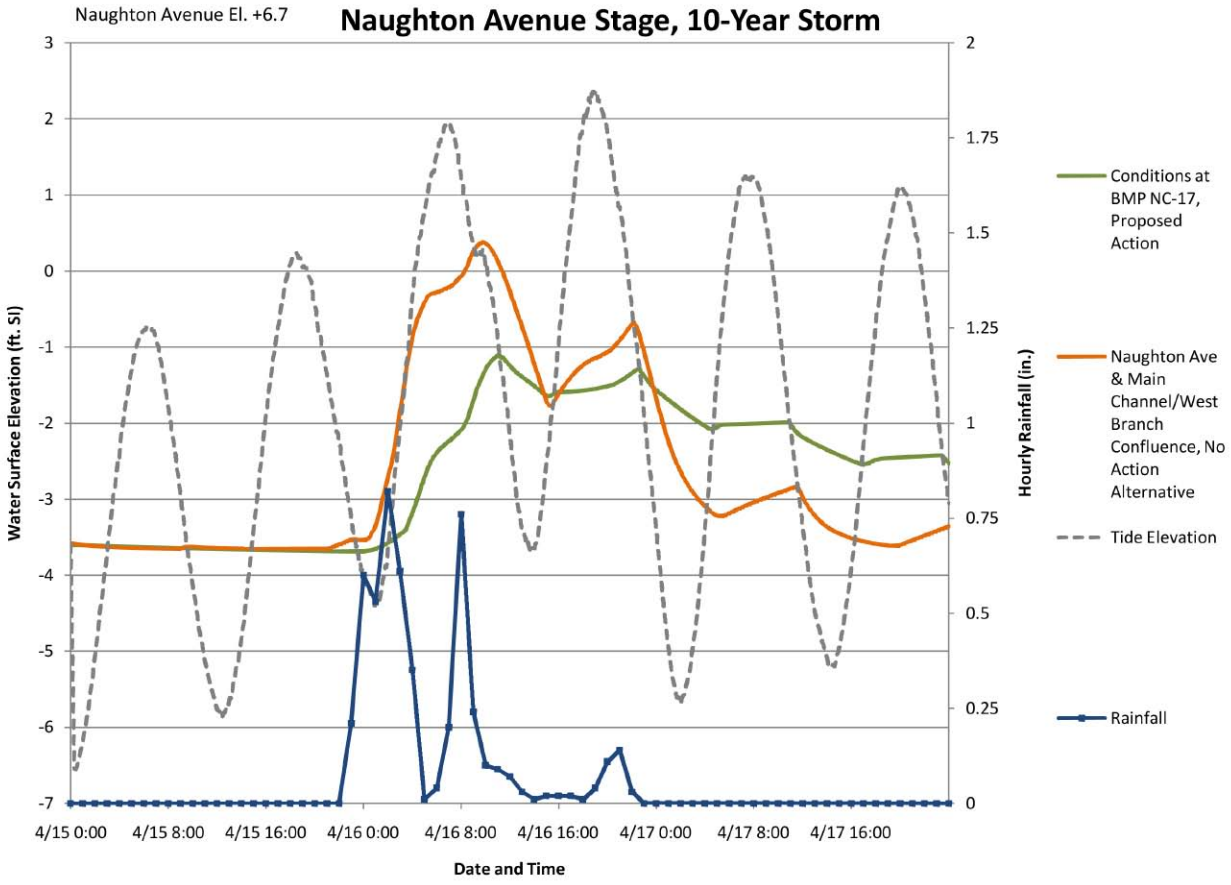
Figure 4.9-12



SOURCE: Hazen & Sawyer, 2010

Main Channel of New Creek at Olympia Boulevard:
Existing and Proposed Water Surface Elevations
for the 10-Year Storm

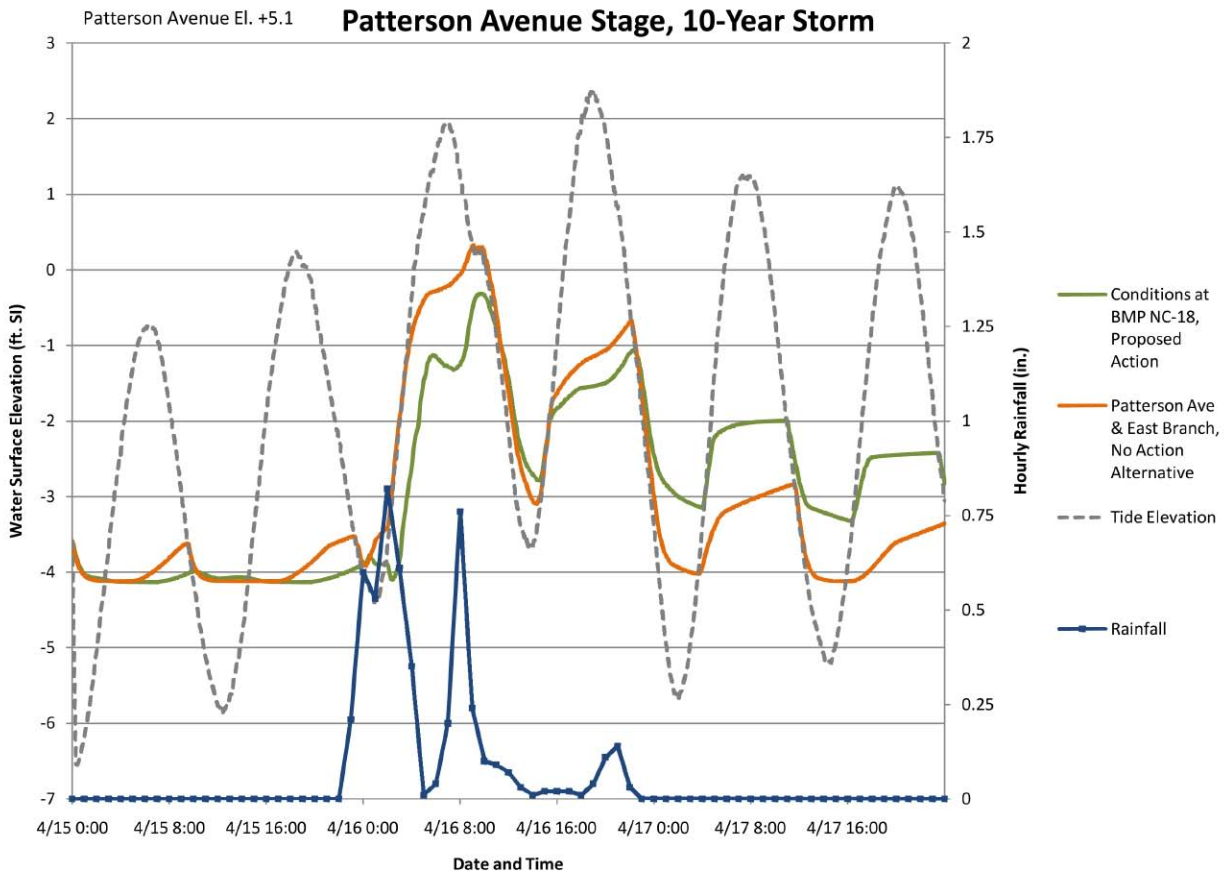
Figure 4.9-13



SOURCE: Hazen & Sawyer, 2010

Main Channel of New Creek at Naughton Avenue:
Existing and Proposed Water Surface Elevations
for the 10-Year Storm

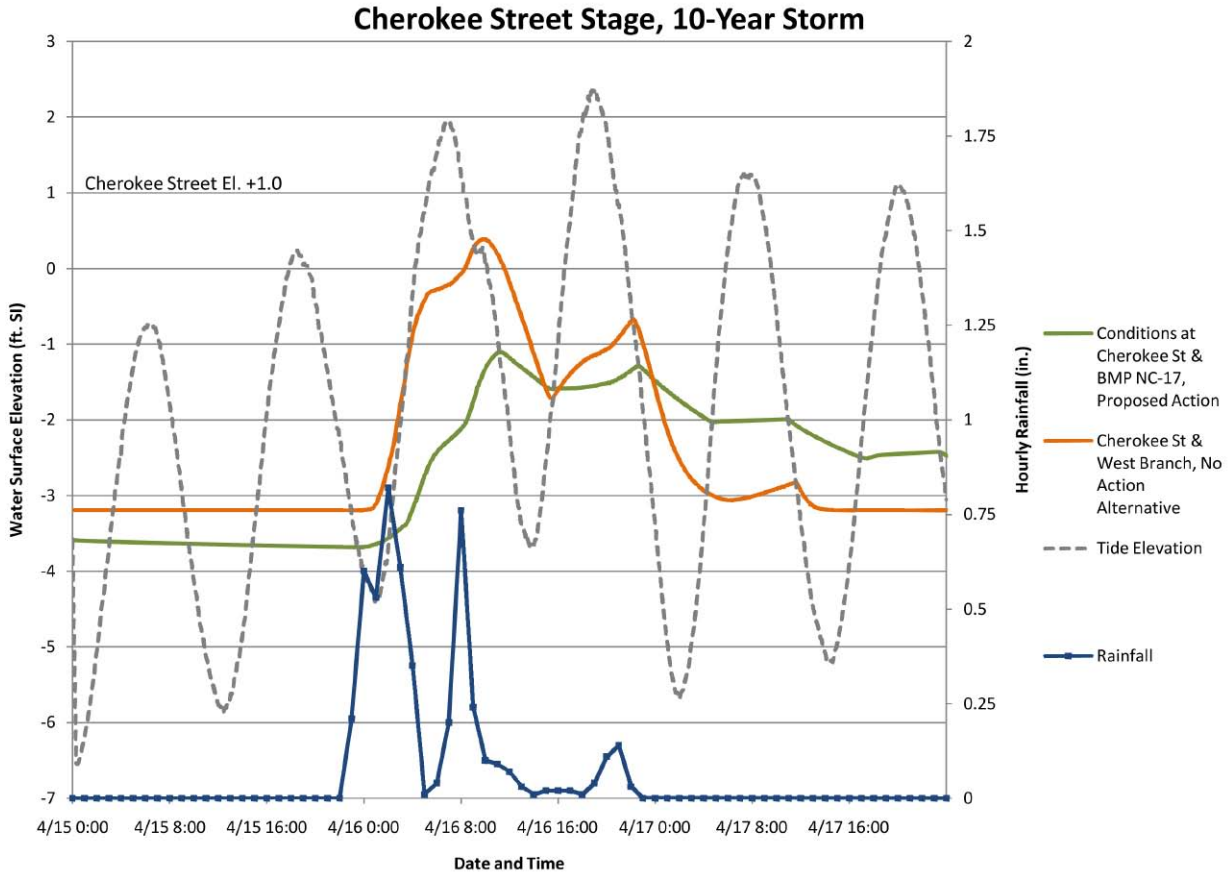
Figure 4.9-14



SOURCE: Hazen & Sawyer, 2010

East Branch of New Creek at Patterson Avenue:
Existing and Proposed Water Surface Elevations
for the 10-Year Storm

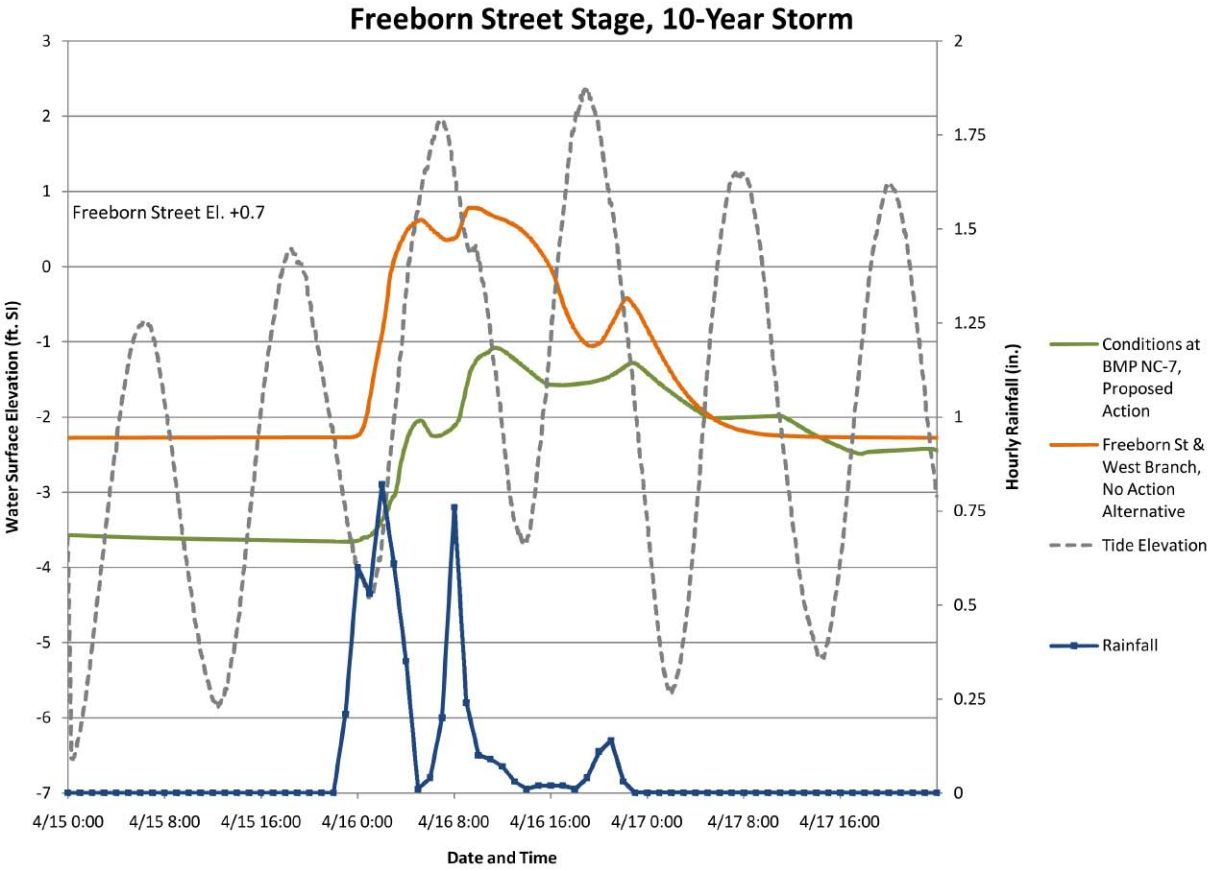
Figure 4.9-15



SOURCE: Hazen & Sawyer, 2010

West Branch of New Creek at Cherokee Street:
Existing and Proposed Water Surface Elevations
for the 10-Year Storm

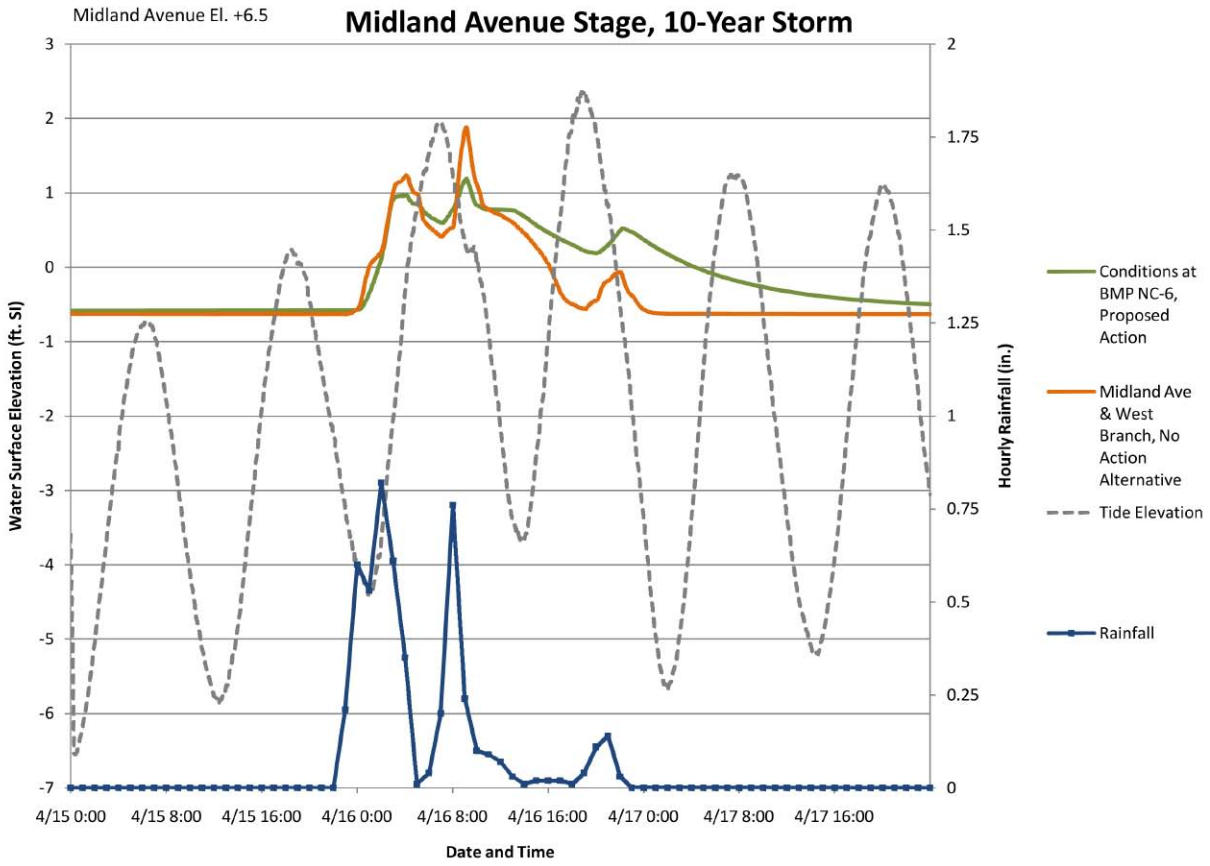
Figure 4.9-16



SOURCE: Hazen & Sawyer, 2010

West Branch of New Creek at Freeborn Street:
Existing and Proposed Water Surface Elevations
for the 10-Year Storm

Figure 4.9-17



SOURCE: Hazen & Sawyer, 2010

West Branch of New Creek at Midland Avenue:
Existing and Proposed Water Surface Elevations
for the 10-Year Storm

Figure 4.9-18

Chapter 4.10: Hazardous Materials of the New Creek Drainage Plan

A. INTRODUCTION

This chapter examines the potential for the presence of subsurface hazardous materials at each of the proposed BMP sites and the potential for these materials to be disturbed by the proposed project. The analysis focuses on hazardous materials that may have resulted from historic and existing land use conditions and activities at the proposed BMP sites and in their respective study areas; if such contamination is present, the section provides a summary of potential impacts and recommendations that through project implementation measures would avoid impacts to workers, the community, and the environment.

B. EXISTING CONDITIONS

SUBSURFACE CONDITIONS

The New Creek watershed elevations range from approximately 400 feet above mean sea level in the upper watershed to less than 10 feet above mean sea level in the lower watershed, with the greatest changes in topographical relief in the hilly upper watershed. Groundwater flow is expected to follow the general topography and also flow towards the three branches of the New Creek system (the West and East Branches and the Main Channel). Actual groundwater depth and flow direction may be affected by past filling activities, underground utilities, other subsurface openings or obstructions such as basements, tidal fluctuations, and other factors. Groundwater in Staten Island is not used as a source of drinking water. Additional data on groundwater conditions is also provided in Chapter 4.9, "Natural Resources."

Phase II investigations previously prepared for certain properties in the watershed encountered groundwater approximately 2 to 8 feet below grade at the proposed sites of BMPs NC-10, NC-13 and NC-15 through NC-19. Depth to groundwater at most of the other proposed BMP sites in the lower watershed is also expected to be shallow based on the presence or proximity to surface water and the grade above sea level. Greater depth to groundwater is expected at the proposed upper watershed BMP sites due to their elevations. Additional data on groundwater conditions is also provided in Chapter 4.9 "Natural Resources."

CURRENT LAND USES

Land use in the watershed is mostly residential, open space or institutional uses with some commercial uses concentrated along Richmond Road, Hylan Boulevard, Midland Avenue and Seaview Avenue; the Staten Island Railway runs east/west across the watershed. The Staten Island University Hospital campus is located in the eastern portion of the watershed. Commercial uses that may impact groundwater include auto repair facilities, filling stations and dry cleaners.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project it is expected that there would not be any significant changes in environmental conditions at the proposed BMP sites, nor would any project-related soil disturbance be undertaken.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

POTENTIAL FOR SITE CONTAMINATION

NC-1

Phase 1 ESA and Phase II Site Testing Results

No Phase 1 Environmental Site Assessment (ESA) or Phase II testing was previously performed for this site.

DGEIS Investigations

As part of the investigations performed for this DEGIS, a small quantity of dumped concrete was observed in the accessible portion of the proposed site of BMP NC-1. Portions of the proposed site which could not be visually inspected due to dense vegetation and a steep slope may also contain dumped materials. No other potential sources of contamination were noted. Based on these observations, the proposed site of NC-1 has a moderate potential for contamination.

NC-2

Phase 1 ESA and Phase II Site Testing Results

No Phase 1 ESA or Phase II testing was previously performed for this site.

DGEIS Investigations

As part of the field investigations performed for this DGEIS, dumped concrete and asphalt were observed in the accessible portions of the proposed site of BMP NC-2. Portions of the proposed site which could not be visually inspected due to dense vegetation and/or a steep slope may also contain dumped materials. No other potential sources of contamination were noted. Based on these observations, the proposed site of NC-2 has a moderate potential for contamination.

NC-3

Phase 1 ESA and Phase II Site Testing Results

No Phase 1 ESA or Phase II testing was previously performed for this site.

DGEIS Investigations

As part of the field investigations performed for this DGEIS, dumped materials (trash and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-3. Portions of the proposed site which could not be visually inspected due to dense vegetation may also contain dumped materials. No other potential sources of contamination were

noted. Based on these observations, the proposed site of NC-3 has a moderate potential for contamination.

NC-4

Phase 1 ESA and Phase II Site Testing Results

No Phase 1 ESA or Phase II testing was previously performed for this site.

DGEIS Investigations

As part of the field investigations performed for this DGEIS, an excavator and dumped materials (trash and construction/demolition debris) were observed adjacent to the proposed site of BMP NC-4. Portions of the proposed site which could not be visually inspected due to dense vegetation and a fence may also contain dumped materials. In addition, this site currently and historically has been part of the Richmond County Country Club golf course which may have used pesticides Based on these observations and data, the proposed site of NC-4 has a moderate potential for contamination.

NC-5

Phase 1 ESA and Phase II Site Testing Results

No Phase 1 ESA or Phase II testing was previously performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash and construction/demolition debris) were observed in the accessible portions of the proposed site of BMPNC-5. Portions of the proposed site which could not be visually inspected due to dense vegetation and a fence may also contain dumped materials. In addition, this site currently and historically has been part of the Richmond County Country Club golf course which may have used pesticides. An abandoned quarry was also shown approximately 660 feet north of the proposed site of NC-5 on historical Sanborn maps. The name of a nearby street (Ironmine Drive) suggests this may have been an iron ore quarry, which is not likely to have adversely impacted the proposed site of NC-5. Based on these observations and data, the proposed site of NC-5 has a moderate potential for contamination.

NC-6

Phase 1 ESA and Phase II Site Testing Results

No Phase 1 ESA or Phase II testing was previously performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash and construction/demolition debris) were observed on the periphery of the proposed site of BMP NC-6. The interior of the proposed site, which could not be visually inspected due to a fence and dense vegetation, were also observed to contain dumped materials. In addition, historical Sanborn maps show the Grant City Pumping Station (a water supply facility) in the northern portion of the proposed site of NC-6 until the mid-20th century. Mercury-containing equipment, PCB-containing electrical equipment, fill or demolition debris may be associated with this

historical structure. A 1983 historical Sanborn map appeared to show the proposed site of NC-6 as a parking lot, but by 1990, the proposed site was vacant. Regulatory databases noted a potential on-site spill, involving recurrent dumping of waste oil from a truck into a "wooded area," at the intersection of Boundary Avenue and Zwicky Street. However, the spill listing had been closed since NYSDEC was unable to verify that a spill had occurred.

Regulatory databases also listed three active-status spills involving groundwater contamination with gasoline, or methyl tert butyl ether (MTBE), a gasoline additive, and/or floating petroleum on groundwater potentially upgradient of the proposed site of NC-6. The nearest of these spills was reported at a filling station at Midland Avenue and Hylan Boulevard (approximately 470 feet to the northwest). Historical maps also showed potentially upgradient auto repair shops on the blocks to the north. A fuel oil storage tank test failure was reported within 400 feet of the proposed site of NC-6; the listing was closed due to lack of recent information. Based on these observations and data, the proposed site of NC-6 has a high potential for contamination.

NC-7

Phase 1 ESA Results

A 2003 Phase I ESA noted historical development on or adjacent to the proposed BMP. Fill or demolition debris may be associated with this development. Five active-status spills involving groundwater contamination with fuel oil, gasoline and/or MTBE and, in three cases, floating petroleum on groundwater, were reported potentially upgradient of the proposed site of BMP NC-7. However, the nearest of these spills was approximately 1,680 feet to the northeast.

Phase II Testing Results

No Phase II investigations have been performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash, a hubcap and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-7. Portions of the proposed site which could not be visually inspected due to dense vegetation and/or being obscured by residences on the proposed BMP perimeter may also contain dumped materials. Based on these observations and data, the proposed site of NC-7 has a moderate potential for contamination.

NC-8

Phase 1 ESA Results

A 2003 Phase I ESA indicated that historically, dwellings were present in or adjacent to the proposed BMP NC-8. Fill or demolition debris may be associated with the development. Regulatory databases reported a potentially on-site spill (a car dumped into a wetland area) on Olympia Boulevard, which passes between the proposed sites of NC-8 and NC-9, near Graham Boulevard. The car was found and removed, and the spill listing was closed. In addition to the active-status gasoline spills located potentially upgradient of the proposed sites of NC-7 and NC-8, an active-status spill involving gasoline-impacted soil was reported approximately 1,280 feet southwest of the proposed site of NC-8 (potentially upgradient)

Phase II Testing Results

No Phase II investigations have been performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-8. Portions of the proposed site which could not be visually inspected due to dense vegetation and/or being obscured by residences on the proposed BMP perimeter may also contain dumped materials. Based on these observations and data, the proposed site of BMP NC-8 has a moderate potential for contamination.

NC-9

Phase 1 ESA Results

A 2003 Phase I ESA prepared for this BMP area noted historical development on or adjacent to the proposed BMP. Fill or demolition debris may be associated with the development. Regulatory databases reported a potentially on-site spill (a car dumped into a wetland area) on Olympia Boulevard, which passes between the proposed sites of BMPs NC-8 and NC-9, near Graham Boulevard. The car was found and removed, and the spill listing was closed. Regulatory databases identified active-status gasoline spills located potentially upgradient of the proposed sites of BMPs NC-7, NC-8 and NC-9.

Phase II Testing Results

No Phase II investigations have been performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-9. Portions of the proposed site which could not be visually inspected due to dense vegetation and/or being obscured by residences on the proposed BMP perimeter may also contain dumped materials. Based on these observations and data, the proposed site of NC-9 has a moderate potential for contamination.

NC-10

Phase I ESA Results

A Phase I ESA performed for this BMP area identified historical dwellings (demolished by the late 20th century). Additionally, regulatory databases identified a historical New York City municipal waste disposal site, used for dumping unspecified waste, on Quincy Avenue, potentially at or adjacent to the proposed site of NC-10. Fill or demolition debris may be associated with the historical on-site structures and potential on-site municipal waste dumping. Regulatory databases identified active-status gasoline spills located potentially upgradient of the proposed sites of NC-7 through NC-10. A closed-status spill was reported on Patterson Avenue between Hunter and Mapleton Avenues, potentially adjacent to the proposed site of NC-10. According to the spill listing, a caller reported that contaminated soil was used as backfill during construction in this area, but no further information was provided.

Phase II Testing Results

A 2005 Phase II investigation at this site included the collection of one soil sample from a boring advanced in the proposed area of BMP NC-10. The soil sample was analyzed for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs) and metals. Two composite soil samples were collected from the vicinity of proposed BMP sites NC-10, NC-15, NC-16 and NC-18 for waste classification purposes and analyzed for polychlorinated biphenyls (PCBs) and various waste characterization parameters, including VOCs, SVOCs, pesticides and metals using the Toxicity Characteristic Leaching Procedure (TCLP). The sampling results revealed elevated concentrations of metals were identified in the soil sample, likely due to the presence of fill and/or runoff from nearby filled areas. Neither of the two composite soil samples exceeded hazardous waste thresholds.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash and metal) were observed in the accessible portions of the proposed site of BMP NC-10. Portions of the proposed site which could not be visually inspected due to dense vegetation and/or being obscured by residences on the proposed BMP perimeter may also contain dumped materials. Based on these data findings, the proposed site of NC-10 has a high potential for contamination above NYSDEC Part 375 Soil Cleanup Objectives for Unrestricted Use (USCOs), likely including certain metals.

NC-11

Phase I ESA Results

A 2003 Phase I ESA noted stained soil along the western boundary of the proposed site along Stobe Avenue between Hylan Boulevard and Zoe Street. The Phase I ESA also noted historical development on or adjacent to the proposed BMP area. Fill or demolition debris may be associated with the development. Two active-status spills involving groundwater contamination with gasoline and MTBE were reported potentially upgradient of the proposed site at a filling station approximately 1,200 feet to the northwest.

Phase II Testing Results

No Phase II investigations have been performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash, soil mixed with gravel, a car tire and construction/demolition debris including asphalt roof shingles) were observed in the accessible portions of the proposed site of BMP NC-11. Portions of the proposed site which could not be visually inspected due to dense vegetation may also contain dumped materials. Based on these observations and data, the proposed site of NC-11 has a high potential for contamination.

NC-12

Phase I ESA Results

A 2003 Phase I ESA performed for this site noted historical development on or adjacent to the proposed BMP area. Fill or demolition debris may be associated with this prior development. However, the proposed site of BMP NC-12 was identified as potentially downgradient from a

dry cleaner observed on Seaver Avenue between Hylan Boulevard and Joyce Street (approximately 250 feet to the east). Regulatory databases have also identified an active-status gasoline spill located potentially upgradient of NC-11 and NC-12

Phase II Testing

No Phase II investigations have been performed for this site.

DGEIS Investigations

As part of the investigations performed for this DGEIS, portions of the proposed site of BMP NC-12 could not be visually inspected due to dense vegetation; these areas may contain dumped materials. Based on these observations and data, the proposed site of BMP NC-12 has a high potential for contamination, including the potential presence of MTBE.

NC-13

Phase I ESA Results

A 2003 Phase I ESA noted historical development on or adjacent to the proposed BMP area. Fill or demolition debris may be associated with the development. The proposed site of NC-13 was also potentially downgradient from a dry cleaner on Seaver Avenue between Hylan Boulevard and Joyce Street (approximately 280 feet to the north). A photo shop (photo developing can use a variety of chemicals) was located approximately 140 feet northeast of the proposed site on Seaver Avenue. In addition to the active-status gasoline spill located potentially upgradient of the proposed sites of NC-11, NC-12and NC-13, three active-status spills involving petroleum-contaminated soil were reported potentially upgradient of the proposed site. The two closest spills were located approximately 700 feet to the northeast at a former car dealership. A filling station was shown on historical Sanborn maps at Hylan Boulevard and Stobe Avenue, approximately 170 feet to the west (potentially upgradient). A filling station was also observed on Hylan Boulevard approximately 500 feet to the northeast. A closed-status spill reported approximately 230 feet to the southwest involved an abandoned petroleum storage tank; no soil contamination was noted.

Phase II Testing

A 2004 Phase II investigation in the vicinity of this site included the collection of one soil sample. Elevated concentrations of metals were identified in two of the three soil samples, presumably due to the presence of fill and/or runoff from nearby filled areas. The concentration of lead identified in a groundwater sample also exceeded sewer discharge limits, MTBE was also detected (but at levels below its NYSDEC Class GA standard drinking water standard), and several metals exceeded their respective Class GA (drinking water) standards. Based on these data, the proposed site of BMP NC-13 has a high potential for contamination above USCOs, including certain metals, and MTBE may potentially be present.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash, hay bales and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-13. Portions of the proposed site which could not be visually inspected due to dense vegetation may also contain dumped materials.

NC-14

Phase I Results

A 2003 Phase I ESA noted historical development on or adjacent to the proposed BMP area. Fill or demolition debris may be associated with the development. The potential BMP site was also identified as potentially downgradient from a dry cleaner on Seaver Avenue between Hylan Boulevard and Joyce Street (approximately 530 feet to the north). Regulatory databases identified active-status gasoline spills located potentially upgradient of the proposed sites of NC-11 through NC-14, as noted above. A closed-status spill reported approximately 260 feet to the west involved an abandoned petroleum storage tank; no soil contamination was noted. A filling station is shown at Hylan Boulevard and Stobe Avenue, approximately 330 feet to the northwest (potentially upgradient) on the 1937-1990 historical Sanborn maps and a filling station was also observed during the 2010 field investigations on Hylan Boulevard approximately 750 feet to the northeast of the BMP site.

Phase II Testing Results

No Phase II investigations have been performed for this site.

DGEIS Investigations Results

As part of the investigations performed for this DGEIS, portions of the proposed site of BMP NC-14 could not be visually inspected due to dense vegetation and/or a fence; these areas may contain dumped materials. Based on these observations and the above data, the proposed BMP site of NC-14 has a high potential for contamination.

NC-15

Phase I ESA Results

A 2003 Phase I ESA noted historical development on or adjacent to the proposed BMP area. Fill or demolition debris may be associated with the development. Regulatory databases have also identified active-status gasoline spills located potentially upgradient of the site. A filling station also appears at the intersection of Hylan Boulevard and Stobe Avenue, approximately 960 feet to the northwest (potentially upgradient) on the 1937-1990 historical Sanborn maps.

Phase II Testing Results

A 2005 Phase II investigation revealed elevated concentrations of SVOCs and metals were identified in the soil sample, likely due to the presence of fill and/or runoff from nearby filled areas. A trace concentration of the VOC naphthalene was detected in this sample as well. Neither of the two composite soil samples exceeded hazardous waste thresholds.

DGEIS Investigations

As part of the investigations performed for this DGEIS, although portions of the proposed site of BMP NC-15 could not be visually inspected due to dense vegetation, based on observations from the site periphery, these areas may contain dumped materials. Based on these data, the proposed site of BMP NC-15 has a high potential for contamination above USCOs, including certain metals and SVOCs.

NC-16

Phase I ESA Results

A Phase 1 ESA identified fill of an unknown origin that may have been placed within the proposed BMP site as part of adjacent development. Regulatory databases reported two potentially on-site spills. The first involved a car dumped into a wetland area on Olympia Boulevard near Graham Boulevard. The second involved an abandoned drum containing trichloroethene, a chlorinated solvent, on Graham Boulevard and Nugent Avenue. The dumped materials were removed, and both spill listings were closed. A closed-status spill reported approximately 190 feet west of the proposed site indicated that a resident of Rowan Avenue was repeatedly dumping waste oil and gasoline onto the street. Olympia Homes was identified as a construction/demolition debris landfill at an unspecified location on Slater Boulevard (potentially in close proximity to the proposed site of NC-16). Regulatory databases identified active-status gasoline spills located potentially upgradient of the proposed sites of NC-11 through NC-16.

Phase II Results

A 2005 Phase II investigation revealed elevated concentrations of SVOCs and metals were identified in some soil samples, likely due to the presence of fill and/or runoff from nearby filled areas. A trace concentration of the VOC naphthalene was detected in the sample located north of the proposed site of NC-16. Neither of the two composite soil samples exceeded hazardous waste thresholds. Lead and zinc slightly exceeded their respective sewer discharge limits in the groundwater sample collected east of the proposed site of NC-16, but not in the sample collected within the proposed site. Several metals exceeded their respective Class GA standards in both groundwater samples, likely due to the samples' collection from temporary monitoring wells, which likely contained suspended sediment.

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash and construction/demolition debris) were observed in the accessible portions of BMP site NC-16. Portions of NC-16 which could not be visually inspected due to dense vegetation and/or being obscured by residences on the BMP perimeter may also contain dumped materials. Based on the above data, the proposed site of BMP NC-16 has a high potential for contamination above USCOs including certain metals and SVOCs.

NC-17

Phase I ESA Results

During the preparation of the Phase 1A for this site, small patches of sheen were noted on New Creek near Graham Boulevard and Baden Place; it was not clear whether the sheen was of natural (e.g., bacterial) origin or indicative of contamination. Regulatory databases reported a potentially on-site spill (a car dumped into a wetland area) on Olympia Boulevard near Graham Boulevard. The car was found and removed, and the spill listing was closed. Regulatory databases identified a historical New York City municipal waste disposal site, used for dumping unspecified waste, on Quincy Avenue (potentially at or adjacent to the proposed site of NC-17). Fill or demolition debris may be associated with the adjacent structures and potential on-site municipal waste dumping. Olympia Homes was identified as a construction/demolition debris landfill at an unspecified location on Slater Boulevard (potentially in close proximity to the

proposed site of NC-17). Regulatory databases identified active-status gasoline spills located potentially upgradient of the proposed sites of NC-11 through NC-17, as noted above.

Phase II Testing Results

A 2004 Phase II investigation revealed concentrations of some metals in the soil sample that exceeded their respective NYSDEC Part 375 Soil Cleanup Objectives for USCOs, but most metals were within their typical Eastern USA background ranges. The composite soil sample did not exceed hazardous waste thresholds. PCB concentrations in the groundwater sample exceeded their sewer discharge limit, MTBE was detected at its Class GA standard, and several metals exceeded their respective Class GA standards. MTBE was not detected in the soil sample, and may have originated from an off-site source. Based on these data, the proposed site of BMP NC-17 has a high potential for contamination above USCOs, including certain metals and possibly PCBs. MTBE is likely present (no concentrations above USCOs or Class GA standards were identified in potentially upgradient samples).

DGEIS Investigations

As part of the investigations performed for this DGEIS, dumped materials (trash, metal, and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-17. Portions of the proposed site which could not be visually inspected due to dense vegetation and/or being obscured by residences on the proposed BMP perimeter may also contain dumped materials.

NC-18

Phase I ESA Results

Regulatory databases identified a historical New York City municipal waste disposal site, used for dumping unspecified waste, on Quincy Avenue (potentially at or adjacent to the proposed site). Thus, fill of unknown origin may be present beneath the proposed site.

Phase II Testing Results

A 2004 Phase II investigation uncovered elevated concentrations of SVOCs and metals in the soil samples, likely due to the presence of fill and/or runoff from nearby filled areas. The composite soil sample was not classified as hazardous waste. Lead and zinc concentrations in the groundwater sample exceeded their respective sewer discharge limitations, and several metals exceeded their respective Class GA standards, likely due to the sample's collection from a temporary monitoring well, which likely contained suspended sediment.

A 2005 Phase II investigation also revealed elevated concentrations of metals identified in the soil sample, likely due to the presence of fill and/or runoff from nearby filled areas. The composite soil samples were not classified as hazardous waste. Based on these data, the proposed site of BMP NC-18 has a high potential for contamination above USCOs, including certain metals.

DGEIS Investigations

As part of the DGEIS site investigations, dumped materials (trash and construction/demolition debris) were observed in the accessible portions of the proposed site of BMP NC-18. Portions of the proposed site which could not be visually inspected due to dense vegetation may also contain dumped materials.

NC-19

Phase 1 ESA Results

Regulatory databases in this report identified a historical New York City municipal waste disposal site, used for dumping unspecified waste, on Quincy Avenue (potentially at or adjacent to the proposed site). Thus, fill of unknown origin may be present beneath the proposed site. Regulatory databases reported two closed-status spills involving waste oil dumping approximately 370 feet northeast of the proposed site of NC-19 (potentially upgradient).

Phase II Testing Results

A 2004 Phase II investigation revealed concentrations of some metals in the soil samples that exceeded their respective USCOs; however, most metals were within their Eastern USA background ranges. SVOCs were detected in one soil sample, but were below their respective USCOs. The composite soil sample was not identified as hazardous waste. Based on these data, the proposed site of BMP NC-19 has a moderate potential for contamination above USCOs, including certain metals.

DGEIS Investigations

As part of the DGEIS site investigations, portions of the proposed site of BMP NC-19 could not be visually inspected due to dense vegetation; these areas may contain dumped materials.

LOWER BAY OUTFALL

A review of historical Sanborn maps performed for this DGEIS identified small historical dwellings on Midland Beach in the early 20th century. Some of these dwellings may have been located in the vicinity of the proposed outfall location. Associated demolition debris may remain beneath the upland portion of the proposed outfall location. Regulatory databases identified closed-status spills involving raw sewage, petroleum and, in one case, medical waste impacting Staten Island beaches; however, insufficient information was provided to determine it whether any of these spills occurred in the vicinity of the proposed outfall location. Based on these data and observations, the proposed outfall site has a moderate potential for contamination.

SUMMARY OF POTENTIAL FOR BMP SITE CONTAMINATION

Table 4.10-1 identifies the potential for contamination at each BMP site based on the above data. Those results are as follows:

- Proposed sites of BMPs NC-1 through NC-5: moderate potential for site contamination;
- Proposed site of BMP NC-6: historical uses, site observations and the regulatory databases have indicated the need for site testing to identify any potential impacts on soil and groundwater conditions;
- Proposed sites of BMP NC-7 through NC-9: moderate potential for site contamination;
- Proposed sites of BMP NC-10 through NC-17: historical uses, site observations, the regulatory databases and limited Phase II testing have indicated the need for site testing to identify any potential impacts on soil and groundwater conditions;
- Proposed site of BMP NC-18: high potential for site contamination based on site testing;

Table 4.10-1
New Creek Amended Drainage Plan: Conclusions and Recommendations Summary for Hazardous Materials

BMP Number	BMP Name/Location	Potential for Contamination	Recommendations	Notes
NC-1	Merrick Ave	Moderate	Conduct work in accordance with a CHASP	Minor potential for impact from dumping in BMP area
NC-2	Ocean Terrace	Moderate	Conduct work in accordance with a CHASP	Minor potential for impact from dumping in BMP area
NC-3	Annfield Court	Moderate	Conduct work in accordance with a CHASP	Minor potential for impact from dumping in BMP area
NC-4	Whitlock Avenue	Moderate	Conduct work in accordance with a CHASP	Minor potential for impact from dumping in BMP area, pesticide use
NC-5	Todt Hill Road	Moderate	Conduct work in accordance with a CHASP	Minor potential for impact from dumping in BMP area, pesticide use
NC-6	Boundary Avenue	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, off-site uses and reported petroleum spills with potential to impact BMP
NC-7	Grimsby Street	Moderate	Conduct work in accordance with a CHASP	Potential impact from filling and dumping in BMP area
NC-8	Freeborn Street	Moderate	Conduct work in accordance with a CHASP	Potential impact from filling and dumping in BMP area, spills with potential to impact BMP
NC-9	Graham Boulevard	Moderate	Conduct work in accordance with a CHASP	Potential impact from filling and dumping in BMP area, spills with potential to impact BMP
NC-10	Jefferson Ave	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, spills with potential to impact BMP. Limited testing performed (2005) – elevated M (soil)
NC-11	Last Chance Pond	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, spills with potential to impact BMP
NC-12	Joyce Street	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, off-site uses with potential to impact BMP, potential V in groundwater based on 2004 testing near BMP
NC-13	Hylan Boulevard	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, off-site uses and spills with potential to impact BMP, potential elevated M (soil) and V (groundwater) based on 2004 testing near BMP
NC-14	Meadow Place	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, off-site uses and spills with potential to impact BMP, potential V in groundwater based on 2004 testing near BMP
NC-15	Laconia Avenue	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, potential elevated S, M (soil) based on 2004 testing near BMP
NC-16	Olympia Boulevard	High	Conduct work in accordance with a CHASP	Testing performed (M&E, 2005) – elevated M, S (soil), M (groundwater)
NC-17	Slater Boulevard	High	Conduct subsurface testing	Potential impact from filling and dumping in BMP area, potential elevated M (soil) and M, V (groundwater) based on 2004 testing near BMP
NC-18	Patterson Avenue	High	Conduct work in accordance with a CHASP	Testing performed (2004) – elevated M, S (soil), M (groundwater)
NC-19	Buel Avenue	Moderate	Conduct work in accordance with a CHASP	Potential impact from filling and dumping in BMP area , spills with potential to impact BMP, potential elevated M (soil) based on 2004 testing near BMP
Proposed NC Tidal Outfall	Between Jefferson and Hunter Avenue	Moderate	Conduct work in accordance with a CHASP	Spills with minor potential to affect outfall site, potential demolition debris

Notes:
CHASP – Construction Health and Safety Plan
M – metals, S – semi-volatile organic compounds, V – volatile organic compounds, P – pesticides

- Proposed site of BMP NC-19:high potential for site contamination based on site testing; and
- Proposed site of Lower Bay outfall: historical uses and the regulatory databases have indicated a moderate potential for site contamination.

RECOMMENDATIONS TO BE IMPLEMENTED AS PART OF THE PROPOSED PROJECT

Table 4.10-1 provides recommendations for each of the proposed BMP sites. For the proposed BMP sites where additional subsurface testing is recommended because no or limited Phase II soil or groundwater testing has been performed to date and there is the potential for contamination, Phase II subsurface investigations are proposed as part of the project including the collection and laboratory analysis of soil and groundwater samples. For all proposed BMP sites where sampling to date has identified the potential for soil or groundwater contamination, or where future site testing identifies potential soils or groundwater contamination, site-specific Remedial Action Plans (RAPs) and Construction Health and Safety Plans (CHASPs) would be implemented as part of each capital project, as necessary. The RAP and CHASP would specify procedures for managing any identified or unexpectedly encountered contamination (including procedures for stockpiling and off-site transportation and disposal) and appropriate health and safety procedures to be used during construction. In addition, excavated soil at the proposed BMP sites may include urban fill materials, and would therefore need to be managed in accordance with all applicable regulations. All material that needs to be disposed of (e.g., both petroleum-contaminated soil and excess fill including demolition debris) would be properly handled and disposed of off-site in accordance with all applicable federal, state and local regulations.

Dewatering may also be required during the proposed construction. If discharge to sanitary sewers is proposed, testing would need to be performed to ensure that the groundwater would meet DEP sewer discharge requirements. If necessary, the water would be pretreated prior to discharge to the City's sewer system. Should discharge to surface water bodies or to a storm sewer not connecting to a treatment plant be proposed, dewatering activities would be subject to NYSDEC State Pollution Discharge Elimination System (SPDES) requirements.

Lastly, any dumped materials in the areas to be disturbed will be properly disposed of in accordance with all applicable federal, state and City regulations. If dumped building materials potentially containing asbestos are identified, such materials will be tested for asbestos prior to disposal.

E. CONCLUSIONS

The proposed project would involve the disturbance of soil and groundwater in areas where prior uses and regulatory database searches have indicated a potential for the presence of hazardous materials in the soil and/or groundwater. At some proposed BMP locations this conclusion is based on Phase II testing and in some locations additional site testing to be performed as part of the capital project is necessary in order to determine if the proposed project would result in any impacts by disturbing soil or groundwater. At all sites where the proposed project may disturb contaminated soil or groundwater, the proposed project would implement a CHASP and RAP to avoid impacts on workers or the community.

All excavated soil would need to be handled and managed in accordance with all federal, state, and City regulations. If any dewatering is necessary during construction and discharge to

sanitary sewers is proposed, the residual water would need to meet DEP standards for discharging to a City sanitary line and pretreatment would need to be performed as necessary. If residual water is proposed to be discharged to a stream or waterway, it would need to meet NYSDEC SPDES standards for such discharges. In addition, any previously dumped materials would also need to be handled and disposed of in accordance with all applicable regulations (i.e., asbestos containing materials). With these measures in place, the proposed project would not result in potential significant adverse impacts to hazardous materials. ✷

Chapter 4.11: Water and Sewer Infrastructure of the New Creek Drainage Plan

A. INTRODUCTION

Preliminary amended drainage plans have been developed for the New Creek watershed with the objectives of improving water quality, reducing flooding and erosion, and enhancing vegetative communities and wildlife habitats. The proposed project would not introduce new residents or employees that would generate any added demands on water supply, nor would it install any impervious coverage that would generate additional runoff. However, the proposed project would include the installation of sanitary and storm sewers, and this chapter examines the potential effects of the proposed project on water and sewer infrastructure in the New Creek watershed.

B. EXISTING CONDITIONS

SANITARY SEWERS

The New Creek watershed is largely sewered for sanitary service. There are sections of the watershed, in most cases one or two block lengths, where sanitary sewers have not yet been installed. For example, the Todt Hill area of the watershed (north of Richmond Avenue) is an area that has no sanitary sewer service. In these areas, septic systems would be currently used to provide on-site sanitary wastewater management. The general direction of sanitary sewer flow in the watershed is south, toward the lower elevations of the watershed where an interceptor conveys collected flows to the Oakwood Beach Wastewater Treatment Plant (WWTP). The treatment capacity of the plant is 40 million gallons per day (mgd).

STORMWATER MANAGEMENT

OVERVIEW

The New Creek watershed is largely urbanized, with some residential and commercial development, and covers about 3.5 square miles. Impervious surfaces (e.g., building rooftops and streets) account for about 36 percent of the watershed. Approximately 1.2 square miles of the watershed, or about 33 percent, drains directly into New Creek while the remaining areas drains to a system of sewers, trunk sewers and outfalls that discharge to Lower Bay. There are also several miles of existing stream channels that convey stormwater. Approximately 20 percent of the watershed has existing system sewers, and those completed segments are scattered throughout the watershed.

UPPER WATERSHED

The upper portion of the watershed is characterized by steeper topography and less dense development, which yields less stormwater runoff. Therefore, the upper watershed does not experience intensive street or structure flooding, but does experience stream erosion on steeply sloped hillsides.

LOWER WATERSHED

The lower watershed is flat and does not drain as well as the upper watershed, but does have a larger storm sewer network than the upper. Trunk sewers run along New Dorp Lane, Ebbits Street and Tysens Lane and convey stormwater to outfalls located downstream. One-way flap gates within the outfalls allow discharge to Lower Bay when the water surface elevation in the sewers is greater than that of the bay. However, these gates also block stormwater outflow when there is an extreme high tide, coupled with a rainfall event. During these times of combined high tide and storm events, local properties and streets become flooded by trunk sewer surcharges. As a result of this localized flooding, excess stormwater flows may infiltrate nearby sanitary sewers, resulting in increased flows to the Oakwood Beach WWTP.

C. FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project, the existing drainage patterns in the watershed would remain essentially unchanged through the year 2043. Therefore, under this condition flooding is expected to continue and other benefits of the proposed project with respect to sanitary wastewater and stormwater management would not be achieved.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

SANITARY SEWERS

While the sanitary sewer system is largely built in the New Creek watershed, the proposed drainage plan would build additional sanitary sewer segments that would be completed under future capital improvement projects. With the proposed project, all wastewater generated in the watershed would be conveyed to the Oakwood Beach WWTP for treatment prior to discharge, which is what currently occurs existing conditions. With the installation of sanitary sewers in the fronting street, property owners who currently have septic systems would then need to connect to the sanitary collection sewer. In addition, the proposed amended drainage plan would increase the size of some existing sanitary collection sewers from 8 inches to 10 inches in diameter, in order to conform with current DEP standard sewer sizes. The expansion of sanitary service would be limited to street sections one or two blocks in length; remaining sewer segments are scattered throughout the watershed. This added service would not significantly increase sanitary flows to the WWTP, which currently is operating at about 29 mgd and has a permitted capacity of 40 mgd.

Therefore, the proposed project would not result in potential significant adverse impacts to sanitary sewer infrastructure.

STORMWATER MANAGEMENT

The proposed project would not introduce any new development or impervious surface coverage that would generate runoff. Rather, this project would improve local stormwater management

with the implementation of BMPs. The proposed amended drainage plan would provide storm sewers throughout the watershed with storm sewers that would discharge to wetland BMPs, thereby providing flood volume and velocity controls along with enhanced ecological conditions through the protection and restoration of wetlands.

Hydrologic and hydraulic modeling of the proposed project was performed for the watershed. In the upper watershed, the proposed drainage plan would provide a storm sewer system that integrates the existing water bodies and stormwater features to create a comprehensive drainage system, with stormwater conveyance and detention. In the lower watershed, modeling shows that the proposed amended drainage plan would lower water surface elevations in the low-lying areas, to a level that provides positive drainage to the BMPs and wetlands, thereby reducing local street flooding. Reductions in street flooding would thus reduce events where sanitary sewers are impacted by street flooding. The proposed project would also relieve flows to the existing trunk sewers during large storm events as some stormwater would flow to the proposed BMPs for extended detention.

The proposed BMPs would be mapped as part of the drainage plan and are designed to handle the City's 5-year storm in the upper watershed and 10 year storm in the lower watershed (the larger design storms in the lower watershed BMPs are proposed address the tidal influence on the system). They would be important elements of the City's drainage system and, in conjunction with the storm sewers feeding into them, would be key elements in the City's infrastructure.

Therefore, the proposed project would not result in potential significant adverse impacts to storm stormwater management infrastructure.

E. CONCLUSIONS

The proposed project would upgrade local sanitary sewers to current design standards and would extend sewer service to areas of the watershed where there is no sanitary service. The extension of this sewer service would not impact the Oakwood Beach WWTP. The proposed project would also provide a comprehensive stormwater management plan for the watershed. This would result in positive impacts with reductions in local street and property flooding.

Therefore, the proposed project would not result in potential significant adverse impacts to water and sewer infrastructure. ✷

Chapter 4.12: Solid Waste and Sanitation Services of the New Creek Drainage Plan

Operation and maintenance of the proposed drainage plan would not generate a significant volume of additional solid waste. Solid waste generated from the maintenance of the proposed BMPs would be disposed of in accordance with the City's Solid Waste Management Plan (SWMP). The maintenance debris generated by the proposed BMPs would be primarily comprised of vegetative waste and street accumulated litter. The volume of these materials would not significantly add to the solid waste volumes generated in New York City. Waste materials would then be handled by DEP, and disposed of in accordance with all applicable federal, state, and City regulations. If practical and economic, residual tree limbs and branches would be reused, and chipped into mulch. Potential solid waste impacts during construction are presented below in Chapter 6.1, "Impacts During Construction." Therefore, the proposed project would not result in potential significant adverse impacts to the City's solid waste and sanitation services. ✷

Chapter 4.13: Energy of the New Creek Drainage Plan

Operation of the proposed New Creek drainage plan would require minimal energy. The proposed BMPs are natural systems, with the exception of occasional maintenance. Chapter 6.1, "Impacts During Construction," assesses the potential impacts of the proposed project as it relates to energy demands during construction. Therefore, the proposed project would not result in potential significant adverse impacts to energy. ✷

Chapter 4.14: Transportation of the New Creek Drainage Plan

A. INTRODUCTION

Preliminary amended drainage plans have been developed for the New Creek watershed with the objectives of improving water quality, reducing flooding and erosion, and enhancing vegetative communities and wildlife habitats. The proposed project would not generate any vehicular, transit, or pedestrian trips; however, it would require the demapping of a number of street segments within the watershed. This chapter therefore analyzes the potential transportation impacts of the proposed project in the New Creek watershed. Chapter 2.1, "Methodology," describes in greater detail the procedures used in this analysis.

B. EXISTING CONDITIONS

The New Creek watershed is bound by Miller Field and New Dorp Lane to the west and Seaview Avenue, the Staten Island University Hospital and Burgher Avenue form the eastern boundary. The northern boundary extends through and includes portions of the Richmond County Country Club and the Reeds Basket Willow Swamp Park, and Lower Bay is the southern boundary. The major east and west collector roads in the watershed are Ocean Terrace at the northern end of the watershed, Amboy Road/Richmond Road and Hylan Boulevard through the center of the watershed, and Father Capodanno Boulevard which run along the southern portion of the watershed and providing access to the waterfront beaches. North/south collector roads include: Todt Hill Road which intersects with Ocean Terrace on the north and Richmond Hill Road on the south; Midland Avenue which extends between Richmond Avenue on the north and Father Capodanno Boulevard on the south and Seaview Avenue which also extends between Richmond Avenue on the north and Father Capodanno Boulevard on the south. These major collector roads are more heavily traveled and carry larger volumes of traffic during the morning, afternoon and evening peak hours.

The other streets in the watershed are generally local residential streets some of which dead end or are interrupted by large open spaces such as Richmond County Country Club, Reeds Basket Willow Swamp Park and Miller Field (part of the Gateway National Recreation Area). The Staten Island Railway also runs east/west across the watershed and interrupts the street grid at certain locations. However, for the most part the street grid is complete in the upper portion of the watershed (Hylan Boulevard and above), with a number of quiet and lightly traveled residential streets in and around the Todt Hill neighborhood. Segments of the street grid in the lower portion of the watershed have not been completed. These street segments have not been completed because of freshwater wetlands and streams that have restricted development of these properties, thus largely eliminating the need for a local access road. In addition, these wetlands have also impeded the construction of roads, due to physical and regulatory constraints faces when building through wetlands. Currently, these wetlands have been or are in the process of being acquired by DEP under the Bluebelt program. The incomplete street grid in the lower watershed is generally associated with the mapped, but unbuilt streets, that are occupied by

streams, wetlands and floodplains associated with the West Branch, Main Branch and East Branch of the New Creek watershed south of Hylan Boulevard, with the exception of the mapped but unbuilt streets within NC-11: Last Chance Pond and NC-12: Joyce Street which are north of Hylan Boulevard. The lower watershed streets are also characterized by quiet, lightly traveled and narrow residential streets.

PARKING

There are few on-street parking restrictions in this area. Most parking needs are met off-street in residential driveways, although some denser areas of residential development do use on-street parking to address local parking needs. Another exception is along the commercial corridors, such as Hylan Boulevard, where on-street parking is metered or time-restricted along certain segments.

TRANSIT

The New Creek watershed is served by both rail and bus service. Rail service is provided by the Staten Island Railway and there are three stops in the study area: Grant City, Jefferson Avenue and Dongan Hills. Bus service is also provided along the major roads such as Richmond Avenue, Midland Avenue, Lincoln Avenue, Seaview Avenue, New Drop Lane and Hylan Boulevard.

PEDESTRIANS

Sidewalks and formal crosswalks are provided throughout much of the watershed although there are segments of streets where no sidewalks are provided. With the exception of the major commercial corridors in the watershed, like Hylan Boulevard, pedestrian traffic is generally light in the watershed.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project, no major changes are expected with respect to local transportation conditions. It is expected that there would be local street improvement projects (e.g., the intersection of Todt Hill Road and Circle Road is proposed for improvements; Todt Hill Road between Circle Road and Ocean Terrace is proposed for a realignment) and minor modifications in transit service through the No Build year (2043).

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

TRAFFIC

It is not expected that that proposed project would result in impacts on traffic conditions for the following reasons that the site access is maintained to all existing privately held properties, where necessary. The watershed is largely built-out under the current zoning, there is little remaining developable land, and no additional large development is expected in the watershed that would generate a large traffic demand on local streets. Acquisition of the remaining vacant land under the Bluebelt program would preserve these lands for Bluebelt purposes which generates no traffic and eliminates additional traffic demands that might otherwise occur on these properties under development densities allowed under the current zoning.

In sum, the proposed BMPs would not conflict with any major east/west collector streets, but would affect only limited segments of local collector streets (see **Figures 4.14-1a and 4.14-1b**, and Chapter 4.1, "Project Description of the New Creek Drainage Plan" for a description of the affected streets) that would not necessary since the adjoining lands would be preserved and undeveloped under the Bluebelt program—thus, the proposed project would not adversely impact any through or local traffic circulation patterns in the neighborhood, but would preserve some of the lightly traveled local streets that characterize the lower watershed through the land preservation elements of the Bluebelt project.

In addition, although BMP NC-1: Merrick Avenue and BMP NC-4: Whitlock Avenue are proposed in the bed of sections of mapped, but unbuilt streets (Merrick Avenue and Whitlock Avenue, respectively, it is not expected that the mapped segments of these streets will be constructed in the future without the proposed project as they would serve no access purposes and would continue to dead end at City park or Department of Environmental Conservation preserved open space properties. Thus, the proposed project would not conflict with any traffic circulation objectives for these areas. Therefore, the proposed project would not result in potential significant adverse impacts to traffic.

PARKING

The proposed project would not modify any local parking regulations nor would it eliminate any existing on-street parking or generate a new added parking demand. Therefore, the proposed project would not result in any impacts to parking.

TRANSIT

The proposed project would not place any added demands on transit facilities in the study area as it would not generate any transit trips. It would also not result in any long term (operational) impacts on transit facilities as the proposed project would not permanently impact any local streets served by these facilities. Therefore, the proposed project would not result in potential significant adverse impacts to transit.

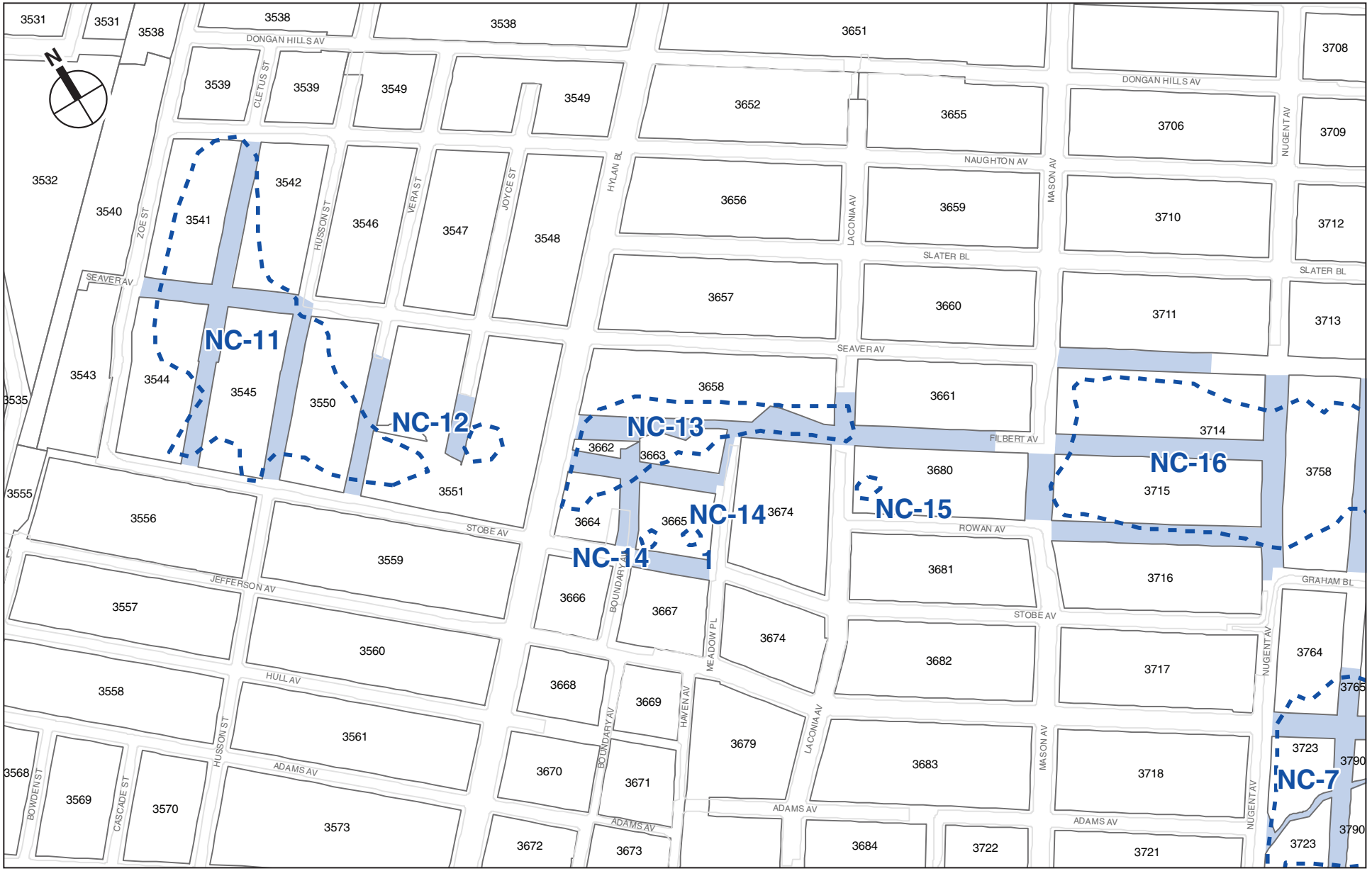
The proposed project would require construction within local right of way and streets served by public transit. This includes NC-12, -13 and -14 portions of which are along Hylan Boulevard. Chapter 6.1, "Impacts During Construction" addresses the potential for temporary construction period impacts on these facilities. Therefore, the proposed project would not result in potential significant adverse impacts to pedestrians.

PEDESTRIANS

The proposed project would not affect any pedestrian facilities like sidewalks or crosswalks. Therefore, the proposed project would not result in any significant impacts to pedestrians.

E. CONCLUSIONS

The proposed project would not affect any collector roads and would reduce vehicular trip generation and the need for certain local streets since the Bluebelt would preserve these sites as BMP wetlands. The proposed project would also not affect local on-street parking, transit systems or pedestrian circulation. Therefore, the proposed project would not result in potential significant adverse impacts to transportation. ✷



Proposed BMP Footprint

Street Area to be Demapped

0 500 FEET

SCALE

Unbuilt Streets to be Demapped in the New Creek Watershed

Figure 4.14-1a

Unbuilt Streets to be Demapped in the New Creek Watershed

Figure 4.14-1b

Chapter 4.15: Air Quality of the New Creek Drainage Plan

Ambient air quality is affected by air pollutants produced by both vehicles (i.e., mobile sources) and fixed facilities (i.e., stationary sources). The proposed drainage plans would not result in any new vehicular traffic or any new significant stationary sources of airborne emissions. Potential air quality impacts during construction are addressed in Chapter 6.1, "Impacts During Construction." Therefore, the proposed project would not result in potential significant adverse impacts to air quality. ✷

Chapter 4.16: Greenhouse Gasses of the New Creek Drainage Plan

The *CEQR Technical Manual* recommends a greenhouse gas analysis for development projects greater than 350,000 gross square feet in size, or projects that have unique energy demands (e.g., power plants, major modifications in transportation). The proposed project would not develop any square footage and would not have any measureable energy demand during operation. In addition, the proposed project would not result in any mobile or stationary sources of air emissions. Thus, no further analysis of greenhouse gas emissions is required. Therefore, the proposed project would not result in potential significant adverse impacts related to greenhouse gasses. ✷

Chapter 4.17: Noise of the New Creek Drainage Plan

The proposed drainage plan amendments would not result in any new mobile source noises (e.g., vehicular traffic) and would not introduce any new stationary source noises. Noise impacts during construction are addressed below in Chapter 6.1, "Impacts During Construction." Therefore, the proposed project would not result in potential significant adverse impacts to noise. ✷

Chapter 4.18: Public Health of the New Creek Drainage Plan

According to the *CEQR Technical Manual*, public health may be impacted by poor air quality resulting from traffic or stationary sources, hazardous materials in soil or groundwater used for drinking water, significant adverse impacts related to noise or odors, solid waste management practices that attract vermin and pest populations, and actions that exceed federal, state, or City standards.

The proposed project would not result in significant adverse impacts to traffic, air quality, or noise, nor would any applicable federal, state, or City standards be exceeded. The proposed project would also not involve solid waste management practices that would attract vermin or pest populations. In addition, any hazardous materials encountered during construction would be handled in accordance with all federal, state, and City regulations, and in accordance with the protection measures in place within the proposed project. Therefore, the proposed project would not result in potential significant adverse impacts to public health. ✷

Chapter 4.19: Neighborhood Character of the New Creek Drainage Plan

The *CEQR Technical Manual* defines neighborhood character as a number of combined elements that together define a community. These elements include land use, urban design and visual resources, socioeconomics, traffic, air quality and noise. The proposed project would reduce street flooding and improve storm sewer conditions while implementing BMPs that provide both an ecological and stormwater management benefit. These are positive changes for the neighborhood and would help benefit existing residential, commercial, and open space uses in the area. Therefore, the proposed project would not result in potential significant adverse impacts to neighborhood character. ✷

Chapter 4.20: Growth Inducing Impacts of the New Creek Drainage Plan

A. INTRODUCTION

Preliminary amended drainage plans have been developed for the New Creek watershed with the objectives of improving water quality, reducing flooding and erosion, and enhancing vegetative communities and wildlife habitats. This chapter considers the potential effects of the proposed project of growth-inducing aspects in the New Creek watershed. As described in Chapter 2.1, "Methodology," the proposed amended drainage plans have been examined to determine if potential significant adverse growth-inducing aspects within New Creek would result.

B. EXISTING CONDITIONS

LAND USE AND ZONING CONDITIONS

The watershed is zoned primarily for lower density residential use (R1-1, R1-2, R2, R3-1, R3-2, R3X, and R5). In addition, a commercial uses are zoned along major thoroughfares, such as Hylan Boulevard and Richmond Avenue. The northern portion of the watershed is within the Staten Island Natural Area Special District. In this special district, natural features are protected by limiting modifications in topography, preserving trees and vegetative habitat, and natural water courses, and by encouraging clustered development.

The watershed is urbanized and the developed land uses are primarily residential uses that comprise a significant portion of the watershed (944 acres or 42.0 percent). Approximately 16.2 percent of the watershed (or 364 acres) is open space. There are several open spaces at the northern portion of the watershed, including Reeds Basket Willow Swamp Park and the Staten Island Greenbelt.

Of the 2,249 acres in the watershed, only 7.4 percent (or 166 acres) is vacant land. Most of this vacant land is located in the southern portion of the watershed, and is also mapped by NYSDEC as freshwater wetlands and also includes DEP Bluebelt property.

POPULATION GROWTH: 1980 TO 2010

Table 4.20-1 shows population trends in the New Creek watershed between 1980 and 2010. Overall, the study area population increased by 12.3 percent from 32,026 residents in 1980 to 35,952 residents in 2010. The study area's population grew at a slower pace than Staten Island and New York City as a whole, where the population increased by 33.1 percent and 15.6 percent, respectively, between 1980 and 2010.

Between 1980 and 1990, the study area experienced minimal population growth (0.1 percent). Although most census tracts in the study area experienced a decline in population during this time period, Census Tract 112.01's population did increase by 16.7 percent from 4,579 residents in 1980 to 5,342 residents in 1990 (this tract is located south of Hylan Boulevard in the Lower

Watershed, as shown in **Figure 4.20-1**). This population growth was more than double the borough's growth rate during this time period.

Between 1990 and 2000, the study area's population grew at a faster rate (7.6 percent) than the prior decade, but was still below the county's 17.1 percent growth rate and the city's 9.4 percent growth rate. Within the study area, Census Tract 112.02 had the highest population growth at 14.6 percent, from 4,889 residents in 1990 to 5,605 residents in 2000. Census Tract 96.02 followed with a 13.5 percent increase in population during this time period.

Between 2000 and 2010, the study area's population grew by 4.2 percent from 34,498 residents in 2000 to 35,952 residents in 2010. This growth rate was higher than New York City's 2.1 percent population growth rate, but lower than Staten Island's 5.6 percent population growth rate. Census Tract 112.02 continued to experience the highest population growth of the census tracts (14.7 percent).

Table 4.20-1
Total Population: 1980 to 2010

Geography (2010 Census Tracts)	Total Population				Percentage Change			
	1980	1990	2000	2010	1980-1990	1990-2000	2000-2010	1980-2010
CT 96.02	3,163	2,944	3,340	3,461	-6.9	13.5	3.6	9.4
CT 112.01[1]	4,579	5,342	5,590	5,758	16.7	4.6	3.0	25.7
CT 112.02[2]	4,497	4,889	5,605	6,428	8.7	14.6	14.7	42.9
CT 114.01	3,187	3,031	2,946	3,067	-4.9	-2.8	4.1	-3.8
CT 114.02	3,259	3,028	3,254	3,450	-7.1	7.5	6.0	5.9
CT 122	3,846	3,580	3,759	3,813	-6.9	5.0	1.4	-0.9
CT 177[3]	6,531	6,437	6,920	7,001	-1.4	7.5	1.2	7.2
CT 181[2]	2,964	2,812	3,084	2,974	-5.1	9.7	-3.6	0.3
Study Area	32,026	32,063	34,498	35,952	0.1	7.6	4.2	12.3
Staten Island	352,121	378,977	443,728	468,730	7.6	17.1	5.6	33.1
New York City	7,071,639	7,322,564	8,008,278	8,175,133	3.5	9.4	2.1	15.6

Notes: [1] Some census tract boundaries were altered for the 2010 Census (see Figures 4.20-1 and 4.20-2). As of the 2010 Census, Census Tract 112.01 was extended to include a landscaped area to the east that had been part of Census Tract 112.02 in the prior census. This landscaped area does not contain any residential units or businesses.

[2] As defined by the 2010 Census, Census Tract 112.02 is bounded by New Dorp Lane to the southwest, Hylan Boulevard to the northwest, Hunter Avenue to the northeast, and the bulkhead line to the southeast. This Census Tract does not include the landscaped portion along the waterfront to the north east that had been included in the former census. This landscaped area does not contain any residential units or businesses.

[3] As defined by the 2010 Census boundaries, Census Tract 177 includes the following census tracts in 2000: Census Tract 177 and Census Tract 169.02.

[4] As defined by 2010 Census boundaries, Census Tract 181 includes the following census tracts in 2000: Census Tract 179 and Census Tract 185.

Sources: U.S. Bureau of the Census, 1980, 1990, 2000, and 2010 Census.

HOUSING GROWTH: 1980 TO 2010

Table 4.20-2 provides data on housing trends for the study area, Staten Island, and New York City. Between 1980 and 2010, the study area's housing stock increased by 27.2 percent—higher than the 14.4 percent increase in housing units in New York City, but lower than the 48.5 percent increase in Staten Island.

Table 4.20-2
Total Housing Units, 1980 to 2010

Geography (2010 Census Tracts)	Housing Units				Change from 1980 to 1990		Change from 1990 to 2000		Change from 2000 to 2010	
	1980	1990	2000	2010	Number	Percent	Number	Percent	Number	Percent
CT 96.02	1,236	1,254	1,402	1,437	18	1.5	148	11.8	35	2.5
CT 112.01[1]	1,449	1,833	2,039	2,185	384	26.5	206	11.2	146	7.2
CT 112.02[2]	1,557	1,815	2,101	2,427	258	16.6	286	15.8	326	15.5
CT 114.01	1,182	1,306	1,339	1,373	124	10.5	33	2.5	34	2.5
CT 114.02	1,208	1,246	1,355	1,407	38	3.1	109	8.7	52	3.8
CT 122	1,395	1,393	1,503	1,536	-2	-0.1	110	7.9	33	2.2
CT 177[3]	2,085	2,254	2,480	2,528	169	8.1	226	10.0	48	1.9
CT 181[4]	864	890	1,054	1,067	26	3.0	164	18.4	13	1.2
Study Area	10,976	11,991	13,273	13,960	1,015	9.2	1,282	10.7	687	5.2
Staten Island	119,000	139,726	163,993	176,656	20,726	17.4	24,267	17.4	12,663	7.7
New York City	2,946,410	2,992,169	3,200,912	3,371,062	45,759	1.6	208,743	7.0	170,150	5.3

Notes: [1] Some census tract boundaries were altered for the 2010 Census (see Figures 4.20-1 and 4.20-2). As of the 2010 Census, Census Tract 112.01 was extended to include a landscaped area to the east that had been part of Census Tract 112.02 in the prior census. This landscaped area does not contain any residential units or businesses.

[2] As defined by the 2010 Census, Census Tract 112.02 is bounded by New Dorp Lane to the southwest, Hylan Boulevard to the northwest, Hunter Avenue to the northeast, and the bulkhead line to the southeast. This Census Tract does not include the landscaped portion along the waterfront to the north east that had been included in the former census. This landscaped area does not contain any residential units or businesses.

[3] As defined by the 2010 Census boundaries, Census Tract 177 includes the following census tracts in 2000: Census Tract 177 and Census Tract 169.02.

[4] As defined by 2010 Census boundaries, Census Tract 181 includes the following census tracts in 2000: Census Tract 179 and Census Tract 185.

Sources: U.S. Bureau of the Census, 1980, 1990, 2000, and 2010 Census.

Between 1980 and 1990, the number of housing units in the study area increased by 9.2 percent from 10,976 units in 1980 to 11,991 units in 1990. Within the study area, Census Tract 112.01's housing stock had the most growth, increasing by 26.5 percent from 1,449 units in 1980 to 1,833 housing units in 1990. Census Tract 112.02 followed, with a 16.6 percent growth rate, which was slightly lower than the 17.4 percent growth rate in Staten Island.

Between 1990 and 2000, housing inventory in the study area increased by 10.7 percent to 13,273 housing units. Similar to the decade prior, Census Tract 112.02 had the highest growth rate at 15.8 percent. Census Tract 96.02 had the next highest growth rate during this time period, at 11.8 percent. This growth rate was significantly higher than the 1.5 percent growth rate from 1980 to 1990. Census Tract 112.01 had the third highest growth rate, increasing by 11.2 percent from 1,833 housing units in 1990 to 2,039 housing units in 2000.

Between 2000 and 2010, the number of housing units in the study area increased by 5.2 percent from 13,273 housing units in 2000 to 13,960 housing units in 2010. This was comparable to the 5.3 percent growth rate in New York City, but lower than the 7.7 percent growth rate in Staten Island. Census Tract 112.02 continued to have the highest growth rate at 15.5 percent. The next highest growth rate was Census Tract 112.01, which had a growth rate of 7.2 percent.

HOUSEHOLD GROWTH: 1980 TO 2010

Between 1980 and 2010, the number of households in the study area increased by 24.8 percent from 10,585 households in 1980 to 13,210 households in 2010 (see **Table 4.20-3**). In comparison, the number of households increased by 11.4 percent in New York City and by 44.6 percent in Staten Island.

Table 4.20-3
Household Characteristics, 1980 to 2010

Geography (2010 Census Tracts)	Households				Percent change from			Average Household Size			
	1980	1990	2000	2010	1980 to 1990	1990 to 2000	2000 to 2010	1980	1990	2000	2010
CT 96.02	1,214	1,188	1,341	1,349	-2.1	12.9	0.6	2.64	2.48	2.48	2.56
CT 112.01[1]	1,387	1,732	1,956	2,072	24.9	12.9	5.9	3.28	3.08	2.86	2.78
CT 112.02[2]	1,444	1,617	1,958	2,274	12.0	21.1	16.1	3.09	2.88	2.86	2.82
CT 114.01	1,142	1,263	1,276	1,318	10.6	1.0	3.3	2.81	2.40	2.3	2.32
CT 114.02	1,187	1,197	1,317	1,325	0.8	10.0	0.6	2.75	2.53	2.47	2.60
CT 122.00	1,378	1,332	1,451	1,439	-3.3	8.9	-0.8	2.8	2.69	2.57	2.64
CT 177.00[3]	2,001	2,138	2,388	2,414	6.8	11.7	1.1	3.21	3.00	2.89	2.90
CT 181[4]	832	849	1,029	1,019	2.0	21.2	-1.0	3.17	2.96	2.70	2.62
Study Area	10,585	11,316	12,716	13,210	6.9	12.4	3.9	2.99	2.79	2.68	2.69
Staten Island	114,485	130,519	156,341	165,516	14.0	19.8	5.9	3.00	2.85	2.78	2.78
New York City	2,792,614	2,819,401	3,021,588	3,109,784	1.0	7.2	2.9	2.49	2.54	2.59	2.57

Notes:
[1] Some census tract boundaries were altered for the 2010 Census (see Figures 4.20-1 and 4.20-2). As of the 2010 Census, Census Tract 112.01 was extended to include a landscaped area to the east that had been part of Census Tract 112.02 in the prior census. This landscaped area does not contain any residential units or businesses.
[2] As defined by the 2010 Census, Census Tract 112.02 is bounded by New Dorp Lane to the southwest, Hylan Boulevard to the northwest, Hunter Avenue to the northeast, and the bulkhead line to the southeast. This Census Tract does not include the landscaped portion along the waterfront to the north east that had been included in the former census. This landscaped area does not contain any residential units or businesses.
[3] As defined by the 2010 Census boundaries, Census Tract 177 includes the following census tracts in 2000: Census Tract 177 and Census Tract 169.02.
[4] As defined by 2010 Census boundaries, Census Tract 181 includes the following census tracts in 2000: Census Tract 179 and Census Tract 185.

Sources: U.S. Bureau of the Census, 1980, 1990, 2000, and 2010 Census.

Between 1980 and 1990, the number of households in the study area increased by approximately 6.9 percent, which was lower than the 14.0 percent growth in Staten Island. Within the study area, Census Tract 112.01 had the highest growth rate, increasing by 24.9 percent from 1,387 households to 1,732 households. Census Tract 112.02 followed with the second highest household growth rate, increasing by 12.0 percent from 1,444 households in 1980 to 1,617 households in 1990.

Between 1990 and 2000, the number of households in the study area increased by 12.4 percent, which was a higher growth rate compared to the decade prior. Within the study area, Census Tract 112.02 had the highest growth rate, increasing by 21.1 percent from 1,617 households in 1990 to 1,958 households in 2000.

Between 2000 and 2010, the number of households in the study area increased by 3.9 percent, higher than the household growth rate in New York City (2.9 percent), but lower than the household growth rate in Staten Island (5.9 percent).

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

As discussed above, there was continued residential development (housing growth) in the study area between 1980 and 2010. According to NYMTC projections, the study area population is expected to increase by 12.8 percent from 25,162 residents in 2015 to 28,372 residents in 2035.[1] In comparison, the population growth rate over a twenty-year period between 1990 and 2010 was 12.1 percent. Based on NYMTC projections, the number of households in the New Creek watershed is projected to increase by 13.1 percent over a twenty-year period from 13,951 households in 2015 to 15,784 households in 2035. This household growth rate is lower than the 16.7 percent increase in households that was experienced between 1990 and 2010.

However, in the future without the proposed project, new construction in the New Creek watershed is also expected to be limited due to the availability of developable land. As discussed above, approximately 7.4 percent or 165.9 acres of the watershed is vacant land. However, development of this vacant land is constrained since much of it is located in the Lower Watershed of the watershed and includes freshwater wetlands—many of which are either state-owned or regulated or are City-owned. There are also limitations to development and discretionary actions (permits), since much of this land is mapped by NYSDEC as freshwater wetlands.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

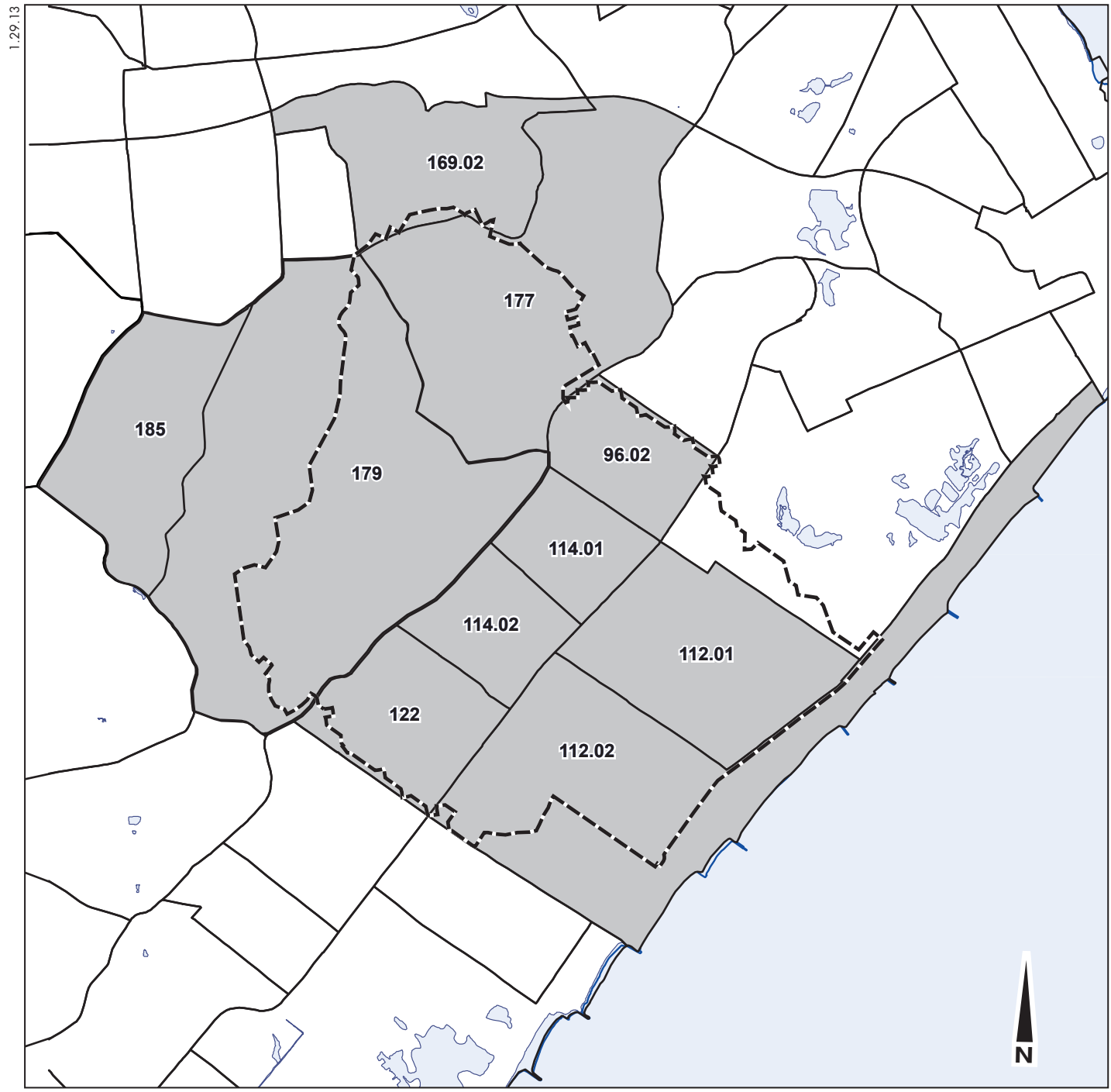
Implementation of the proposed amended New Creek Drainage Plan would provide a stormwater management plan for the watershed and would enhance natural resources through habitat restoration and protection. The proposed project does not involve any rezonings, new residential or commercial development, or an increase in development density within the watershed.

There is historical development pressure in the watershed that would be expected to continue in the future without the proposed project were it not for the presence of freshwater wetlands and the otherwise limited supply of vacant land. In addition to the regulatory restrictions that limit development in these wetlands, many of the wetland acres are also preserved as City open space or Bluebelt properties which would also preclude their development. Moreover, the watershed is already provided with substantial infrastructure including sanitary sewers, water supply, developed streets, and transit service. While the proposed project would enhance natural resources in the study area and would preserve wetlands for stormwater management, these actions are not expected to generate any additional growth pressure. Therefore, the proposed project would not result in potential significant adverse impacts to growth inducing characteristics.

E. CONCLUSIONS

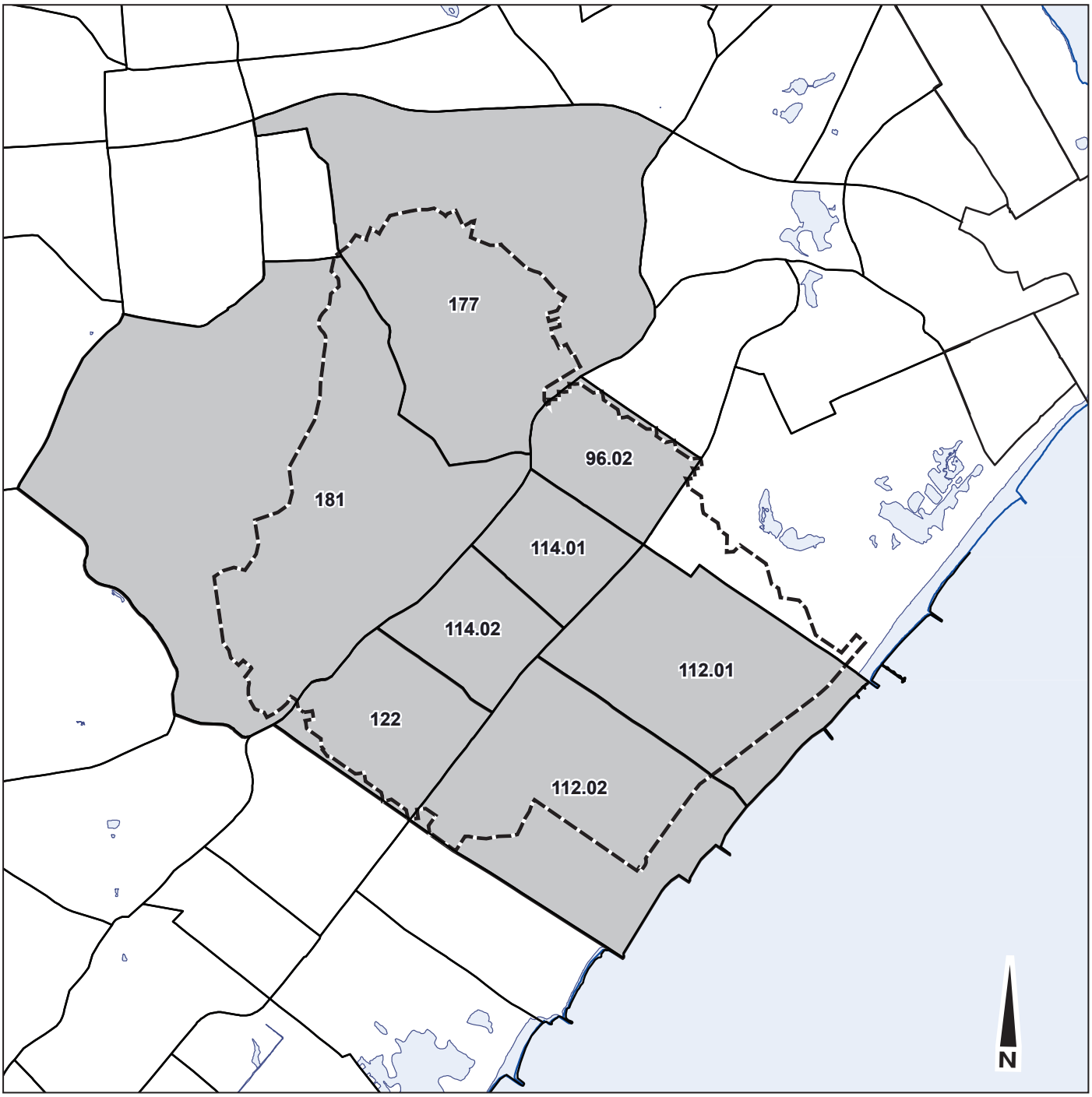
There is historical development pressure in the watershed and what remains of the vacant land includes freshwater wetlands where development is restricted either due to regulations or public ownership (i.e., Bluebelt properties). Much of the watershed is considered urbanized and is already provided with substantial infrastructure including sanitary sewers, water supply, developed streets, and transit service and the proposed project is not expected to generate any additional growth pressure. Therefore, the proposed project would not result in potential significant adverse growth-inducing impacts. ✷

[1] NYMTC projections are for the Transportation Analysis Zones that best represent the New Creek watershed: 1587, 1590, 1596, 1599, 1603, and 1604.



2000 Census Tracts:
New Creek Watershed

Figure 4.20-1



2010 Census Tracts:
New Creek Watershed
Figure 4.20-2