FINAL

ENVIRONMENTAL IMPACT STATEMENT
For the Rebuild by Design Meadowlands Flood Protection Project

October 2018

Boroughs of Little Ferry, Moonachie, Carlstadt, and Teterboro and the Township of South Hackensack, Bergen County, New Jersey

REBUILD BY DESIGN
MEADOWLANDS

Prepared by AECOM for the State of New Jersey Department of Environmental Protection

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Acronyms and Abbreviations

°F	Degrees Fahrenheit
AADT	Average Annual Daily Traffic
AC	Advisory Circular
ACHP	Advisory Council on Historic Preservation
ADCIRC	Advanced Circulation
AF	Aviation Facilities
AM	Morning
ANSI	American National Standards Institute
APE	Area of Potential Effect
ASD	Acceptable Separation Distance
ASL	American Sign Language
AST	Above-ground Storage Tank
ASTM	American Society for Testing and Materials
ATR	Automatic Traffic Recorders
AUL	Activity and Use Limitation
BCR	Benefit-Cost Ratio
BCSA	Berry’s Creek Study Area
BCUA	Bergen County Utilities Authority
BEA	Bureau of Economic Analysis
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
BP	Before Present
Btu	British Thermal Unit
CAA	Clean Air Act
CAG	Citizen Advisory Group
CDBG-DR	Community Development Block Grant - Disaster Recovery
CDC	Centers for Disease Control and Prevention
CEA	Classification exception area
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CKE	Currently Known Extent
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent
COP	Citizen Outreach Plan
COPC	Chemicals of Potential Concern
CP	Commercial Park
CREC	Controlled Recognized Environmental Condition
CSA	Carlstadt Sewerage Authority
CWA	Clean Water Act
CY	Cubic Yard

CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
dB	Decibel scale
dBA	A-weighted Decibel Scale
DDT	Dichloro-diphenyl-trichloroethane
DEIS	Draft Environmental Impact Statement
DPW	Department of Public Works
E&S	Erosion and Sediment
EC	Environmental Conservation
EDR	Environmental Data Resources
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EJ	Environmental Justice
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
EPW	Evaluation for Planned Wetlands
ESA	Endangered Species Act
ESC	Executive Steering Committee
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHACA	Flood Hazard Area Control Act
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
FPPA	Farmland Protection Policy Act
FR	Federal Register
FTA	Federal Transit Administration
GACT	Generally Available Control Technology
GHG	Greenhouse gas
GIS	Geographic Information System
GPI	Guidance for Public Involvement
GWRA	Global Warming Response Act
HAP	Hazardous Air Pollutant
HCM	Highway Capacity Manual
HEC	Hydrologic Engineering Center
HMDC	Hackensack Meadowlands Development Commission
HMS	Hydrologic Modeling System
HREC	Historical Recognized Environmental Condition
HUD	Department of Housing and Urban Development
Hz	Hertz
I-80	Interstate 80
I-95	Interstate 95

I-280	Interstate 280
IEC	International Electrotechnical Commission
IPaC	Information for Planning and Conservation
ISO	International Organization for Standardization
ISRA	Industrial Site Recovery Act
ITE	Institute of Traffic Engineers
KCS	Known Contaminated Site
kW	Kilowatt
L_{dn}	Day-night Average Sound Level
LDR	Low Density Residential
LEED	Leadership in Energy and Environmental Design
L_{eq}	Equivalent Sound Level
LF	Linear Feet
LI-A	Light Industrial A
LI-B	Light Industrial B
LID	Low Impact Development
LiDAR	Light detection and ranging
LMI	Low- and moderate-income
LNG	Liquid natural gas
LOP	Line of Protection
LOS	Level of Service
LSRP	Licensed Site Remediation Professional
MACT	Maximum Achievable Control Technology
MASSTR	Meadowlands Adaptive Signal System for Traffic Reduction
MD	Midday
MERI	Meadowlands Environmental Research Institute
MHW	Mean high water
mgd	Million gallons per day
MIMAC	Meadowlands Interagency Mitigation Advisory Committee
MLUL	Municipal Land Use Law
MOA	Memorandum of Agreement
MRI	Marsh Resources Inc.
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MUTCD	Manual on Uniform Traffic Control Devices
N/A	Not applicable
NAAQS	National Ambient Air Quality Standards
NACCS	North Atlantic Coast Comprehensive Study
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAVD 88	North American Vertical Datum of 1988
NC	Neighborhood Commercial
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutant
NFA	No Further Action

NFIP	National Flood Insurance Program
NGVD 29	National Geodetic Vertical Datum of 1929
NH_3	Ammonia
NHPA	National Historic Preservation Act
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJCMP	New Jersey Coastal Management Program
NJDCA	New Jersey Department of Community Affairs
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJHPO	New Jersey Historic Preservation Office
NJMC	New Jersey Meadowlands Commission
NJPDES	New Jersey Pollutant Discharge Elimination System
NJSA	New Jersey Statutes Annotated
NJSEA	New Jersey Sports and Exposition Authority
NJSM	New Jersey State Museum
NMFS	National Marine Fisheries Service
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	Nitrogen oxides
NPCC	New York Panel on Climate Change
NPL	National Priorities List
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NWI	National Wetlands Inventory
NWS	National Weather Service
O&M	Operations and Maintenance
O_3	Ozone
OU	Operable Unit
PA	Parks and Recreation
PAH	Polycyclic aromatic hydrocarbon
PANYNJ	Port Authority of New York and New Jersey
Pb	Lead
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
pCi/L	Pico-Curies per liter
PI	Program Interest
PL	Public Law

PM	Evening
PM_{10}	Particulate matter 10 micrometers or less in diameter
$PM_{2.5}$	Particulate matter 2.5 micrometers or less in diameter
ppb	parts per billion
ppm	parts per million
PR	Planned Residential
PRP	Potentially Responsible Parties
PSE&G	Public Service Electric and Gas
PU	Public Utility
RA	Redevelopment areas
RAO	Response Action Outcomes
RAS	River Analysis System
RBD	Rebuild by Design
RBDM	Rebuild by Design Meadowlands
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RFF	Reasonably Foreseeable Future
RIMS II	Regional Input-Output Modeling System
ROD	Record of Decision
ROI	Region of Influence
ROSI	Recreational and Open Space Inventory
RPZ	Runway Protection Zone
SARA	Superfund Amendments and Reauthorization Act
SCP	Scientific chemical processing
SF	Square Feet
SHPO	State Historic Preservation Office
SLR	Sea Level Rise
SO_2	Sulfur dioxide
SPL	Sound Pressure Level
SVAP	Stream Visual Assessment Protocol
SVOC	Semivolatile Organic Compound
SWAN	Simulating Waves Nearshore
SWQC	Surface Water Quality Criteria
SWPPP	Stormwater Pollution Prevention Plan
TCDD	Tetrachlorodibenzo-p-dioxin
TCT	Technical Coordination Team
TMC	Turning movement counts
TMP	Traffic Management Plan
TNM	Traffic Noise Model
TRB	Transportation Research Board
TrkAv	Westbrook, Ipswich, Sandy hook soils, very frequently flooded soil unit
TSCA	Toxic Substances Control Act
TSS	Total suspended solids
UdoB	Udorthents, organic substratum soil unit

UdouB	Udorthents, organic substratum-Urban Complex soil unit
UdwB	Udorthents, wet substratum soil unit
ULSD	Ultra-low sulfur diesel
UOP	Universal Oil Products
UR	Urban Land
US	United States
USACE	US Army Corps of Engineers
USC	United States Code
USCG	US Coast Guard
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geologic Survey
UST	Underground storage tank
VdB	Vibration decibel scale
VOC	Volatile Organic Compound
WMA	Watershed Management Area
WOUS	Waters of the United States
WR	Waterfront Recreation

4.0 Environmental Consequences

Section 4.0 describes the potential direct and indirect effects or impacts[33] to the physical, natural, cultural, and socioeconomic environment (see **Section 3.0**) of each of the Proposed Project's Build Alternatives[34], as well as the No Action Alternative (see **Section 2.0**). In accordance with 40 CFR § 1508.20, **Section 4.0** also recommends mitigation measures that could be implemented to avoid, minimize, rectify, reduce, or compensate for potential adverse impacts, as and where possible. This analysis presents the technical resource areas in the same order as they were presented in **Section 3.0**. Potential cumulative effects of the Proposed Project, in conjunction with other Federal and non-Federal actions, are discussed in **Section 5.0**.

4.1 Introduction

4.1.1 Approach to the Analysis

NEPA requires the consideration and disclosure of potential direct, indirect, and cumulative environmental impacts in the evaluation of any proposed Federal action. Direct impacts are those that are caused by the Proposed Project and occur at the same time and place (e.g., direct tree removal). Indirect impacts are those related to the Proposed Project that occur later in time or are further removed in distance. Indirect effects may further include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8). Cumulative impacts on the environment result from the incremental impact of the action when added to other past, present, and RFF actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7).

As described by CEQ regulations (40 CFR § 1508.27), the significance of effects is defined in terms of both context and intensity. Context refers to the portion or geographic extent of the environment that could reasonably be expected to experience a meaningful change as a result of a proposed action. A "contextual" review means that the significance of an action must be analyzed in one or more of the various contexts of a proposed action, such as society as a whole, the affected region, the affected interests, or the locality. Intensity refers to the severity of an impact and is evaluated in terms of the type, quality, duration (short-term or long-term), and sensitivity of the resource involved. Specifically, CEQ regulations require the following factors to be considered when evaluating intensity:

- Degree to which adverse effects outweigh beneficial effects, or vice versa;
- Degree to which the proposed action affects public health or safety;
- Unique characteristics in the geographic area;
- Degree of controversy;
- Degree to which the possible effects on the human environment may be highly uncertain or involve unique or unknown risks;

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[33] Within this analysis, the terms "impact" and "effect" are synonymous and used interchangeably.

[34] As stated in **Section 2.5.2.1**, impact analysis for the Alternative 3 *Future Plan* is not included in **Section 4.0**; this section only includes impact analysis for the Alternative 3 *Build Plan*.

- Degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration;
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts;
- Degree to which the action may affect significant scientific, cultural, or historical resources;
- Degree to which the action may adversely affect federally listed threatened and endangered species; and
- Whether the action threatens to violate a Federal, State, or local law or requirement imposed for the protection of the environment.

The level at which an impact is considered significant is defined by established significance criteria or thresholds; thresholds may be quantitative or qualitative. They may be based on scientific data relative to the lead agency's jurisdiction; legislative or regulatory performance standards of Federal, State, regional, or local agencies; relevant models; or other factors. Significance thresholds are specific to each technical resource area; therefore, each technical resource area analysis in this section clearly presents the thresholds that are applied in the analysis.

Based on these resource-specific significance thresholds, the conclusion of each impact analysis under each technical resource area provides a significance determination of the potential effects for each Build Alternative. The following broad classifications are consistently used throughout this section to denote the significance of potential environmental impacts:

- **No Impact**. This classification applies if there is either no potential for impact, or if the impact would be negligible[35]. If regulatory standards apply, the impact would be well below those standards. Resources classified with a "No Impact" significance criterion do not require mitigation.
- **Less-than-Significant**. This classification applies if the alternative would result in an adverse effect that has measurable changes on a local or regional level, but would not reach the threshold of significance. Mitigation measures or BMPs might be appropriate or recommended to further reduce this impact.
- **Potentially Significant.** This classification applies if the alternative would potentially result in an adverse effect that has measurable changes on a local or regional level that exceed the threshold of significance. Such an impact may or may not be able to be mitigated to less-than-significant levels through the implementation of BMPs and/or mitigation measures. The analysis identifies the anticipated post-mitigation level of significance in each applicable case. If regulatory standards apply, the impact would exceed those standards.
- **Beneficial.** A beneficial impact is an impact that would cause a positive change or improvement in the environment and for which no mitigation measures would be required.

The Analysis Methodology section for each technical resource area provides the basis for the impact analysis, relative to the significance criteria, and identifies and defines applicable regulatory guidelines, thresholds, or standards used to assess the significance of environmental impacts during both the construction and operational phases of the Proposed Project, as appropriate. This section also identifies

[35] "Negligible" can be defined as "so small or unimportant as to be not worth considering; insignificant."

which of the significance criteria, if any, do not apply to the Proposed Project and its considered alternatives and why those criteria are not discussed further.

Further, the conclusion of each impact analysis indicates whether mitigation measures would be warranted. Mitigation measures are project-specific actions that are not routinely implemented by the NJDEP, but that are necessary for the Proposed Project in order to avoid, minimize, rectify, reduce, or compensate for identified potentially significant adverse impacts. Per established protocols, procedures, and requirements, the NJDEP would also implement BMPs and satisfy all applicable regulatory requirements in association with the Proposed Project. BMPs, which are discussed in tandem with mitigation measures, are regulatory compliance measures that the NJDEP regularly implements as part of their activities, as appropriate, across the State of New Jersey.

4.1.2 Future Conditions Analyzed in this EIS

As described in **Section 3.10**, climate change and sea level change are expected to impact the Project Area over time. Sea level in the Project Area is expected to rise between 1.2 and 2.4 feet by 2075 (NOAA 2013a). Climate change is also expected to result in more frequent, severe storms and precipitation events in the Project Area. These changes, in turn, would generally affect all technical resource areas considered in this EIS to some extent. As such, it is important to establish upfront in this impact analysis a common understanding of these future anticipated changes, since they could affect all resource areas under each considered alternative, including the No Action Alternative. This discussion is presented below.

4.1.2.1 No Action Alternative

Under the No Action Alternative, flooding within the Project Area would be expected to continue, and to increase over time. The future condition within the Project Area under the No Action Alternative is expected to include continued coastal and inland flooding from coastal storm surges, heavy rain events, and local stormwater drainage problems. These sources of flooding are further expected to increase due to climate change and SLR. The frequency and intensity of coastal flooding would be expected to increase in the future with rising sea levels, and inland flooding would be expected to worsen from more frequent intense precipitation events, which would further stress existing drainage infrastructure.

As described in **Section 3.17.3.3**, coastal hydrodynamic models were used to analyze storm surge for the Proposed Project under several flood event scenarios (i.e., normal tide, 10-year storm, and 50-year storm[36]) (NJDEP 2018). To illustrate existing and potential future conditions under the No Action Alternative, the normal tide and 50-year storm[37] event modeling scenarios were chosen for comparative purposes. Future conditions under the No Action Alternative were modeled based on the NOAA Intermediate Low (i.e., 1.2 feet of SLR) and Intermediate High (i.e., 2.4 feet of SLR) sea level change values for the 2075 horizon.

Figure 4.1-1 depicts the No Action Alternative during normal tide conditions under existing conditions (i.e., present day) and future conditions (i.e., the 2075 horizon, consistent with NOAA SLR scenarios). Based on the modeling analysis (see **Table 4.1-1**), approximately 17 percent of the Project Area

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[36] For example, a 50-year storm event is a storm event with a 2 percent chance of occurring within any given year.

[37] The 50-year storm event was chosen for comparative purposes. The Proposed Project would provide flood risk reduction for the Project Area up to approximately the 50-year storm event.

currently has the potential to flood under normal tide conditions[38]. During an existing normal tide, the Borough of Carlstadt experiences the greatest flooding with approximately 34 percent of the portion of this municipality in the Project Area at risk, followed by the Township of South Hackensack, Borough of Little Ferry, Borough of Moonachie, and Borough of Teterboro.

Under future conditions (i.e., 2075 horizon), modeling results indicate up to approximately 19 percent to 42 percent of the Project Area (under the 1.2-foot and 2.4-foot SLR scenarios, respectively) would flood during normal tide conditions. This would represent an additional 2 to 25 percent of the Project Area that would be subjected to flooding from normal high tide by the year 2075 due to SLR.

Table 4.1-1: Area at Risk of Flooding Under No Action Alternative By Municipality

Community	Flooded Area Within Project Area		
	Existing	SLR = 1.2 feet	SLR=2.4 feet
Normal Tide			
Borough of Little Ferry	9.4%	10.0%	39.5%
Borough of Moonachie	0.0%	0.0%	24.9%
Borough of Carlstadt	33.8%	37.7%	63.5%
Borough of Teterboro	0.0%	0.0%	2.7%
Township of South Hackensack	12.2%	15.1%	39.5%
Project Area	**17.3**%	**19.3**%	**42.4**%
50-Year Storm			
Borough of Little Ferry	34.1%	56.6%	73.3%
Borough of Moonachie	13.2%	28.7%	56.1%
Borough of Carlstadt	57.3%	65.1%	77.3%
Borough of Teterboro	0.0%	0.0%	7.5%
Township of South Hackensack	39.2%	43.4%	45.5%
Project Area	**36.0**%	**46.9**%	**61.9%**

Figure 4.1-2 depicts the No Action Alternative during a 50-year storm event under existing conditions (i.e., present day) and future conditions (i.e., 2075 horizon; NOAA SLR scenarios). Based on the modeling analysis (see **Table 4.1-1**), approximately 36 percent of the Project Area currently has the potential to flood during a 50-year storm event. The Borough of Carlstadt would experience the greatest flooding (57 percent), followed by the Township of South Hackensack, Borough of Little Ferry, Borough of Moonachie, and Borough of Teterboro.

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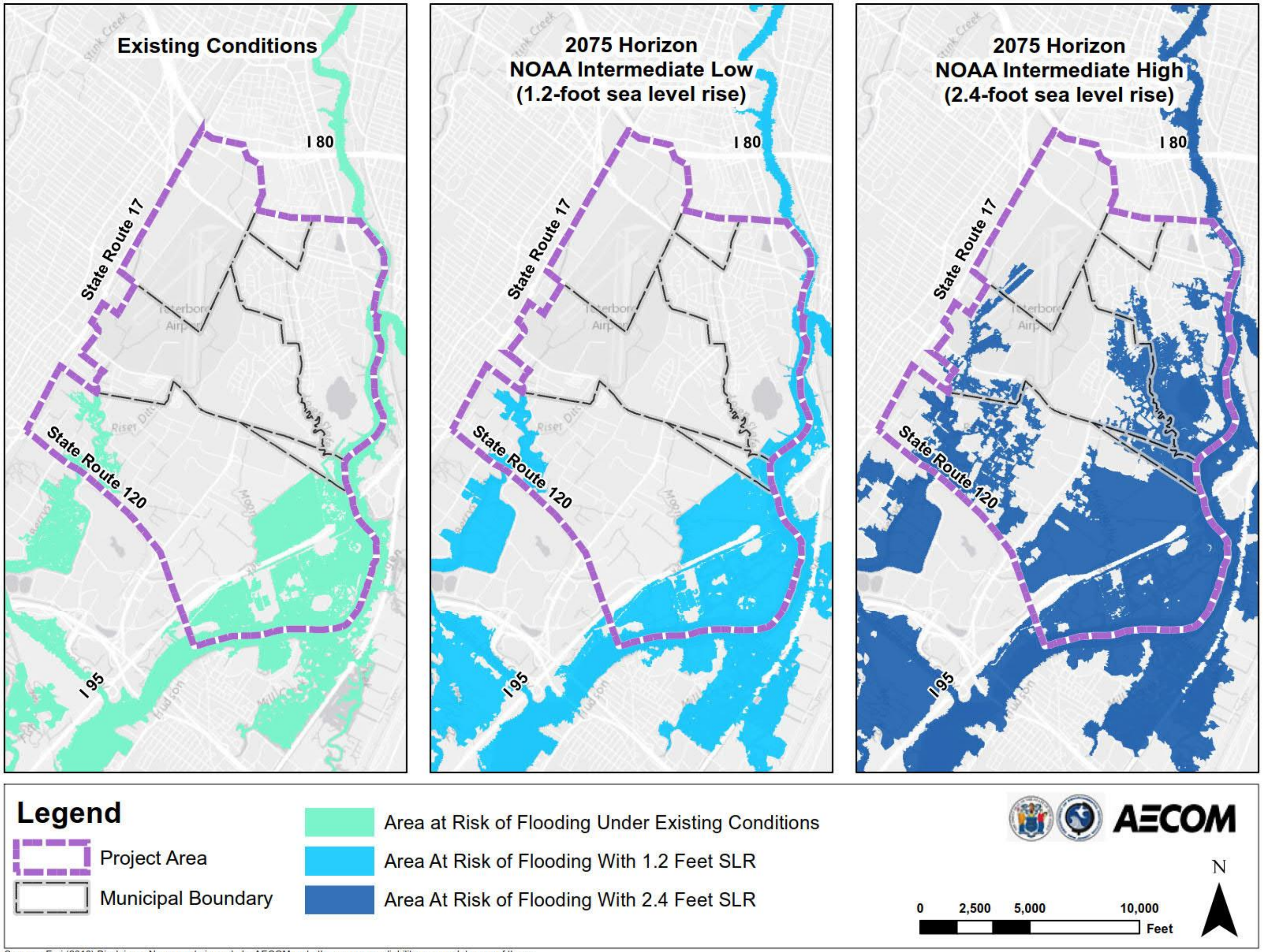
[38] Please note the "area at risk of flooding" (i.e., area with the potential to flood) described in this EIS was determined based on the total acreage within the Project Area for the No Action Alternative and Alternative 1. As shown in **Figure 4.1-1**, the majority of the area "at risk of flooding" under existing normal tide conditions occurs within the southern and eastern portions of the Project Area that are largely dominated by tidal wetlands/waters (e.g., Hackensack River, MRI Wetland Mitigation Bank, the Richard P. Kane Natural Areas and Wetland Mitigation Bank, and Berry's Creek).



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.1-1: Area at Risk of Flooding During the Normal Tide Under the No Action Alternative

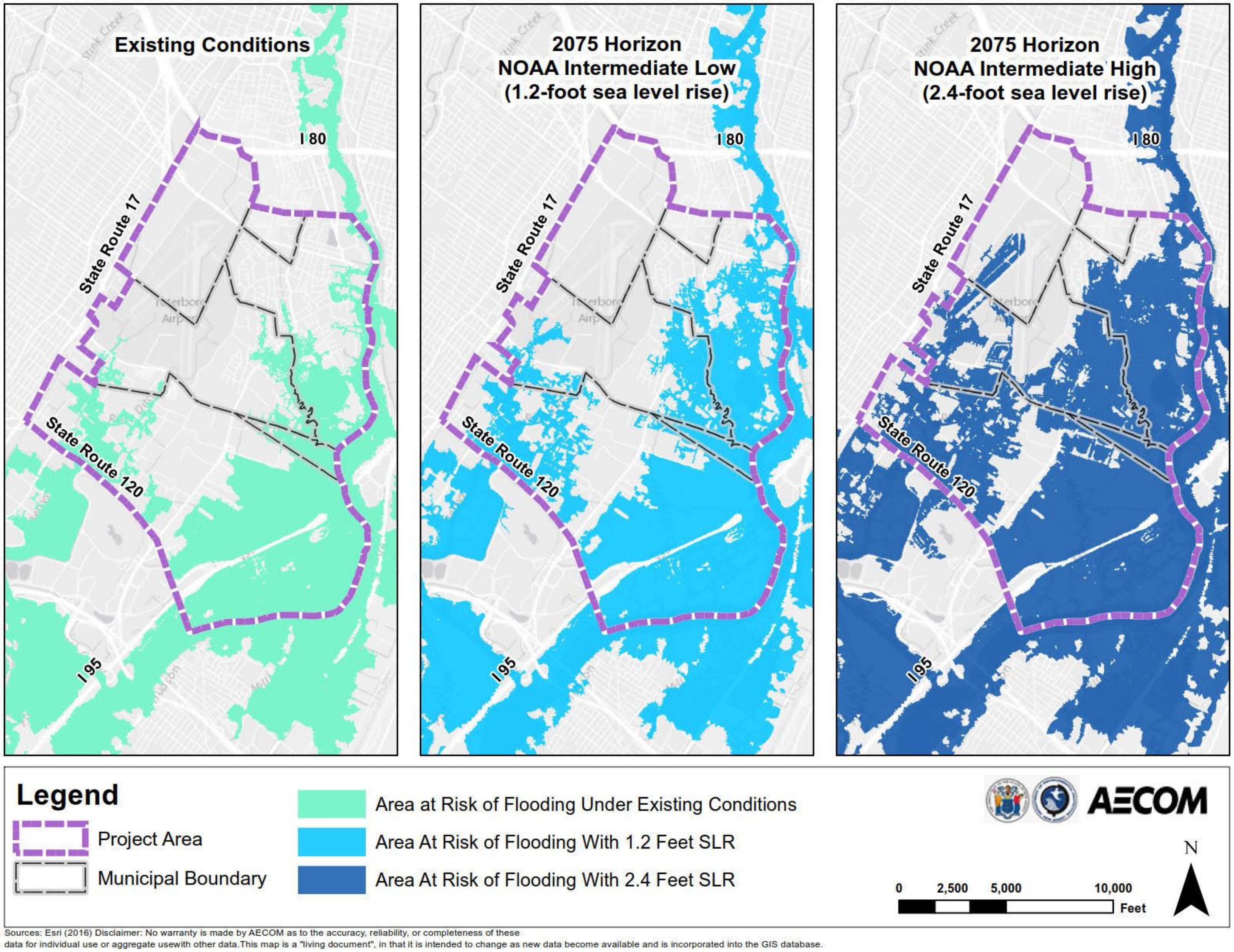


Figure 4.1-2: Area at Risk of Flooding During the 50-year Flood Under the No Action Alternative

Under future conditions (i.e., 2075 horizon), modeling results for the No Action Alternative indicate that up to approximately 47 percent to 62 percent of the Project Area (under the 1.2-foot and 2.4-foot SLR scenarios, respectively) would flood during a 50-year storm event. This would represent an additional 11 to 26 percent of the Project Area that could be subjected to flooding from a 50-year storm event when compared to existing conditions.

As described in **Section 4.17.3.2**, hydraulic drainage models were used to simulate the flow of water through existing main channels, overbank areas, and existing storm drain pipe and ditch networks within the Project Area. These models were used to analyze multiple storm event scenarios (i.e., 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year storms). Using the results of these models, the NJDEP Project Team determined potential changes to the extent of flooding (i.e., floodplain) under future conditions (i.e., 2075) based on anticipated increases in storm intensities over time. Additionally, the data was used to determine flood depth reduction expected under Alternative 2 and Alternative 3, which is discussed in **Sections 4.1.2.3** and **4.1.2.4**. Based on the final design of Alternative 2 and Alternative 3, analysis of stormwater drainage in East Riser Ditch and Losen Slote is relevant to the Proposed Project.

Under existing conditions, the East Riser Ditch floodplain varies between approximately 360 and 871 acres in size, depending on storm intensity. The Losen Slote floodplain varies between approximately 302 and 464 acres. Under future conditions, the extents of flooding from East Riser Ditch and Losen Slote would both be expected to increase. The East Riser Ditch floodplain would be expected to increase between 84 and 221 acres, depending on storm intensity, while the Losen Slote floodplain would be expected to increase between 18 and 50 acres.

While the exact extent of, and increase in, future coastal and inland flooding within the Project Area cannot be identified with full certainty, it is anticipated that a variety of factors would interact to worsen these conditions over time. Based on the above data, the amount of land subject to coastal flooding could more than double in area within the Project Area by 2075 under the various flood scenarios, while the amount of land subject to inland flooding (in the East Riser Ditch and Losen Slote drainage areas) would also increase by smaller amounts. As such, under the No Action Alternative, future flood conditions would impact the Project Area; potential impacts associated with this increase in flooding are described under each technical resource area in the following sections. Alternative 1.

4.1.2.2 Alternative 1

As discussed in **Section 2.5.2**, the Alternative 1 LOP would include a range of infrastructure (e.g., floodwalls, levees, closure gates, a tide gate, and a surge barrier) designed to provide coastal flood protection up to an elevation of 7 feet (NAVD 88) for much of the Project Area. This alternative would only protect the Project Area from coastal flooding; chronic inland flooding from heavy or frequent precipitation events would continue to adversely affect the Project Area. Under Alternative 1, inland flooding from precipitation would be similar to conditions discussed under the No Action Alternative.

Currently, flood infrastructure within the Project Area only provides flood protection to an elevation of approximately 4 to 5 feet (NAVD 88) to portions of the Project Area. A LOP at 7 feet (NAVD 88) under Alternative 1 would be sufficient to provide protection against an approximately 50-year storm surge event under existing conditions (i.e., present day), and against approximately the 10-year storm surge event under future conditions (i.e., 2075), based on SLR projections. Alternative 1 would not provide protection against storm surge events larger than these thresholds.

Figure 4.1-3 and **Figure 4.1-4** provide a visual comparison between Alternative 1 and the No Action Alternative under existing conditions (i.e., present day) and future conditions (i.e., 2075, under both SLR scenarios) during the normal tide and a 50-year storm surge event, respectively, within the Project Area. Flood reduction anticipated under Alternative 1 is described in detail in **Section 4.17.4.2**.

As shown in **Table 4.1-2**, the portions of the Project Area at risk of flooding during the normal tide and the 50-year storm would be substantially reduced under Alternative 1 as compared to the No Action Alternative. The full extent of increased flood protection will be addressed in the Feasibility Study (NJDEP 2018); however, modeling results are summarized herein.

Table 4.1-2: Area at Risk of Flooding Under Alternative 1 By Municipality

Community	Flooded Area Within Project Area		
	Existing	SLR = 1.2 feet	SLR=2.4 feet
Normal Tide			
Borough of Little Ferry	9.3%	9.8%	10.6%
Borough of Moonachie	0.0%	0.0%	0.0%
Borough of Carlstadt	30.4%	33.4%	34.9%
Borough of Teterboro	0.0%	0.0%	0.0%
Township of South Hackensack	12.4%	15.1%	15.4%
Project Area	**15.8**%	**17.3**%	**18.1**%
50-Year Storm			
Borough of Little Ferry	10.7%	30.0%	64.7%
Borough of Moonachie	0.0%	1.2%	16.1%
Borough of Carlstadt	47.7%	49.4%	54.2%
Borough of Teterboro	0.0%	0.0%	0.0%
Township of South Hackensack	15.4%	24.4%	40.2%
Project Area	**23.9**%	**28.9**%	**42.1**%

During the normal tide, there would be minor decreases in the area at risk of flooding under existing conditions and the 1.2-foot SLR scenario. However, under the 2.4-foot SLR scenario, Alternative 1 would provide increased flood protection to approximately 24 percent of the Project Area. On a municipal level, under the 2.4-foot SLR scenario, Alternative 1 would provide increased flood protection to approximately 29 percent of Little Ferry, 25 percent of Moonachie, 29 percent of Carlstadt, 3 percent of Teterboro, and 24 percent of South Hackensack during the normal tide.

During the 50-year storm, increased flood protection would be provided to approximately 12 percent of the Project Area under existing conditions, approximately 18 percent of the Project Area under the 1.2-foot SLR scenario, and approximately 21 percent of the Project Area under the 2.4-foot SLR scenario. On a municipal level, Alternative 1 would provide increased flood protection to approximately 11 percent of Little Ferry, 27 percent of Moonachie, 16 percent of Carlstadt, and 19 percent of South Hackensack during the 50-year storm under the 1.2-foot SLR scenario. Under the 2.4-foot SLR scenario for the 50-year flood, Alternative 1 would provide increased flood protection to approximately 9 percent of Little Ferry, 40 percent of Moonachie, 23 percent of Carlstadt, 7 percent of Teterboro, and 5 percent of South Hackensack.

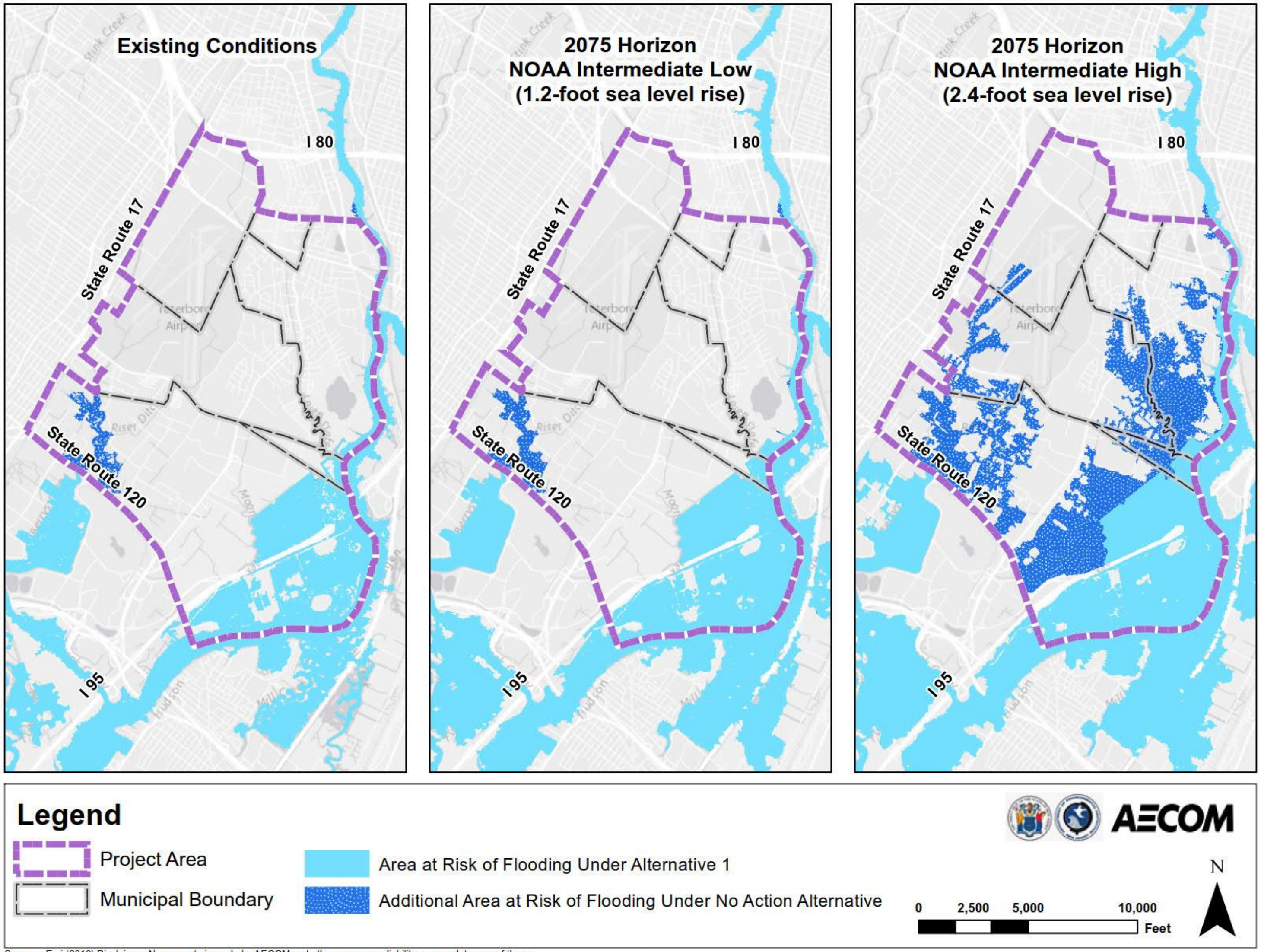


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Figure 4.1-3: Comparison of Flooding During Normal Tide Under Alternative 1 and the No Action Alternative

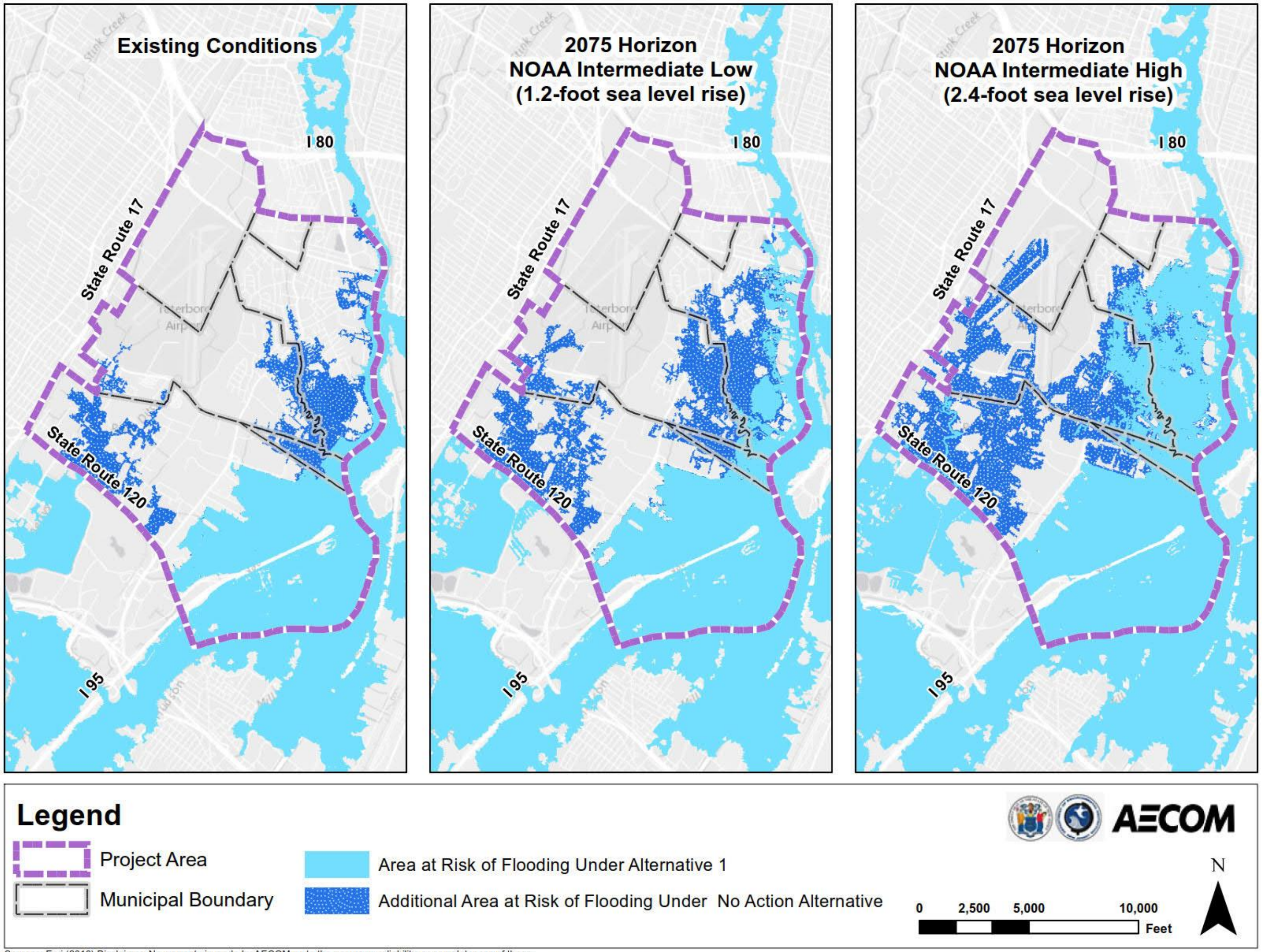

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Figure 4.1-4: Comparison of Flooding During the 50-year Storm Under Alternative 1 and the No Action Alternative

4.1.2.3 Alternative 2

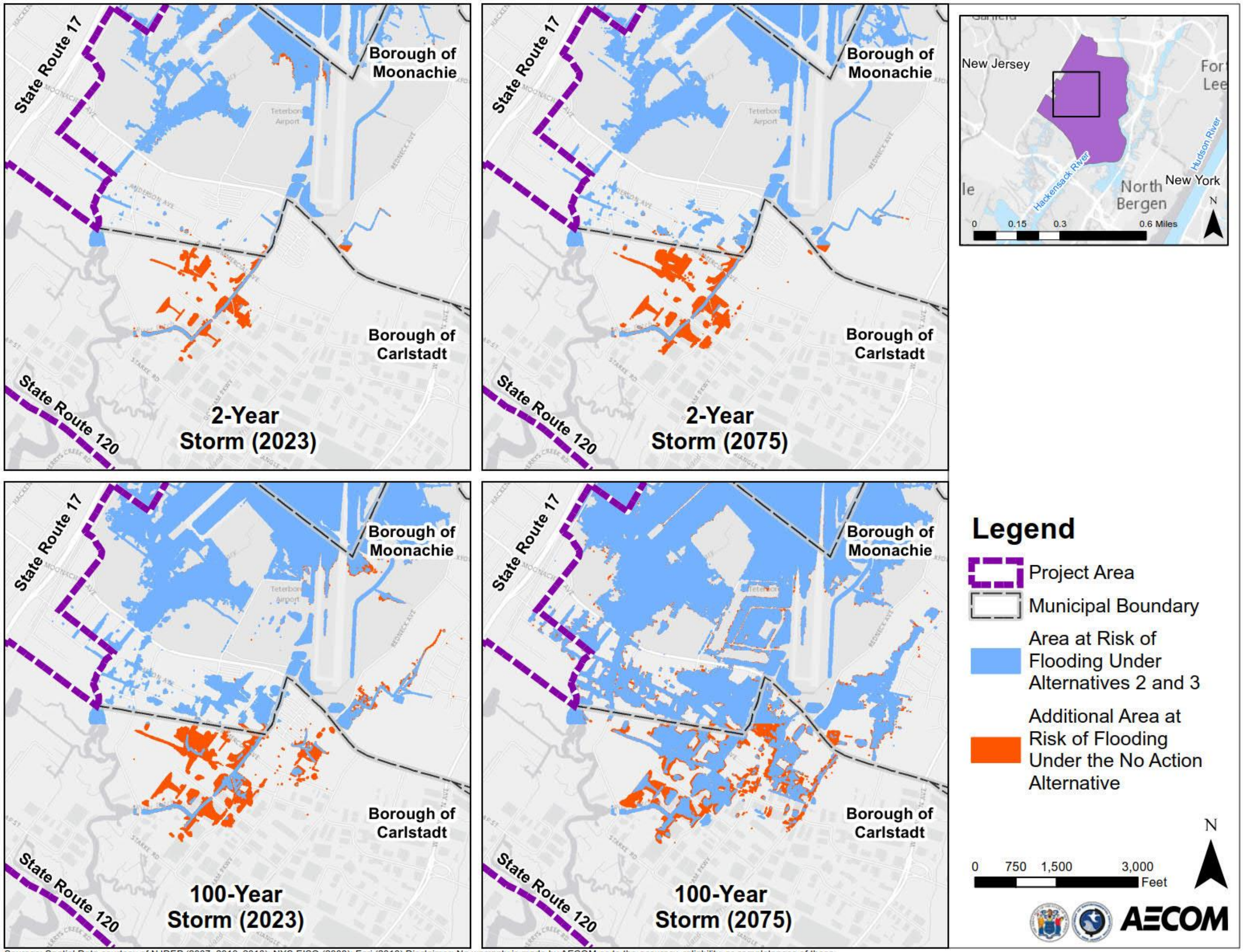
As discussed in **Section 2.5.3**, Alternative 2 would include 41 green infrastructure systems along roadways, five new parks, five existing public open space improvements, three new pump stations, two new force mains, and dredging of the lower reach of East Riser Ditch. This alternative would reduce chronic inland flooding from heavy or frequent precipitation events, but coastal flooding would continue to adversely affect the Project Area. Under Alternative 2, coastal flooding from storm surges would be similar to conditions discussed under the No Action Alternative.

Alternative 2 would be expected to provide reductions in both the depth and extent of flooding in East Riser Ditch and Losen Slote for precipitation events up to and including the 100-year storm. **Figure 4.1-5** provides a visual comparison between Alternative 2 and the No Action Alternative for East Riser Ditch under existing conditions (i.e., present day) and future conditions (i.e., 2075) during the 2-year and 100-year storms. **Figure 4.1-6** and **Figure 4.1-7** provide the same comparison for Losen Slote during the 2-year and 100-year storms, respectively. Flood reduction anticipated under Alternative 2 is detailed in **Section 4.17.4.3**.

Based on the modeling results for East Riser Ditch, flood depths would be reduced to the greatest extent between the existing tide gate and Moonachie Avenue, where the channel improvements would be implemented. Flood depth reduction in this reach of the channel would be between approximately 2.5 and 2.9 feet during a 2-year storm, 1.9 and 2.5 feet during a 25-year storm, and 1.6 and 2.2 feet during a 100-year storm. Additionally, residual flood reduction would occur in the channel north to US Route 46 as a result of the improved conveyance capacity in the lower reach. Under future conditions, projections indicate that flood depth reduction in the lower reach would generally increase by 0.2 feet during a 2-year storm, decrease by 0.2 feet during a 25-year storm, and decrease by 0.7 to 1.0 feet during a 100-year storm compared to existing conditions. However, while flood reduction values may be greater under future conditions for some storms, they would be unlikely to fully compensate for increased normal flood depths expected from more intense precipitation events.

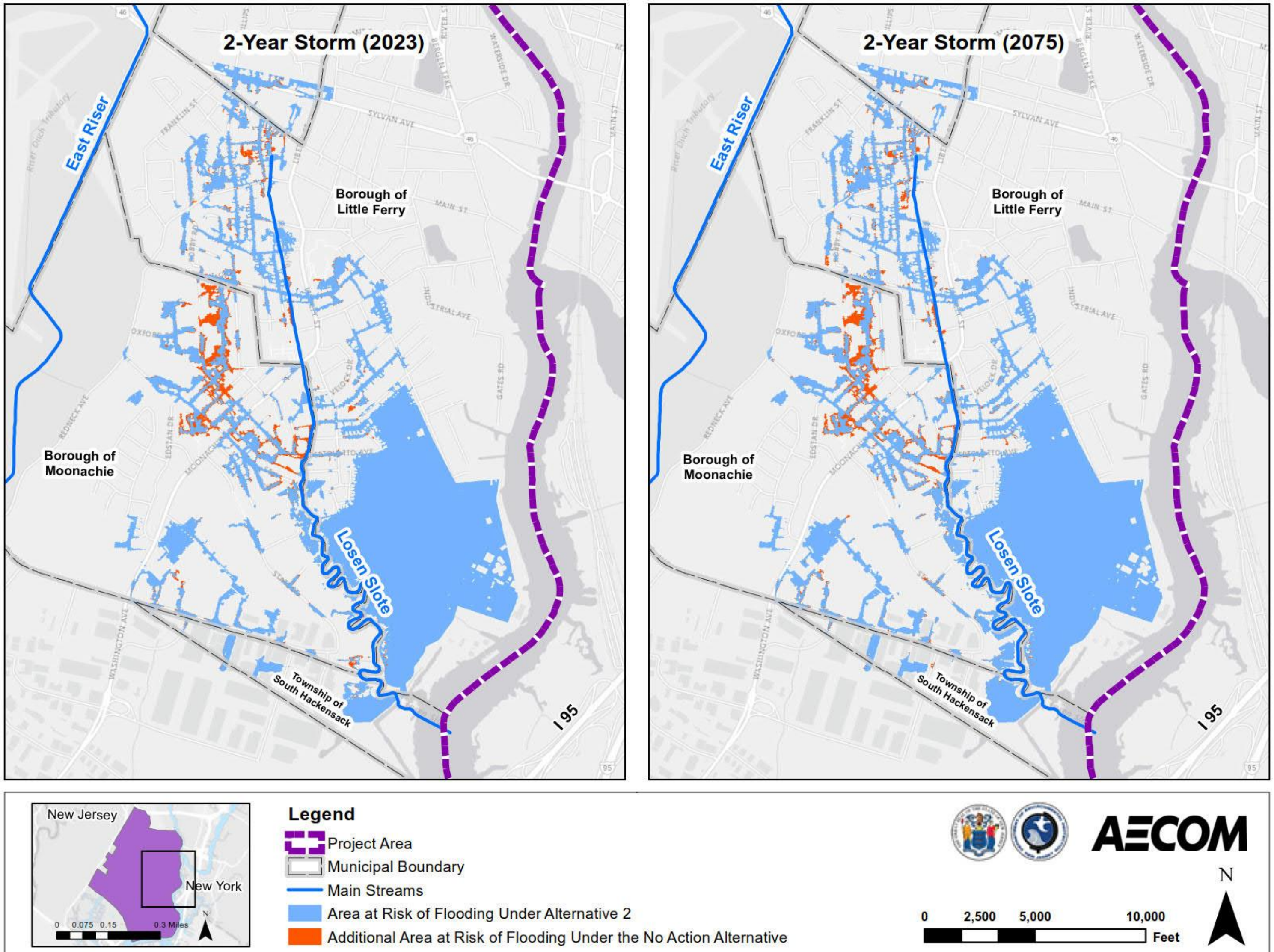
The extent of flooding would also be reduced in the East Riser Ditch floodplain; these flood extent reductions would be concentrated in the Borough of Carlstadt in the area adjacent to the proposed improvements. Under existing conditions, Alternative 2 would reduce the extent of flooding from East Riser Ditch between 14 and 33 acres, depending on the storm event. Under future conditions, Alternative 2 would reduce the extent of flooding by 23 to 46 acres; however, this increased flood extent reduction would not fully account for the approximately 84- to 221-acre increase in flood extent expected under future conditions from more intense precipitation events.

Alternative 2 would also provide measurable flood depth reduction in the Main Reach and Park Street Reach of Losen Slote. In the Main Reach, flood depths would be reduced in the channel primarily between approximately Bertolotto Avenue and Niehaus Avenue. These flood depth reductions would vary between approximately 0.2 and 0.6 feet during a 2-year storm, 0.1 and 0.4 feet during a 25-year storm, and 0.2 and 0.7 feet during a 100-year storm, depending on specific locations. In the Park Street Reach, flood depths would be reduced between its confluence with the Main Reach and approximately Union Avenue. Flood depth reduction would vary between approximately 0.1 and 0.5 feet during a 2-year storm, 0.1 and 0.6 feet during a 25-year storm, and 0.1 and 0.5 feet during a 100-year storm.



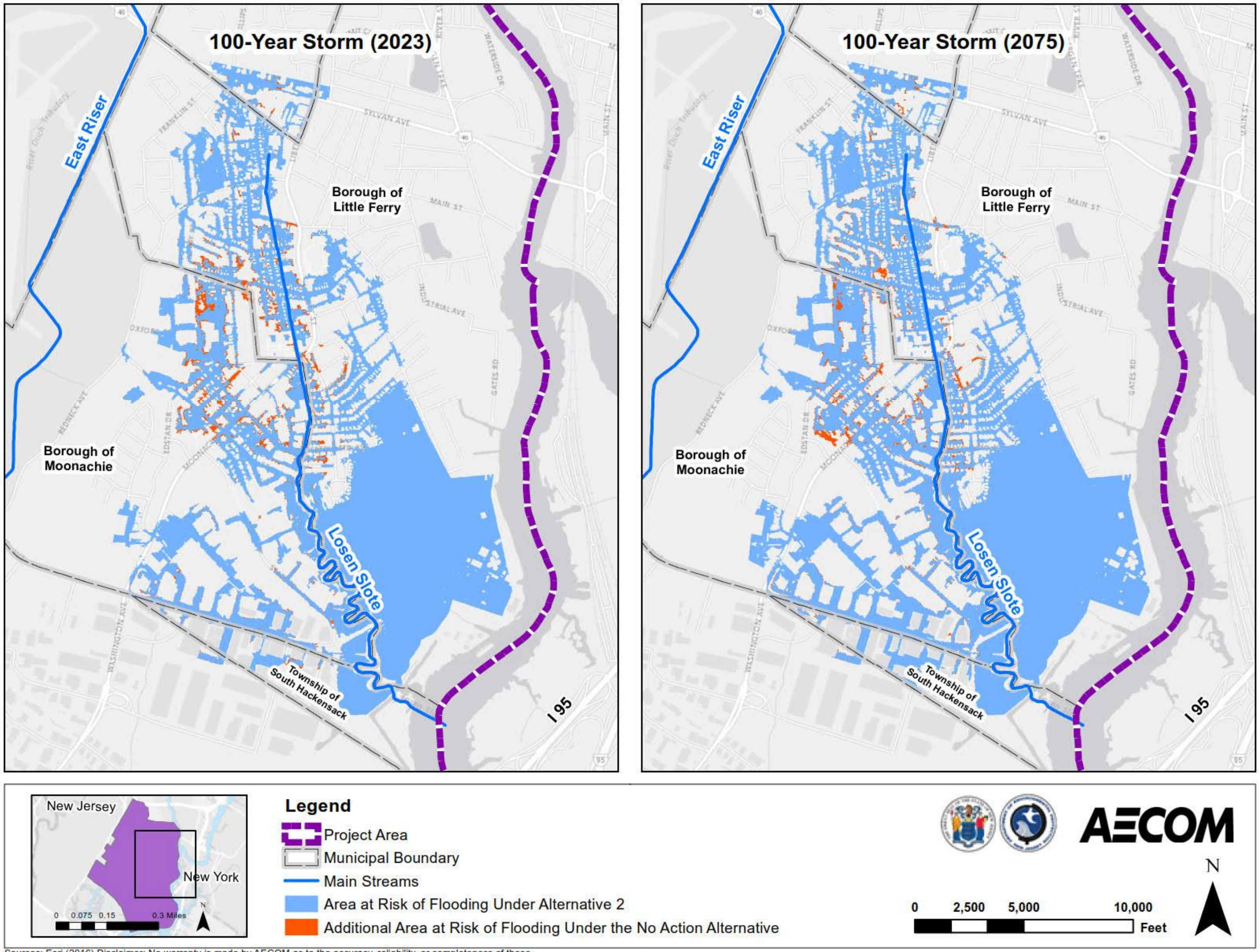
Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.1-5: Comparison of East Riser Ditch Flooding Under Alternative 2 and the No Action Alternative



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.1-6: Comparison of Losen Slote Flooding Under Alternative 2 and the No Action Alternative for the 2-Year Storm



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.1-7: Comparison of Losen Slote Flooding Under Alternative 2 and the No Action Alternative for the 100-Year Storm

Flood depth reduction in Losen Slote under future conditions would not substantially differ from existing conditions in either reach. Generally, projected flood depth reduction values under future conditions are within 0.2 feet of existing conditions. However, normal flood levels in these reaches would be expected to increase due to more intense future precipitation events. Therefore, while Alternative 2 would provide similar flood depth reduction under future conditions, the overall flood depths would likely be higher.

Alternative 2 would reduce the Losen Slote floodplain by approximately 13 to 15 acres, depending on storm event, under existing conditions. Similar to flood depth reduction for Losen Slote, the reduction in flood extent provided by Alternative 2 would not change substantially under future conditions (i.e., 12 to 14 acres of flood reduction), but the overall extent of the floodplain would increase (i.e., 18 to 50 acres) due to more intense future precipitation events compared to existing conditions.

Finally, Alternative 2 would provide localized improvements in stormwater infiltration due to the implementation of new green infrastructure systems, new parks, and open space improvements. These features would be designed to capture stormwater from the NJ Water Quality Design Storm, which is 1.25 inches of rain in a 2-hour span. Therefore, stormwater runoff, and potentially associated inland flooding, could be reduced near these features, but larger precipitation events would exceed their design capability. In the future, more intense precipitation events that would exceed the design of green infrastructure systems would be expected to occur more frequently.

4.1.2.4 Alternative 3

As described in **Section 2.5.4**, Alternative 3 would be generally the same as Alternative 2, except that it would exclude Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and associated force main. Because Alternative 2 and Alternative 3 would seek to address the same existing issue (i.e., inland flooding in East Riser Ditch and Losen Slote), the future conditions against which they'd be compared would be the same. As such, future conditions relevant to Alternative 3 would include more intense precipitation events. Future changes to coastal flooding would be as described for the No Action Alternative.

Flood reduction in East Riser Ditch under Alternative 3 would be the same as described under Alternative 2. However, Alternative 3 would provide less flood reduction in Losen Slote than Alternative 2. In the Main Reach, flood depth reduction would be similar to that described under Alternative 2 (i.e., generally within 0.1 feet) for both existing and future conditions. Additionally, minor flood depth reduction (i.e., approximately 0.1 feet) would be provided in the Main Reach between Bertolotto Avenue and East Joseph Street; this portion of the channel could experience minor increases in flood depths under Alternative 2 (see **Section 4.17.4.3**). Flood depth reduction in the Park Street Reach would be negligible due to the elimination of Losen Slote pump station C.

The extent of flooding for Losen Slote would also be reduced to a lesser degree under Alternative 3. Flood extent would be reduced by approximately 6 acres for most storm events under existing conditions, and between 5 and 7 acres under future conditions. Figures of the anticipated Losen Slote floodplain for the 2-year and 100-year storms under Alternative 3 are provided in **Section 4.17.4.4**.

Minor localized flood reduction provided by green infrastructure, parks, and open spaces would generally be the same as described under Alternative 2, except that no stormwater infiltration improvements would be made to the proposed Fluvial Park or DePeyster Creek Park locations.

4.2 Land Use and Land Use Planning

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on existing land uses and land use planning in and around the Project Area. Impacts to land use can be either direct or indirect. Direct impacts could result from proposed land acquisitions, either via permanent easement or temporary easement[39], associated with the Proposed Project; such impacts could alter land uses or conflict with existing land use plans. Indirect impacts would occur if an alternative would cause long-term changes to land use or land use planning, not immediately caused by project installation. Such an impact would occur if the alternative could result in changes in land use planning or land use classifications in the future in or around the Project Area. Any potential changes to zoning patterns or categories due to land acquisition associated with the Proposed Project also would be an indirect impact.

4.2.1 Definition of Study Area

For the purposes of this analysis, the land use and land use planning study area is defined to include the Project Area, as well as communities that share borders with the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to land use and land use planning in accordance with 40 CFR 1508.27.

4.2.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect land use and land use planning effects of the alternatives are provided in **Table 4.2-1**.

[39] A temporary easement is acquired to provide access during the construction period, with the affected land restored and returned to the property owner immediately following construction. A permanent easement is a fee simple acquisition of all rights to a parcel in perpetuity.

Table 4.2-1: Land Use and Land Use Planning Impact Significance Criteria[40]

Impact Level	Type of Effect	Impact Description
No Impact	Direct Land Use and/or Zoning Change	• No change to existing development, land use, or zoning patterns
	Indirect Land Use and/or Zoning Change	• No conflicts with existing or planned land uses in the study area
	Applies to All Effect Types	• No discernable changes in the region or locality • Land use would be altered for a negligible period of time
Less-than-Significant	Direct Land Use and/or Zoning Change	• Would result in minimal changes to existing development, land use, or zoning patterns that would not result in displacements or substantial long-term changes
	Indirect Land Use and/or Zoning Change	• New land use would differ from, but not be inconsistent with, surrounding land use patterns • Would result in minimal restrictions to land use options for surrounding land uses • Would result in minimal conflicts with existing or planned land uses or changes to zoning in the study area that would not result in displacements or substantial long-term changes
	Applies to All Effect Types	• Land use would only be altered for the duration of the construction phase or a portion of the operations phase
Potentially Significant	Direct Land Use and/or Zoning Change	• Would physically divide established communities • Would substantially change the character of existing land use types or the ability of lands to function for their existing or planned uses • Would trigger an immediate need for a substantial change in zoning or land use planning
	Indirect Land Use and/or Zoning Change	• Would conflict with surrounding land use patterns to the extent that those patterns would substantially change • Would substantially restrict land use options for surrounding land uses • Would trigger a long-term need for a change in zoning or land use planning that could potentially substantially increase or decrease intensity of development
	Applies to All Effect Types	• Would result in adverse impacts observed throughout affected municipalities • Would permanently alter either existing or planned land uses

[40] A number of tables presented in this section contain the terms "substantial" and "negligible." "Substantial" can be defined as "of ample or considerable amount, quantity, or size," and "negligible" can be defined as "so small or unimportant as to be not worth considering; insignificant." These terms can be applied on a resource by resource basis, as needed.

Impact Level	Type of Effect	Impact Description
Beneficial	Direct Land Use and/or Zoning Change	• Would improve utility of a particular land use type or locality
	Indirect Land Use and/or Zoning Change	• Would increase compatibility with surrounding land use types
	Applies to All Effect Types	• Would result in land use benefits observed throughout affected municipalities

4.2.3 Analysis Methodology

Each of the Build Alternatives and the No Action Alternative were evaluated for consistency with existing and proposed land uses, zoning, and land use plans within the defined study area (see **Section 3.2.3.1**). Proposed land uses were determined through reviews of existing plans and discussions with local officials.

Parcels with the potential to be affected directly were identified through comparing preliminary design drawings with existing land use maps and data; the drawings depict existing property lines, buildings, rights-of-way lines, and toe-of-slope lines. Property lines were obtained from the Bergen County Mod IV database[41] (New Jersey Department of the Treasury 2016). Any potential property acquisitions were quantified and evaluated in accordance with the following definitions.

- **Permanent easement:** A full or partial property taking. A full easement involves procuring a defined parcel in its entirety, while a partial property taking involves an easement where the original property would be severed to form two (or more) parcels, only one of which would be acquired. A permanent easement can include a permanent land acquisition that entails a change in land ownership or a permanent agreement with the existing land owner for long-term use.
- **Temporary easement:** A temporary right acquired by one party (from the owner of the property) to use or control the property belonging to another party during construction.

The potential for indirect effects to existing and planned land uses was qualitatively assessed by anticipating changes that could logically occur through implementation of each alternative, based on professional judgement and reasonable assumptions. To conduct this analysis, each considered alternative was overlaid with existing (and planned) land uses, and relationships between project components and surrounding land uses were identified. Using these data, assessments were made as to how the surrounding land use would be indirectly affected by each considered alternative, largely in terms of access, use, and compatibility.

As described in **Section 3.3.2**, projects and activities within 2,500 feet of a civilian airport are subject to HUD and FAA land use regulations that promote and protect the safety of both people on the ground and aviation traffic. In addition, conformity with stipulations established by the FAA AC No.150/5200-33B for *Hazardous Wildlife Attractants on or Near Airports* (dated August 28, 2007) is required. Airport sponsors and managers have a legal responsibility under 14 CFR 139 to ensure their airport maintains a safe operating environment. Consideration must also be made for any land use changes that have the potential to increase wildlife hazards to aircraft. For airports that service turbine-powered aircraft, such as Teterboro Airport, the FAA recommends a 10,000-foot separation distance between the airport's operations area and any hazardous wildlife attractant. All Proposed Project components under the three Build Alternatives occur within 10,000 feet of the airport. As an initial matter, the Proposed Project features for each Build Alternative within 2,500 feet of Teterboro Airport were identified. For features within this buffer zone, a land use compatibility assessment was conducted to determine the potential land use changes and construction activities associated with them. In addition, a review of all Proposed Project components was conducted in accordance with FAA AC No. 150/5200-33B.

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[41] The New Jersey Property Tax System, known as MOD-IV, provides for the uniform preparation, maintenance, presentation, and storage of the property tax information required by the Constitution of the State of New Jersey, the New Jersey Statutes, and the rules promulgated by the Director of the Division of Taxation (NJAC 18:12-2 and 3) (State of New Jersey 2016b).

Based on this analysis, potential short- and long-term, direct and indirect effects to land use were identified. Construction-related impacts are typically short-term direct impacts that would be experienced only during the construction phase of the Proposed Project. Where potential adverse effects were identified, mitigation measures were recommended, as appropriate.

4.2.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to land use and land use planning associated with the implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operation activities.

4.2.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented, and no changes to land use attributable to the Proposed Project would occur within the Project Area. As such, there would be no direct impacts to land use under the No Action Alternative.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse*** impacts on land use and land use planning within the Project Area. Depending on the magnitude, severity, and frequency of future flooding events and SLR, these effects could increase to ***indirect, potentially significant adverse*** impacts by resulting in longer term, more permanent effects to land use and land use planning. Per the significance criteria, the No Action Alternative:

- *Could conflict with surrounding land use patterns to the extent that those patterns would substantially change*
- *Could substantially restrict land use options for surrounding land uses*
- *Could trigger a long-term need for a change in zoning or land use planning that could potentially substantially decrease intensity of development.*

Continued and increased flooding within the Project Area could lead to increased property damage, flood-related costs, or other hazards that could reduce the ability of property owners to use the land for its existing or intended purpose. For example, following severe and/or more frequent flood events, residents could be forced to vacate their homes for extended periods of time, and on some occasions permanently. Commercial and industrial businesses could experience more frequent disruptions in services and a loss in revenue, leading them to potentially relocate outside of the Project Area. Recreational areas, such as ball fields, could become unusable for their intended purpose due to more frequent flooding. These potential effects could lead to substantial changes in the existing land use types within the Project Area, and necessitate substantial changes in zoning and land use planning.

4.2.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Long-term, potentially significant, adverse*** impact due to the displacement of one business.

- ***Short-term, less-than-significant, adverse*** impacts to existing land uses from a short-term change in use during the construction phase of Alternative 1.
- ***Long-term, less-than-significant, adverse*** impacts to existing land use from permanent land acquisitions that result in a change in use.
- ***Long-term, less-than-significant, adverse*** impacts to the study area due to expected or potential zoning changes of acquired properties.
- ***Long-term, beneficial*** impacts associated with improved utility of a particular land use type or locality.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects to existing and planned land uses by increasing flood protection against coastal storm surges, enhancing the sustainability of existing land uses, and allowing future planned land uses to be implemented in accordance with existing plans.

The following subsections provide greater detail.

Direct Impacts

Land Acquisition

Under Alternative 1, a total of 69 parcels would be affected by permanent easements and/or temporary easements. To accommodate Alternative 1, 26.6 acres of land would be permanently acquired; an additional 8.3 acres of land would require temporary easements to support construction staging and access.

Land uses affected by permanent and temporary easements include: industrial, commercial, residential, wetland, recreational/open space, transportation, and other land use (i.e. cleared vacant land) designations. A more detailed breakdown of the permanent and temporary easement requirements for Alternative 1 is provided in **Table 4.2-2**. **Table 4.2-3** identifies these proposed land acquisitions by Alternative 1 segment (i.e., Northern, Central, Southern, and Berry's Creek).

Table 4.2-2: Temporary and Permanent Easements Proposed under Alternative 1

Land Use Affected	Number of Parcels Affected	*Temporary Easements*			*Permanent Easements*		
		# of Parcels Affected	Size Range of Easements (acres)	Total Land Affected (acres)	# of Parcels Affected	Size Range of Acquisitions (acres)	Total Land Acquired (acres)
Commercial	13	10	<0.1-0.6	1.3	11	<0.1-0.8	2.2
Residential	13	13	0.1-0.6	1.6	9	<0.1-1.0	2.7
Industrial	11	10	<0.1-0.2	0.7	11	<0.1-3.5	7.3
Recreational/ Open Space	7	7	<0.1-0.1	0.6	7	<0.1-0.4	3.7
Transportation	7	8	<0.1-0.2	0.4	8	<0.1-0.7	2.1
Wetland	14	11	<0.1-0.2	1.2	13	0.1-0.4	6.2
Other*	4	4	<0.1-1.3	2.5	4	<0.1-0.6	2.4
Total	**69**	**63**	**<0.1-1.3**	**8.3**	**63**	**<0.1-3.5**	**26.6**

*Other denotes land use such as cleared vacant land

Table 4.2-3: Temporary and Permanent Easements Proposed under Alternative 1 by Project Segment

Land Use	Number of Parcels Affected	Temporary Easements			Permanent Easements		
		# of Parcels Affected	Size Range of Easements (acres)	Total Land Affected (acres)	# of Parcels Affected	Size Range of Acquisition (acres)	Total Land Affected (acres)
Northern Segment							
Commercial	6	6	<0.1-0.1	0.9	6	<0.1-0.4	0.8
Residential	3	3	<0.1-0.6	1.3	3	<0.1-0.8	2.0
Industrial	0	0	0	0	0	0	0
Recreational / Open Space	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0
Wetland	0	0	0	0	0	0	0
Other**	1	1	<0.1	0	1	<0.1	<0.1
Subtotal	**10**	**10**	**<0.1-0.6**	**2.2**	**10**	**<0.1-0.8**	**2.8**
Central Segment							
Commercial	6	3	<0.1-0.3	0.3	4	0.1-0.8	1.4
Residential	10	10	<0.1-0.1	0.3	7	<0.1-0.2	0.7
Industrial	10	10	<0.1-0.2	0.7	10	<0.1-1.3	3.9
Recreational / Open Space	7	7	<0.1-0.4	0.6	6	<0.1-2.7	3.7
Transportation	4	5	0.1-0.2	0.4	5	0.3-0.7	2.0
Wetland	4	4	0.1-0.2	0.4	4	0.2-0.8	1.7
Other**	3	3	0.3-1.3	2.5	3	0.3-0.6	2.4
Subtotal	**44**	**42**	**<0.1-1.3**	**5.2**	**39**	**<0.1-2.7**	**15.8**
Southern Segment							
Commercial	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0
Recreational / Open Space	0	0	0	0	0	0	0
Transportation	2	2	<0.1-0.1	<0.1	2	<0.1	<0.1
Wetland	8	6	<0.1-0.2	0.7	8	0.1-1.2	3.4
Other**	0	0	0	0	0	0	0
Subtotal	**10**	**8**	**<0.1-0.2**	**0.7**	**10**	**<0.1-1.2**	**3.4**

Land Use	Number of Parcels Affected	*Temporary Easements*			*Permanent Easements*		
		# of Parcels Affected	Size Range of Easements (acres)	Total Land Affected (acres)	# of Parcels Affected	Size Range of Acquisition (acres)	Total Land Affected (acres)
Berry's Creek Storm Surge Barrier							
Commercial	1	1	<0.1	<0.1	1	<0.1	<0.1
Residential	0	0	0	0	0	0	0
Industrial	1	0	0	0	1	3.5	3.5
Recreational / Open Space	0	0	0	0	0	0	0
Transportation	1	1	<0.1	<0.1	1	0.1	0.1
Wetland	2	1	0.1	0.1	1	0.4-0.7	1.0
Other*	0	0	0	0	0	0	0
Subtotal	**5**	**3**	**<0.1-0.1**	**0.1**	**4**	**<0.1-3.5**	**4.6**
TOTAL	**69**	**63**	**<0.1-1.3**	**8.3**	**63**	**<0.1-3.5**	**26.6**

*Other denotes land use such as cleared vacant land
Mathematical inconsistencies due to rounding.

Temporary Easements

During the construction phase, 8.3 acres of land would be placed under temporary easement to support construction staging and access. Temporary easements would impact 63 parcels within the Project Area, as shown in **Table 4.2-2** and **Table 4.2-3**. Individual easements would range from less than 0.1 acre to 1.3 acres per parcel. The duration of each easement would vary based on site-specific construction requirements; however, no temporary easements would remain active beyond September 2022. A temporary easement agreement would be established with each land owner to allow for the use of their property; each agreement would provide specific details, terms, and requirements, as well as consideration to the land owner for the temporary easement. Execution of these easements would not require demolition of any structures, displacement of any land uses, or changes in land use or land use designations. During the agreed upon easement period, use of the portions of each parcel by the affected landowner would be precluded. However, in all cases, the existing land use of each affected portion would not impact the overall land use of the entire parcel. Because the impacts on the use of these parcels would be temporary and coordinated in advance with each land owner, adverse impacts to the use of each parcel would be anticipated to be ***short-term*** and ***less-than-significant***.

Temporary easements are proposed mostly in the Northern and Central Segments. In the Northern Segment, temporary easements would be established primarily along commercial and residential land uses adjacent to the narrow construction area, allowing for construction access and staging. These easements would be along parcel edges by the water, and collectively occupy a total of 2.3 acres of land. While some parking spaces in paved lots may be unavailable during construction, there is ample additional space to compensate for the temporary loss on each impacted parcel. Temporary easements in the Central Segment would encompass a total of 5.2 acres of a variety of land uses and, similar to the Northern Segment, be located along the edges of the Alternative 1 footprint to provide for construction access and staging. The exception is the currently vacant area at the northern end of the Central

Segment, immediately adjacent to the proposed Fluvial Park to the west. These temporary easements encompass more space than simply a buffer adjacent to the Project Area to allow for required construction material staging.

Permanent Easements

Implementation of Alternative 1 would require the permanent easement of 26.6 acres of land. Permanent easements would include six full parcel acquisitions and 58 partial parcel acquisitions. Of the six full parcel acquisitions, five are included within the Central Segment to accommodate the proposed development of K-Town Park and Riverside Park. These parcels are designated as commercial, residential, and recreational/open space land uses, and are currently vacant.

The remaining full parcel acquisition is an industrial parcel within the proposed Berry's Creek storm surge barrier footprint that contains a truck repair and storage facility. This acquisition would result in the only potential displacement under Alternative 1, and could result in a ***long-term, potentially significant adverse*** impact to this landowner.

The remaining 58 parcels would require a partial parcel acquisition, ranging in size from less than 0.1 acre to 3.5 acres. None of these partial parcel acquisitions would displace structures.

As shown in **Table 4.2-2**, industrial and wetland land uses are the most impacted by Alternative 1 at 7.3 and 6.2 acres of permanent easements, respectively. Through the entire Southern Segment and much of the Central Segment, the majority of the impacted parcels are comprised of wetland or industrial land uses; the LOP would be installed in a relatively narrow band through these uses, and would not impact existing structures. In addition, the Recreational/Open Space land that would be acquired is currently vacant, resulting in no impact and ultimately increasing the utility of the land's use through proposed park development. **Table 4.2-3** quantifies the short-term easements and permanent easements by each segment.

With the exception of the single displacement described above, implementation of Alternative 1 is anticipated to result in a ***long-term, less-than-significant adverse*** impact to land use due to permanent land easements. Permanent easements would be coordinated in advance with each land owner to avoid and minimize potential impacts.

Based on current planning data, 6.6 acres of the 26.6 acres of permanent easements would result in a land use change (see **Table 4.2-2** and **Figure 4.2-1**). Of these 6.6 acres, 1.4 acres of commercial, 0.57 acres of residential, 2.2 acres of industrial, and 2.4 acres of other land use would be converted to open space/recreational use for proposed parkland and riverside walkways. The remaining permanent easements would be consistent with the existing land use; areas where the LOP would consist only of a floodwall or similarly unobtrusive structure, no land use change would occur. As such, a ***long-term, less-than-significant adverse*** impact to existing land uses would occur from land use conversions under Alternative 1.

The land conversions to recreational/open space designation would occur within the Northern and Central Segments of Alternative 1 (see **Figure 4.2-1**). Because the proposed acquisitions are narrow along the parcel edges, or the parcels of land are generally underutilized waterfront properties, the conversion of these portions of parcels to recreational use is anticipated to improve the utility of these properties and result in a ***long-term beneficial*** impact on the Project Area.

Zoning Changes

Within the 26.6 acres of proposed permanent easements, zoning changes are anticipated to occur on 12.2 acres. As discussed in **Section 3.2.3**, zoning is under the jurisdiction of several entities within the Project Area, including the Meadowlands District and, for areas outside the District, by municipality. Under Alternative 1, zoning changes would vary by jurisdiction; zoning is anticipated to be re-designated as Waterfront Recreation, Parks and Recreation, Public Facilities, Public Utilities, Community, Regional, or Mixed Use. **Table 4.2-4** provides a summary of the existing zoning designations within the Project Area by Segment, the zoning district, and the probable new zoning designation that would be triggered by the implementation of Alternative 1.

Table 4.2-4: Anticipated Zoning Changes, by Segment, under Alternative 1

Segment	Existing Zoning Designation	Zoning District	Land (acres)	Probable New Zoning Designation
Northern	**Manufacturing**	**Hackensack**	**0.8**	**Community; Regional; Mixed Use**
	Highway Business	**Little Ferry**	**<0.1**	**Public Facilities**
	Multifamily Residential	**Little Ferry**	**1.6**	**Public Facilities**
Central	*Environmental Conservation*	*Meadowlands District*	*0.6*	*Waterfront Recreation; Parks and Recreation*
	Light Industrial B	*Meadowlands District*	*2.2**	*Waterfront Recreation; Parks and Recreation*
	Low Density Residential	*Meadowlands District*	*0.8*	*Waterfront Recreation; Parks and Recreation*
	Planned Residential	**Meadowlands District**	**1.6**	**Waterfront Recreation; Parks and Recreation**
	Public Utilities	*Meadowlands District*	*5.5*	*Waterfront Recreation; Parks and Recreation*
	Highway Business	**Little Ferry**	**4.0**	**Public Facilities**
Southern	*Environmental Conservation*	*Meadowlands District*	*2.9*	*Waterfront Recreation; Parks and Recreation*
	Light Industrial A	*Meadowlands District*	*0.3*	*Waterfront Recreation; Parks and Recreation*
Berry's Creek	*Light Industrial A*	*Meadowlands District*	*0.1*	*Public Facilities*
	Light Industrial B	**Meadowlands District**	**3.5**	**Public Facilities**
	Redevelopment Area	*Meadowlands District*	*0.4*	*Public Facilities*
	Sports Exposition Authority	**Meadowlands District**	**0.7**	**Public Facilities**
TOTAL Expected Change			**12.2**	
TOTAL Potential and Expected Change			**25.0**	

*<0.1 acre of Central Segment Light Industrial B Zoning would be expected to change zoning designation.
Bold denotes expected zoning change, while *italic* denotes potential zoning change.

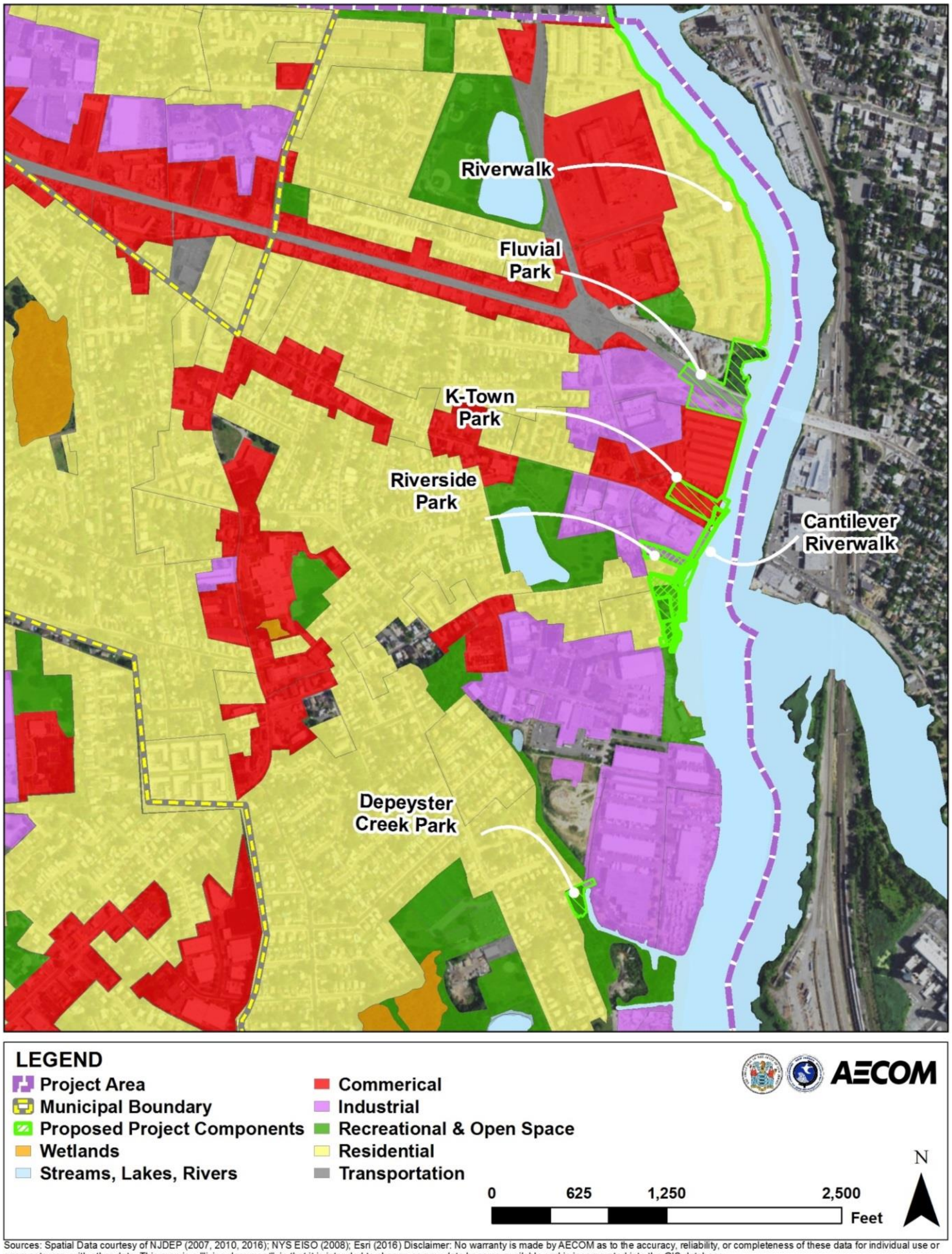


Figure 4.2-1: Land Uses Converted to Recreational/Open Space Use under Alternative 1

Along with *expected* changes to existing zoning, **Table 4.2-4** identifies areas of land acquisition along the LOP that could also *potentially* be subject to zoning changes, depending upon type of construction and purchase agreement with the landowner. While it is possible that some properties adjacent to the LOP could experience minimal impacts based on the long-term changes in zoning, it is equally possible that there would be some residents who would benefit from these same changes. Overall, because the proposed zoning changes are not anticipated to change the intensity of long-term development, ***long-term, less-than-significant, adverse*** impacts would occur to the study area due to expected or potential zoning changes.

Indirect Impacts

No adverse indirect impacts on land use are anticipated to occur as a result of the construction and operation of Alternative 1. Alternative 1 would not be anticipated to induce a change in existing land use patterns or long-term land use plans. None of the Alternative 1 components occur within 2,500 feet of Teterboro Airport; therefore, proposed land use changes would be compatible with aviation activities and in compliance with 24 CFR Part 51, Subpart D. However, under Alternative 1, four proposed parks (i.e., Fluvial Park, K-Town Park, Riverside Park, and DePeyster Creek Park) would be constructed along the Hackensack River waterfront that would create approximately 1.1 acres of wetland habitat and 1.1 acres of upland habitat. Because these proposed parks would occur within 10,000 feet of the Teterboro Airport and would have the potential to attract wildlife, conformity with FAA AC No. 150/5200-33B must be considered. Because the proposed parks are approximately 7,000 feet from the eastern boundary of the airport and would provide only a very small amount of new wildlife habitat, particularly when compared to the overall Project Area and surrounding area, Alternative 1 would not be expected to increase the potential for wildlife hazards. To further minimize this potential, BMPs to reduce wildlife hazards would be implemented.

Alternative 1 would provide existing and currently planned future land uses in the Project Area with increased protection against coastal storm surges. This would enhance the sustainability of existing land uses, and allowing future planned land uses to be implemented in accordance with existing plans. In addition, existing land uses would be enhanced through the provision of additional recreation and park lands within the Project Area. Therefore, implementation of Alternative 1 would result in ***long-term beneficial*** effects on existing land uses within the Project Area.

Mitigation Measures and BMPs

No potentially significant adverse impacts to land use have been identified from the proposed construction or operation of Alternative 1.The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase, the need for both temporary and permanent easements would be minimized to the extent possible.
- Coordination with affected property owners and zoning districts would occur prior to implementing Alternative 1 to effect mutually agreeable settlements and to proactively prepare for required zoning changes.
- Construction BMPs would be implemented, as necessary based on adjacent land uses, to minimize impacts to residences and businesses during construction activities (see **Section 4.8.2.2, Section 4.9.4.2,** and **Section 4.10.4.2** for more information on transportation, noise and vibration, and air quality BMPs, respectively).

- Measures to minimize the potential for wildlife hazards to human health and safety from aircraft collisions would be implemented. Measures would include the use of approved seed mixes and plant species (e.g., with less potential to attract hazardous wildlife species), efforts to deter flocking bird species within sports fields/play areas, maintenance of grassland areas, use of emergent or shrub wetland plants in rain gardens and bioswales to decrease the potential for waterfowl or gull species use, and coordination with the FAA and Teterboro Airport operator.

4.2.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding from heavy precipitation events, but continued and increased coastal storm surges (coastal flooding) would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to existing land uses from a temporary change in use during the construction phase of Alternative 2.
- ***Long-term, less-than-significant, adverse*** impacts to existing land use from permanent land acquisitions.
- ***Long-term, less-than-significant, adverse*** impacts to the study area due to anticipated zoning changes of acquired properties.
- ***Long-term, beneficial*** impacts associated with improved utility of a particular land use type or locality.

Alternative 2 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to adjacent land use during the construction of some of the proposed green and grey infrastructure improvements within existing roadways.
- ***Long-term, less-than-significant, adverse*** impacts on land use compatibility from the proposed Caesar Place Park, Avanti Park, and Robert Craig Elementary School improvements due to their proximity to the Teterboro Airport.
- ***Long-term, less-than-significant, adverse*** impacts on aviation safety from increased wildlife hazards due to creation and enhancement of wildlife habitat in the Project Area.
- ***Long-term, beneficial*** effects to existing and planned land uses by increasing inland flood protection against heavy precipitation events, enhancing the sustainability of existing land uses, and allowing future planned land uses to be implemented in accordance with existing land use plans.

The following subsections provide greater detail.

Direct Impacts

Land Acquisition

Under Alternative 2, a total of 64 parcels would be directly affected by temporary and/or permanent easements. Approximately 45.2 acres of land would require a permanent acquisition or a permanent land use agreement; an additional 5.6 acres would require temporary easements to support construction staging and access. In many cases, construction staging and access would occur within the permanent easement limits under Alternative 2. In comparison, Alternative 1 would affect 69 parcels, and require 26.6 acres of permanent easements and 8.3 acres of temporary easements.

Under Alternative 2, stormwater management improvements would consist of new green infrastructure, new parks, improved open spaces, and grey infrastructure improvements to the East Riser Ditch and Losen Slote drainage areas. All of the green infrastructure improvements would be located within existing roadways. As such, no direct impact to parcel boundaries would occur as result of the construction of these components; direct impacts would be solely within the roadway rights-of-way. Similarly, some of the grey infrastructure improvements (e.g., force mains) would also occur solely in existing rights-of-way. Therefore, Alternative 2 would also include temporary and permanent easements within roadways that are outside parcel boundaries.

Land uses affected by temporary and permanent easements include: commercial, residential, industrial, recreational/open space, transportation, wetland, and other[42] (i.e., cleared vacant land) designations. A summary of the temporary and permanent easement requirements by land use type for Alternative 2 is provided in **Table 4.2-5**.

Table 4.2-5: Temporary and Permanent Easements Proposed under Alternative 2

Land Use	Number of Parcels Affected	*Temporary Easements*			*Permanent Easements*		
		Number of Parcels Affected	Range of Acquisition (acres)	Total Land Acquired (acres)	Number of Parcels Affected	Range of Acquisition (acres)	Total Land Acquired (acres)
Commercial	7	6	<0.1-0.1	0.3	5	<0.1-1.7	3.2
Residential	7	2	<0.1-0.1	0.1	7	<0.1-0.9	1.6
Industrial	16	13	<0.1-0.8	2.1	16	<0.1-1.3	6.0
Recreational/ Open Space	26	12	<0.1-0.4	1.3	25	<0.1-8.0	21.3
Transportation	2	1	<0.1	<0.1	2	<0.1	0.1
Wetland	1	1	0.1	0.1	1	0.1	0.1
Water	0	0	0	0.0	0	0	0.0
Other	5	1	0.2	0.2	5	0.53-4.9	8.7
Roadways*	NA	NA	<0.1-0.2	1.5	NA	<0.1-1.4	4.2
Total	**64**	**36**	**<0.1-0.8**	**5.6**	**61**	**<0.1-8.0**	**45.2**

*Features within roadways are outside of parcel boundaries and are not attributable to a specific land use.
Mathematical inconsistencies due to rounding.

Temporary Easements

During the construction phase, a total of 5.6 acres of land, comprising 4.1 acres of land within parcels and 1.5 acres within roadways, would be placed under temporary easements to support construction staging and access. Temporary easements would impact 36 parcels within the Project Area, as shown in **Table 4.2-5**. Individual easements would range from less than 0.1 acre to 0.8 acre. The duration of each

[42] The Other land use designation refers to vacant land that is either vegetated or open, and does not serve a distinct purpose.

easement would vary based on site-specific construction requirements; however, no temporary easements would remain active beyond September 2022. A temporary easement agreement would be established with each land owner to allow for the use of their property; each agreement would provide specific details, terms, and requirements, as well as consideration to the land owner for the temporary easement. Execution of these easements would not require demolition of any structures, displacement of any land uses, or changes in land use or land use designations. During the period of the agreed upon easement, use of the portions of each parcel by the affected landowner would be precluded. However, in all cases, the existing land use of each affected portion would not impact the overall land use of the entire parcel. Because the impacts on the use of these parcels would be temporary and coordinated in advance with each land owner, adverse impacts to the use of each parcel would be anticipated to result in a ***short-term, less-than-significant, adverse*** impact. Given Alternative 1 would require an additional 2.7 acres of land, impacts associated with temporary land easements are anticipated to be slightly less under Alternative 2.

Temporary easements are proposed along East Riser Ditch and for the various green infrastructure improvements. Temporary easements would provide access and staging areas along both sides of East Riser Ditch, from south of Moonachie Avenue to the East Riser Ditch tide gate at Berry's Creek. While the majority of these easements encompass the vegetated strip of land along both sides of the East Riser Ditch, some paved areas and parking spaces would require a temporary easement as well. All of the impacted parcels would have ample space to continue their respective normal operations (e.g., parking). In addition, temporary easements would be required for staging near the Losen Slote pump stations A and C, for the various green infrastructure improvements, and for some of the proposed park and open space improvements, specifically Joseph Street Park, Caesar Place Park, the Little Ferry Public Schools, and the Little Ferry Municipal Buildings. Temporary easement for the parks and opens space improvements would be 0.5 acre, comprising only a small portion of the overall 5.6 acres devoted to temporary easements within the Project Area.

Permanent Easements

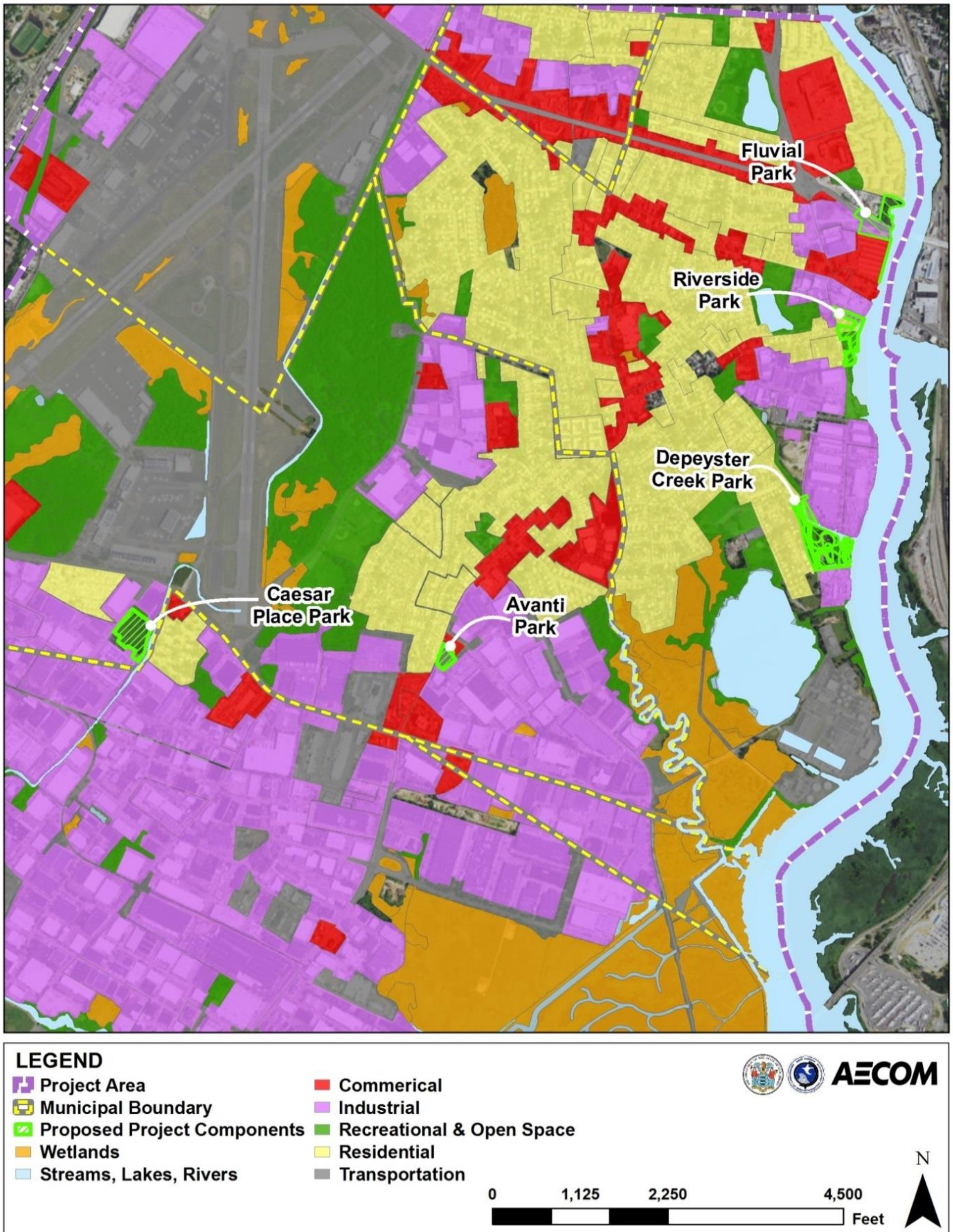
Alternative 2 would require a total of 45.2 acres of land, comprised of 41.0 acres of land within parcels and 4.2 acres within existing roadways. Approximately 75 percent (33.7 acres) of the permanent easements would be acquired to accommodate the proposed parks and open space improvements, while the grey and green infrastructure improvements would require approximately 9.6 acres and 1.9 acres, respectively.

Of the 61 permanently impacted parcels, three of them would require a full taking. Two of these parcels would be acquired for the proposed Riverside Park; they are currently mapped as residential and recreational/open space. The third parcel, which is currently identified as recreational/open space, would be acquired for the proposed DePeyster Creek Park. These parcels are currently vacant. No displacements would occur as result of the permanent easements under Alternative 2.

The remaining 58 parcels would require a partial parcel acquisition, ranging from less than 0.1 acre to 4.9 acres. None of these partial parcel acquisitions would displace structures.

Because no displacements are anticipated and all permanent easements would be coordinated in advance with each land owner, a ***long-term, less-than-significant adverse*** impact to land use would occur from the implementation of Alternative 2 due to permanent land easements. In comparison to Alternative 1, impacts associated with permanent easements are anticipated to be slightly greater under Alternative 2 because approximately 20.3 acres of additional land would require permanent easements.

Approximately 11.7 acres (or 26 percent) of the land permanently impacted under Alternative 2 would result in a land use change (see **Table 4.2-5**). Of the 11.7 acres, 0.6 acre of residential, 2.4 acres of industrial, and 8.7 acres of other land use would be converted to recreational/open space use for the proposed Fluvial Park, Riverside Park, DePeyster Park, Avanti Park, and Caesar Place Park (see **Figure 4.2-2**). Conversion of these portions of parcels to recreational use is anticipated to improve the utility of these properties, as well as contribute to the expansion and enhancement of public space in the Project Area. This would result in a ***long-term, beneficial*** impact. The remaining proposed permanent acquisitions, including all grey and green infrastructure components, would be consistent with their current land use. Therefore, no impact to existing land uses would occur in these other areas under Alternative 2 as result of land use conversions.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.2-2: Land Uses Converted to Recreational/Open Space Use under Alternative 2

Zoning Changes

Within the 45.2 acres of proposed permanent easements, zoning changes would be anticipated to occur on 20.4 acres. As discussed in **Section 3.2.3**, zoning is under the jurisdiction of several entities within the Project Area, including the Meadowlands District and, for areas outside the District, the municipalities. Under Alternative 2, zoning changes would vary by jurisdiction; zoning would be anticipated to be re-designated as Waterfront Recreation, Parks and Recreation, Public Facilities, or Public Utilities. **Table 4.2-6** provides a summary of the existing zoning designations within the Project Area by proposed Alternative 2 component, the zoning district, and the probable new zoning designation that would result from the implementation of Alternative 2.

With the exception of Losen Slote pump stations A and C, the proposed zoning changes would occur due to the development of new parks. It is anticipated that residents would benefit from these changes. Zoning changes related to the pumping stations would be small and isolated and would not be expected to impact residents or adjacent land uses or zoning designations. Overall, because the proposed zoning changes are not anticipated to change the intensity of long-term development, ***long-term, less-than-significant, adverse*** impacts would occur to the study area due to expected or potential zoning changes.

Table 4.2-6: Anticipated Zoning Changes under Alternative 2

Existing Zoning Designation	Alternative 2 Component	Zoning District or Municipality	Land (acres)	Probable Zoning Designation
Highway Business	Fluvial Park	Borough of Little Ferry	4.0*	Waterfront Recreation; Parks and Recreation
Planned Residential	Riverside Park	Meadowlands District	1.5	Waterfront Recreation; Parks and Recreation
Low Density Residential	Riverside Park & DePeyster Park	Meadowlands District	8.5	Waterfront Recreation; Parks and Recreation
Light Industrial A	Avanti Park	Meadowlands District	1.0	Parks and Recreation
Light Industrial B	Caesar Place Park	Meadowlands District	5.2	Parks and Recreation
Manufacturing Zone	Losen Slote Pump Station C	Borough of Moonachie	0.1	Public Facilities; Public Utilities
Neighborhood Business	Losen Slote Pump Station A	Borough of Little Ferry	0.1	Public Facilities; Public Utilities
TOTAL			**20.4**	

*Includes 0.7 acre for land underneath US Route 46, which would be included in the proposed Fluvial Park.

Indirect Impacts

Alternative 2 would not be anticipated to induce a change in existing land use patterns or long-term land use plans. However, Alternative 2 would provide existing and any planned future land uses in the Project Area with increased protection against inland flooding, but would not afford protection against coastal storm surges like Alternative 1. This protection from inland flooding would enhance the sustainability of existing land uses, and allow future planned land uses to be implemented in accordance with existing plans. In addition, existing land uses would be enhanced through the provision of additional recreation and park lands within the Project Area. Therefore, implementation of Alternative 2 would result in ***long-term beneficial*** effects on existing land uses within the Project Area.

While the proposed green and grey infrastructure improvements within roadways would not result in a direct change in land use, a ***short-term, less-than-significant*** impact could occur to adjacent parcels during construction activities. A total of 275 parcels could be impacted during the construction of these Alternative 2 components. **Table 4.2-7** identifies the existing land use for the parcels located adjacent to the proposed roadway features.

No long-term impact would be expected to occur as result of the proposed grey infrastructure components within the roadways. However, the green infrastructure improvements would be anticipated to provide a ***long-term, beneficial*** impact to adjacent parcels through the proposed roadway vegetation and stormwater retention enhancements.

Table 4.2-7: Adjacent Parcels Affected by Roadway Components under Alternative 2

Land Use	Number of Parcels	
	Green Infrastructure	Grey Infrastructure
Commercial	57	16
Residential	73	102
Industrial	17	9
Recreational / Open Space	1	0
Transportation	0	0
Wetlands	0	0
Water	0	0
Other	0	0
Total	**148**	**127**

As discussed in **Section 3.2.2**, the Proposed Project would be subject to both FAA and HUD regulations related to land use and airspace restrictions due to the presence of Teterboro Airport within the Project Area. As illustrated in **Figure 4.2-3**, there are 14 Alternative 2 components that would intersect the 2,500 buffer zone around Teterboro Airport: nine green infrastructure components (eight bioswales and one rain garden), two grey infrastructure features (East Riser Ditch stormwater improvements and Losen Slote pump station C), two new parks (Caesar Place Park and Avanti Park), and one existing public open space improvement (Robert Craig Elementary School). None of these locations are anticipated to be within the RPZ for Teterboro Airport. However, based on consultation with the FAA, the proposed bioswale along the western side of Redneck Avenue would be located on property dedicated to Teterboro Airport. Any land release or dedication of airport property to the Proposed Project would require approval by the FAA and would need to be reflected on the Airport Layout Plan. Further, this activity could trigger a Federal Action subject to NEPA and FAA Orders 1050.1F and 5050.4B. Therefore, the FAA is serving as a Cooperating Agency to the Proposed Project, so that they may adopt this NEPA review.

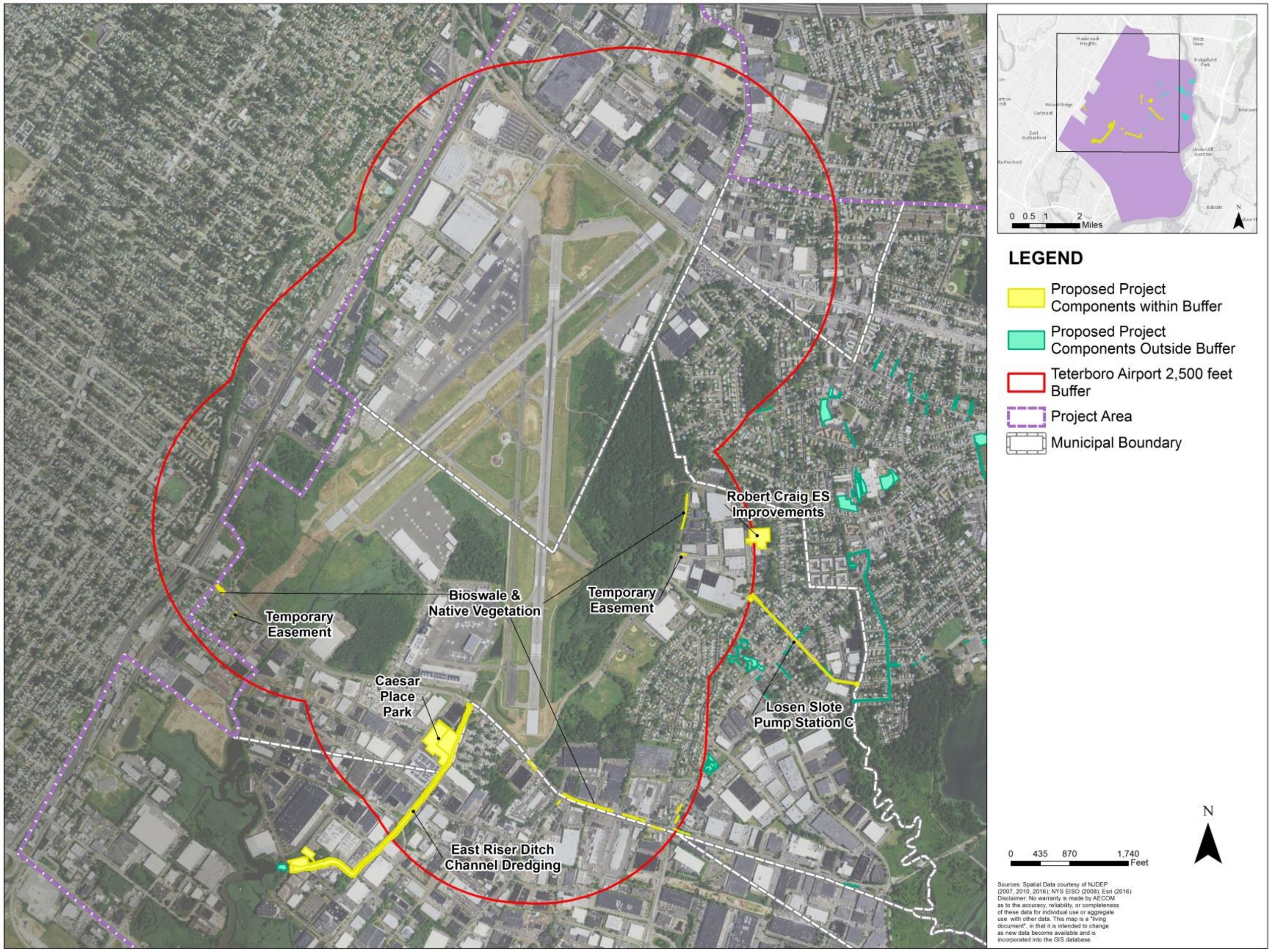


Figure 4.2-3: Alternative 2 Components within 2,500 feet of the Teterboro Airport

The proposed park locations are currently undeveloped land that would be converted from transportation to recreational/open space land use. With the exception of the proposed parks, no change to existing land use would occur within the above listed locations. The proposed parks and proposed Robert Craig Elementary School improvements would provide a place that could be used or occupied more regularly by people. Because these three components would result in a change in land use, increased use by people, and/or the acquisition of undeveloped land, there could be ***long-term, less-than-significant, adverse*** impacts to land use due to their proximity to Teterboro Airport. Potential impacts or conflicts would be coordinated with Teterboro Airport in compliance with 24 CFR Part 51, Subpart D and 14 CFR Part 77.

Further, under Alternative 2, five new parks (approximately 20.0 acres), improvements to existing open spaces/public amenities (11.2 acres), 41 green infrastructure systems (bioswales, rain gardens, storage/tree trenches), and East Riser Ditch improvements that include the creation and enhancement of 7.2 acres of wetlands would be constructed. These components have the potential to attract wildlife; therefore, conformity with FAA AC No. 150/5200-33B is required. Given these features would be scattered throughout the built environment and are generally small in size, they are not expected to draw additional wildlife to the area, particularly given the extensive upland and wetland habitat within the Project Area and the surrounding area. However, some minor, localized increases could occur within the vicinity of these features. Therefore, Alternative 2 could result in ***long-term, less-than-significant adverse*** impacts from increased wildlife hazards to aircraft due to the proposed wildlife habitat improvements. To further minimize this potential, BMPs to reduce wildlife hazards would be implemented to ensure the safety and long-term sustainability of the Teterboro Airport.

Mitigation Measures and BMPs

No potentially significant adverse impacts to land use have been identified from the proposed construction or operation of Alternative 2. The following mitigation measures and/or BMPs would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts. In addition to the mitigation measures and BMPs identified under Alternative 1, the following measures would be implemented.

- During the design phase, consultation with FAA would be conducted to ensure compliance with NEPA, FAA Orders 1050.1F and 5050.4B, FAA AC No. 150/5200-33B, and the Teterboro Airport Wildlife Hazard Management Plan.
- Consultation would be conducted with Teterboro Airport, the FAA, and other applicable cooperating agencies to ensure Alternative 2 would not conflict with airport operations, and to confirm that there are no plans to purchase the properties for a RPZ program within the 2,500-foot buffer zone; any required notices in compliance with 24 CFR Part 51, Subpart D would be implemented.
- Small construction equipment (i.e., less than 200 feet in height) would be utilized to avoid potential navigational airspace hazards associated with the use of tall equipment near Teterboro Airport in accordance with 14 CFR Part 77.
- Construction near Teterboro Airport runways would occur during daylight hours to eliminate potential impacts from bright construction lighting.

4.2.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint due to the exclusion of Fluvial Park, DePeyster Creek Park, and the Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project would impact land uses and land use planning, and thus would not change the impact analysis.

In general, direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences.

Direct Impacts

<u>Land Acquisition</u>

Under Alternative 3, a total of 56 parcels would be directly affected by temporary and/or permanent easements, in comparison to 64 parcels under Alternative 2. Approximately 31.8 acres of land would be would require a permanent acquisition or a permanent land use agreement; an additional 5.6 acres would require temporary easements to support construction staging and access. In many cases, construction staging and access would occur within the permanent easement limits under Alternative 3. More detail on the temporary and permanent easement requirements for Alternative 3 is provided in **Table 4.2-8**.

Similar to Alternative 2, Alternative 3 would also involve temporary and permanent easements within roadways that are outside parcel boundaries. In addition to the 32.6 acres of land within parcels, a total of 4.8 acres of land within existing roadways would also be impacted.

Table 4.2-8: Temporary and Permanent Easements Proposed under Alternative 3

Land Use	Number of Parcels Affected	*Temporary Easements*			*Permanent Land Acquisitions*		
		Number of Parcels Affected	Range of Acquisition (acres)	Total Land Acquired (acres)	Number of Parcels Affected	Range of Acquisition (acres)	Total Land Acquired (acres)
Commercial	6	4	<0.1-0.1	0.3	6	<0.1-1.7	3.2
Residential	7	2	<0.1-0.1	0.1	7	<0.1-0.9	1.7
Industrial	13	13	<0.1-0.8	2.1	13	<0.1-0.9	4.3
Recreational/ Open Space	25	12	<0.1-0.4	1.3	24	<0.1-3.0	13.2
Transportation	2	1	<0.1	0.0	2	<0.1	0.1
Wetland	1	1	0.1	0.1	1	0.1	0.1
Water	0	0	0.0	0.0	0	0.0	0.0
Other	2	1	0.2	0.2	2	1.0-4.9	5.9
Roadways*	NA	NA	<0.1-0.2	1.5	NA	<0.1-0.2	3.3
Total	**56**	**34**	**0.01-0.8**	**5.6**	**55**	**0.01-4.90**	**31.8**

*Features within roadways are outside of parcel bounds and are not attributable to a specific land use.

Temporary Easements

Alternative 3 would also impact 34 parcels and require a total of 5.6 acres of land, comprising 4.1 acres of land within parcels and 1.5 acres within roadways, to support construction staging and access. Therefore, the ***short-term, less-than-significant**, **adverse*** impacts associated with construction activities would be identical to those described under Alternative 2 in **Section 4.2.4.3**.

Permanent Easements

Alternative 3 would require a total of 31.8 acres of land, comprising 28.5 acres of land within parcels and 3.3 acres within roadways, would require permanent easements. Of the 55 permanently impacted parcels, two of them would require a full taking. Both of these parcels would be acquired for the proposed Riverside Park; they are currently mapped as residential and recreational/open space. These parcels are currently vacant. The remaining 53 parcels would require a partial parcel acquisition, ranging from less than 0.1 acre to 4.9 acres. Similar to Alternative 2, no displacements would occur as result of the permanent easements under Alternative 3.

Because no displacements are anticipated and all permanent easements would be coordinated in advance with each land owner, a ***long-term, less-than-significant adverse*** impact to land use would occur from the implementation of Alternative 3 due to permanent land easements. However, in comparison to Alternative 2, impacts are anticipated to be slightly less under Alternative 3 because permanent easements would be approximately 13.4 acres less.

Approximately 7.2 acres (or 23 percent) of the land permanently impacted under Alternative 3 would result in a land use change (see **Table 4.2-8**), in comparison to 11.7 acres under Alternative 2. Of the 7.2 acres, 0.6 acre of residential, 0.7 acre of industrial, and 5.9 acres of other land use would be converted to recreational/open space use for the proposed Riverside Park, Avanti Park, and Caesar Place Park (see **Figure 4.2-4**). Conversion of these portions of parcels to recreational use is anticipated to improve the utility of these properties, as well as contribute to the expansion and enhancement of public space in the Project Area. This would result in a ***long-term beneficial*** impact. The remaining proposed permanent acquisitions, including all grey and green infrastructure components, would be consistent with their current land use. As such, a ***long-term, less-than-significant adverse*** impact to existing land uses would occur from land use conversions under Alternative 3.

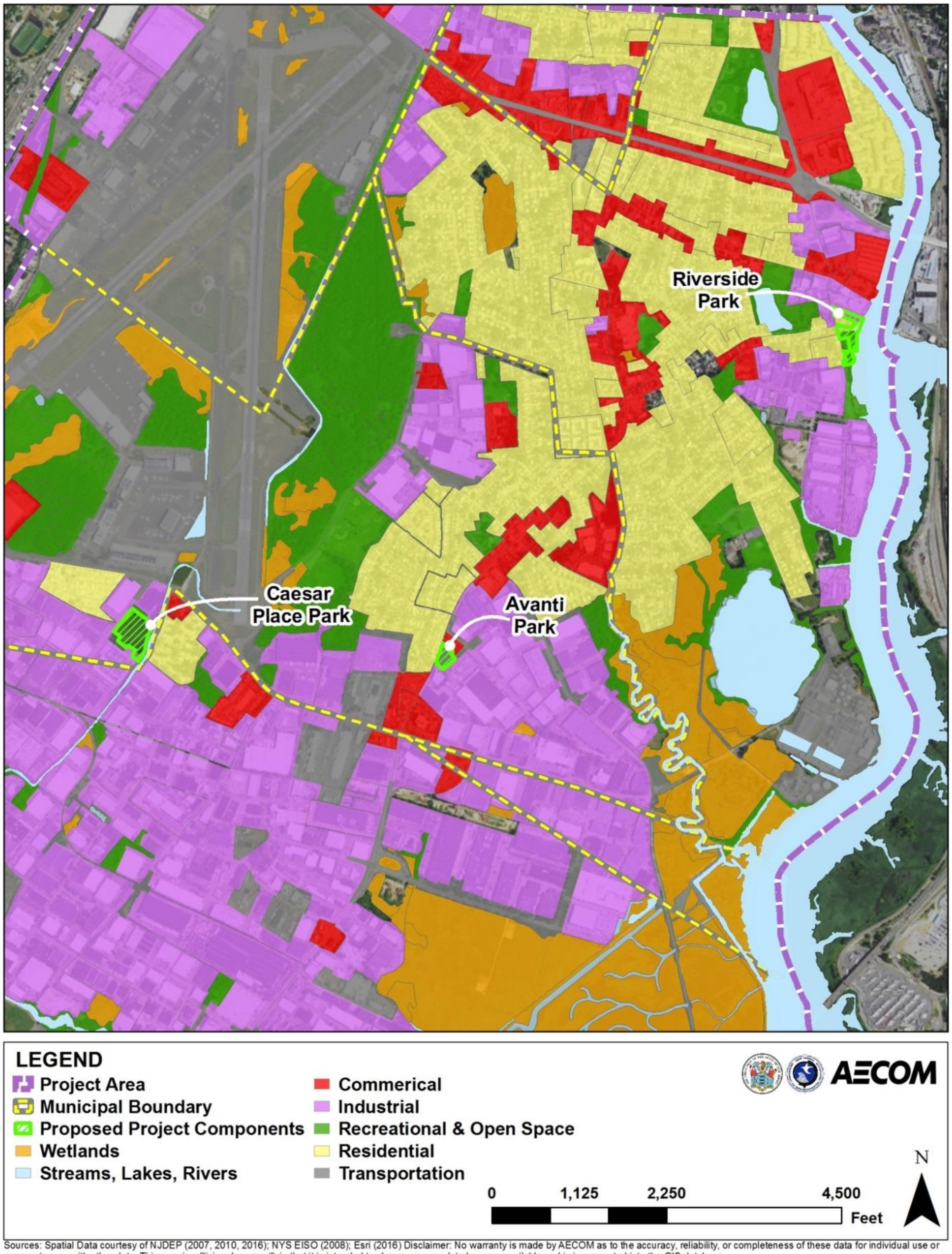


Figure 4.2-4: Land Uses Converted to Recreational/Open Space Use under Alternative 3

Zoning Changes

Within the 31.8 acres of proposed permanent land acquisition, zoning changes are anticipated to occur on 8.0 acres. **Table 4.2-9** provides a summary of the existing zoning designations within the Project Area by proposed Alternative 3 component, the zoning district, and the probable new zoning designation that would result from the implementation of Alternative 3.

Impacts from anticipated zoning changes would be similar to Alternative 2. However, Fluvial Park, DePeyster Park, and Losen Slote pump station C would not be constructed. Therefore, ***long-term, less-than-significant, adverse*** impacts from potential zoning changes would be slightly less under Alternative 3.

Table 4.2-9: Anticipated Zoning Changes under Alternative 3

Existing Zoning Designation	Alternative 3 Component	Zoning District or Municipality	Land (acres)	Probable Zoning Designation
Planned Residential	Riverside Park	Meadowlands District	1.5	Waterfront Recreation; Parks and Recreation
Low Density Residential	Riverside Park	Meadowlands District	0.2	Waterfront Recreation; Parks and Recreation
Light Industrial A	Avanti Park	Meadowlands District	1.0	Parks and Recreation
Light Industrial B	Caesar Place Park	Meadowlands District	5.2	Parks and Recreation
Neighborhood Business	Losen Slote Pump Station A	Borough of Little Ferry	0.1	Public Facilities; Public Utilities
TOTAL			**8.0**	

Indirect Impacts

Alternative 3 would not be anticipated to induce a change in existing land use patterns or long-term land use plans. Similar to Alternative 2, ***long-term beneficial*** effects would occur on existing or future land uses within the Project Area from increased protection against inland flooding. However, these effects would be slightly less because the Losen Slote pump station C and force main would not be constructed.

Similar to Alternative 2, a ***short-term, less-than-significant*** impact could occur to adjacent parcels during construction activities from the proposed green and grey infrastructure improvements within roadways. A total of 242 parcels could be impacted during the construction of these components under Alternative 3, in comparison to 275 parcels under Alternative 2. Thus, overall impacts would be anticipated to be slightly less under Alternative 3. **Table 4.2-10** identifies the existing land use for the parcels located adjacent to the proposed roadway features.

Under Alternative 3, ***long-term, beneficial*** impacts on adjacent parcels from the green infrastructure improvements within roadways that provide vegetation and stormwater retention enhancements would be the same as Alternative 2. In addition, the same components in the vicinity of Teterboro Airport, identified under Alternative 2, would have the potential to result in ***long-term, less-than-significant,***

adverse impacts to land use in accordance with 24 CFR Part 51, Subpart D and 14 CFR Part 77. However, under Alternative 3, the potential for ***long-term, less-than-significant adverse*** impacts from increased wildlife hazards to aircraft due the proposed wildlife habitat improvements would be lower; approximately 12.4 acres less open space, and 3.7 acres less of created/enhanced wetland habitat would be provided, in comparison to Alternative 2. Additionally, Alternative 3 would include the proposed bioswale on Teterboro Airport property along Redneck Avenue, which would require consultation with the FAA. For more information, refer to **Section 4.2.4.3**.

Table 4.2-10: Adjacent Parcels Affected by Roadway Components under Alternative 3

Land Use	Number of Parcels	
	Green Infrastructure	Grey Infrastructure
Commercial	57	8
Residential	73	78
Industrial	17	8
Recreational / Open Space	1	0
Transportation	0	0
Wetlands	0	0
Water	0	0
Other	0	0
Total	**148**	**94**

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.2.4.3**).

4.3 Visual Quality/Aesthetics

This section analyzes the potential direct and indirect impacts of the three Build Alternatives and the No Action Alternative on visual quality and aesthetics, collectively referred to as visual resources, as described in **Section 3.3**, in and around the Project Area. A direct impact would occur if the Proposed Project would directly change a scenic view or contrast markedly with the surrounding aesthetics of an area. An indirect impact would occur if the Proposed Project would induce other changes that could affect the visual resource landscape. For example, an indirect impact would occur if the Proposed Project contributes to a future change in land use that alters the viewshed in a marked way.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to change the visual quality/character of the affected environment.

4.3.1 Definition of Study Area

As described in **Section 3.3.3.1**, the study area, or Area of Visual Effect, for visual resources includes the Project Area, as well as areas within a 5-mile radius from which the Proposed Project could be seen. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to visual resources.

4.3.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect visual resources effects of the alternatives are shown in **Table 4.3-1**.

4.3.3 Analysis Methodology

The Build Alternatives, including the No Action Alternative, were evaluated to determine the potential for changes to the existing visual quality and character of the defined study area. The analysis presented in this section is based on the five landscape units identified in **Section 3.3.3.5**, a review of relevant literature and adopted plans and policies as described in **Section 3.3.2**, and the preparation and analysis of visual simulations.

A number of factors determine the change to visual quality, change to character, overall resource visibility of a resource, and, ultimately, any potentially significant impacts that could result from implementation of a Proposed Project alternative. Because it is not feasible to analyze all of the views from which a Proposed Project alternative would be visible, it is necessary to select a number of landscape units and associated representative views to characterize the visual experience of viewer groups potentially affected by the implementation of each Proposed Project alternative. These landscape units are evaluated to establish existing visual character and visual quality, to identify viewer sensitivity, and to understand potential changes to the visual environment that could occur. Factors used to create the composite analysis included:

- Existing visual character
- Level of existing visual quality
- Proposed (future condition) visual character/visual quality with the Proposed Project alternative
- Level of change to visual quality/character anticipated
- Level of viewer sensitivity (viewer awareness and exposure) based on the anticipated change.

The level of change to visual quality/character was determined based on a comparison between existing and proposed visual quality/character. Factors that were considered included proposed changes in landform, vegetation, structures, roadways, and other project features that would alter existing conditions in a noticeable, direct way. Longer-term, indirect changes potentially induced by implementation of the Proposed Project, such as changes in land use, that could alter visual resources were also considered. Combined with viewer sensitivity, the anticipated level of change to visual quality/character determines the level of impact significance relative to the thresholds of significance. Potential impacts during both construction and operational phases were considered, as were both direct and indirect effects (see **Table 4.3-1**).

A primary concern during and following construction is the long-term disruption of scenery or viewsheds, including views associated with the Hackensack River, associated wetlands and natural areas, and the skyline of nearby New York City. In addition, New Jersey’s Coastal Management Program and Coastal Zone Management Rules contain multiple policy goals referencing the preservation, protection, and conservation of aesthetic resources in New Jersey’s coastal areas (NJDEP 2015c).

Table 4.3-1: Visual Quality and Aesthetics Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Visual Quality/Character Change	• No or negligible change in the factors contributing to the value of visual resources in the study area, such as visual quality/character or viewer sensitivity • Transient or no/negligible visual effects
	Indirect Visual Quality/ Character Change	• Would not induce further adverse changes to visual resources over time in the study area
	Applies to All Effect Types	• No discernable changes in the region or locality • Visual resources would be altered only for a negligible period of time
Less-than-Significant	Direct Visual Quality/ Character Change	• Would result in minimal changes to existing visual resources, such as intermittently noticeable changes in visual quality/character that are marginally negative • Would result in low to moderate viewer sensitivity • Would result in minimal limitations to the access of visual resources
	Indirect Visual Quality/Character Change	• Could induce minor changes to visual resources over time in the study area, such as actions that would limit access to visual resources
	Applies to All Effect Types	• Visual resources would only be altered for the duration of the construction phase or a portion of the operations phase • Impacts would be localized in specific areas and not affect high-value visual resources
Potentially Significant	Direct Visual Quality/ Character Change	• Would result in a substantial loss or degradation of a high-value visual resource • Would result in a moderately high to high viewer sensitivity • Would result in a fundamental and irreversible negative change in visual character/quality
	Indirect Visual Quality/Character Change	• Would induce additional changes that could result in substantial loss or degradation of a high-value visual resource • Would induce changes that result in future access limitations to, or reductions of, a high-value visual resource • Would initiate processes that would lead to permanent or persistent changes to visual character/quality due to future activities
	Applies to All Effect Types	• Would result in adverse impacts observed throughout affected municipalities • Would permanently adversely alter high-quality visual resources or substantially adversely change the aesthetic environment

Impact Level	Type of Effect	Impact Description
Beneficial	Direct Visual Quality/Character Change	• Would beautify and/or improve access to/visibility of visual resources • Would result in positive change in the factors contributing to the value of visual resources in the study area, including visual character/quality or viewer sensitivity
	Indirect Visual Quality/Character Change	• Would promote or contribute to future changes that would beautify and/or improve access to/visibility of visual resources • Would induce further positive changes to visual resources over time in the study area
	Applies to All Effect Types	• Would result in benefits observed throughout affected municipalities

4.3.4 Impact Analysis

The following subsections assess potential direct and indirect visual resource impacts associated with the implementation of three Build Alternatives and the No Action Alternative, including proposed construction and operation activities, on each of the five landscape units within the Project Area, as well as on other areas in the study area, but outside of the Project Area. As described in **Section 3.3.3.2** and illustrated in **Section 3.3-2**, the five landscape units in the Project Area are as follows: Landscape Unit 1 (Wetland Mitigation Area), Landscape Unit 2 (Residential Area), Landscape Unit 3 (Airport Area), and Landscape Units 4a and 4b (Commercial/Industrial Area), and Landscape Unit 5 (Hackensack River Waterfront Area).

4.3.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented, and therefore no changes attributable to the Proposed Project would occur to the existing visual quality and aesthetics within the Project Area. As such, there would be no direct impacts on visual resources from the No Action Alternative.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse*** impacts on visual and aesthetic resources within the Project Area. Depending on the magnitude, severity, and frequency of future flooding events and SLR as well as the viewer sensitivity, these effects reasonably could increase to ***indirect, potentially significant adverse*** impacts. Per the significance criteria, the No Action Alternative:

- *Could induce changes that result in the substantial loss or degradation of a high-value visual resource*
- *Could induce changes that result in future access limitations to a high-value visual resource*

Increased flooding within the Project Area could lead to the loss or degradation of natural habitat, trees, parks, or other open spaces in the natural environment and the dilapidation or abandonment of existing buildings, structures, or other infrastructure in the built environment, resulting in adverse effects to the natural harmony and cultural order within the Project Area.

High quality visual resources within the Project Area are primarily associated with the Hackensack River and the large wetland complexes in the southeast. Public access to high quality visual resources is limited in the Project Area. Access to the waterfront is generally restricted to private residences or private marinas along the Hackensack River. In addition, a large portion of the wetland complexes are mitigation banks, which are also restricted. As such, high quality visual resources are restricted to limited viewers within the Project Area. More frequent flooding and rising sea levels could lead to increased restrictions (both temporary and long-term) to the existing visual resources for these restricted viewer groups. While future access limitations to visual resources would not be widespread within the Project Area, potentially significant impacts could occur to some localized viewer groups.

4.3.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 4a (Commercial/Industrial Area) and Landscape Unit 5 (Hackensack River Waterfront Area) from the presence of construction equipment and materials (see **Figure 3.3-2**).

- ***Long-term, less-than-significant, adverse*** impacts to the natural harmony, cultural order, and visual quality of Landscape Unit 4a (Commercial/Industrial Area) from the construction of the Alternative 1 structural elements.
- ***Long-term, beneficial*** impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 5 (Hackensack River Waterfront Area) from the proposed waterfront improvements (e.g., walkways, parks, and natural landscaping).

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** impacts to the visual sensitivity of the viewing population to visual resources within Landscape Unit 4a (Commercial/Industrial Area) and Landscape Unit 5 (Hackensack River Waterfront Area) from the increased exposure and awareness of these resources generated by the establishment of viewing platforms, riverside pathways, and parks.
- ***Long-term, beneficial*** effects to visual resources within all landscape units due to increased flood protection against storm surges.

The following subsections provide greater detail.

Direct Impacts

Under Alternative 1, no impact would occur to the views within Landscape Unit 2 (Residential Area), Landscape Unit 3 (Airport Area), and Landscape Unit 4b (Commercial/Industrial Area) because the Proposed Project elements would not be visible within these landscape units.

<u>Construction</u>

During the construction phase, ***short-term, less-than-significant adverse*** impacts to natural harmony, cultural order, and visual quality would occur due to the presence of construction equipment and activities within Landscape Unit 1 (Wetland Mitigation Area), Landscape Unit 4a (Commercial/Industrial Area), and Landscape Unit 5 (Hackensack River Waterfront Area). Construction equipment and materials would be aesthetically incompatible with the existing natural, built, and aesthetic environments because of their contrast in material, form, and color. Because the duration of the equipment and materials is temporary, impacts are anticipated to be minor. In addition, the majority of the views within Landscape Units 1 and 5 are blocked by existing built elements from many vantage points. To minimize impacts during the construction phase of Alternative 1, screening fences in a similar color to the natural environment would be used to block the view of construction equipment and other materials.

<u>Operation</u>

As noted above, Alternative 1 would not be visible within Landscape Units 2, 3, or 4b; thus, no impacts to the visual quality, character, or viewer response in these landscape units would occur.

Long-term impacts of Alternative 1 on visual compatibility within landscape units were assessed based on four characteristics: natural harmony, cultural order, project components, and change to visual quality. **Table 4.3-2** provides a summary of these potential effects by landscape unit. Landscape units are illustrated in **Figure 3.3-2**.

Table 4.3-2: Long-Term Direct Impacts on Visual Compatibility

#	Landscape Unit	Natural Harmony	Cultural Order	Project Components	Change to Visual Quality
1	Wetland Mitigation Area	No Impact	No Impact	No Impact	No Impact
2	Residential Area	No Impact	No Impact	No Impact	No Impact
3	Airport Area	No Impact	No Impact	No Impact	No Impact
4a	Commercial/ Industrial Area	Adverse, less-than-significant	Adverse, less-than-significant	No Impact	Adverse, less-than-significant
4b		No Impact	No Impact	No Impact	No Impact
5	Hackensack River Waterfront Area	Beneficial	Beneficial	Beneficial	Beneficial

Landscape Unit 1: Wetland Mitigation Area

Under Alternative 1, no long-term, direct impacts to viewer sensitivity within Landscape Unit 1 (Wetland Mitigation Area) would be anticipated. Within this unit, views of the Alternative 1 components from primary view corridors or publicly accessible vantage points (e.g., River Barge Park), would be blocked by the existing built environment (e.g., I-95). As a result, no changes in the visual quality, character, or viewer response would occur in the Wetland Mitigation Area.

Landscape Unit 4a: Commercial/Industrial Area

Within Landscape Unit 4a (Commercial/Industrial Area), a sheet pile wall with viewing platforms would be constructed along the south side of Commerce Boulevard (see **Figure 2.5-7** and **Figure 4.3-1**). The form of these elements would partially block views to the vegetation and natural environment to the south from the street level, but would continue to frame the roadway of the Proposed Project environment and provide additional vantage points from raised viewing platforms. The wall would be incompatible with the existing aesthetic environment, which consists of vegetated low berms that shield the built elements in the landscape. The anticipated materials that would be used for Alternative 1 would contrast with the natural vegetation around the roadway due to its close proximity to the roadway and viewers. This impact could be mitigated through planting of natural vegetation to screen the wall, or using non-reflective materials of colors similar to the surrounding environment to increase visual coherence.

Existing Conditions

Proposed Conditions (Alternative 1 Rendering)

Figure 4.3-1: View of Commerce Boulevard Looking East under Existing and Proposed Conditions

A surge barrier and corresponding pump station would also be constructed at the southern limit of the Project Area adjacent to and spanning Berry's Creek under Alternative 1 (see **Figure 2.5-8** and **Figure 2.5-16**). As the only flood protection measure along Berry's Creek, this surge barrier would have a permanent, but also **less-than-significant, adverse** impact on the surrounding visual and aesthetic resources. The pump station would be similar to the other buildings in the area, and thus would be compatible with the surrounding industrial landscape. Except during flood events, the surge barrier would remain open and its gates would be raised above the channel (as opposed to opening to the sides), which would at least partially block the downstream view of Berry's Creek from the existing Paterson Plank Road Bridge. Designs to improve visual access around the building and gate or natural vegetative planting could improve the visual access and quality of these flood reduction measures.

Viewers of the Proposed Action elements would be primarily commuters and industrial/delivery personnel who are only present in this landscape unit for a short duration. As a result, the sensitivity of these viewers is low. Overall, Alternative 1 would result in a ***long-term, less-than-significant, adverse*** impact on visual quality within Landscape Unit 4a due to a change in the visual resources associated with the natural and built environments.

Landscape Unit 5: Hackensack River Waterfront Area

Within Landscape Unit 5 (Commercial/Industrial Area), a sheet pile wall with viewing platforms would be constructed along the south side of Commerce Boulevard (see **Figure 2.5-15** and **Figure 4.3-1**).

Under Alternative 1, new floodwalls, levees, drainage swales, and other flood reduction structures would be constructed along the Hackensack River, requiring the removal of some vegetation (see **Figure 2.5-5**). Along the northeast portion of the study area, Alternative 1 would extend north to the existing riverwalk in the City of Hackensack by installing a concrete path along the river to the south. In this case, the form of the built and aesthetic environments would be compatible due to the consistent form, materials, and scale in that the linear flood prevention measures of Alternative 1 would mimic the existing design and structure of the current riverwalk and the linear form of the river. This would result in consistent patterns and shapes throughout the riverwalk area. The proposed improvements would also be compatible with the natural environment because views of the riverfront would be extended to areas that do not currently have accessible river views, and similar natural materials would be implemented, such as wetland vegetation and berms.

Further south along the Hackensack River, the changes would include floodwalls, drainage swales, a cantilever riverwalk, and the development of four new park areas: Fluvial Park, K-Town Park, Riverside Park, and DePeyster Creek Park. These four park spaces would provide a combination of wetlands, boardwalk, paths, common and green spaces, seating, and vegetated spaces. **Figure 4.3-2** illustrates the change in visual resources between existing and proposed conditions. The proposed modifications would improve public space and design, provide new access to visual resources, or become new visual resources themselves. While most of the alterations would be made along industrial areas that are not publicly accessible, there would be some accessible views along roadways, such as at Bergen Turnpike east of Washington Avenue, and from the creation of the proposed parks. The cantilever riverwalk would alter the visual experience along the river by adding elements that are low in scale, compatible with the linear form of the river, and consistent with the natural, built, and aesthetic environment. The materials may contrast in form with the natural environment, but would be compatible with the built and aesthetic environments, both of which contain built elements with little natural harmony.

Existing Conditions

Proposed Conditions (Alternative 1 Rendering)

Figure 4.3-2: View of Riverside Park under Existing and Proposed Conditions

Under Alternative 1, viewers of these areas would be primarily pedestrian travelers. As a result, the sensitivity of these viewers is moderate. These viewers would travel slowly through the area and participate in routine visits, resulting in easy access to the views. Overall, a ***long-term, beneficial*** effect on visual quality within Landscape Unit 5 would occur due to the compatibility of the Alternative 1 project components with the built and aesthetic environments.

Indirect Impacts

The proposed installation of features designed around accessibility to visual resources could over time draw attention to the large contiguous wetland area south of Commerce Boulevard in Landscape Unit 4a as a valuable visual resource. This would increase the exposure of the visual resource to the community, thereby increasing the viewer sensitivity of the site in a positive manner. The floodwall built along Commerce Boulevard provides an opportunity for native vegetation and landscaping, or artistic design. This opportunity would possibly add a new visual resource to the area, having a further beneficial impact that could also mitigate the aforementioned ***less-than-significant, adverse*** impacts of the floodwall blocking views of continuous vegetation.

Similarly, in Landscape Unit 5, the improvements to the visual resources and the additions of new visual resources would draw attention to the intrinsic visual quality of the Proposed Project along the riverfront. This increased attention would raise the viewer sensitivity of the area by increasing exposure, as more neighbors and travelers visit the area as viewers of these natural, built, and aesthetic environments. Therefore, ***long-term, beneficial*** effects would occur to the visual sensitivity of the viewing population with Landscape Units 4a and 5.

All of the landscape units would experience ***long-term, beneficial*** effects from increased storm surge protection under Alternative 1. Increased flood protection would protect the existing natural and built environment in the Project Area, and also promote the further design, development, and maintenance of the existing natural and built environment.

Mitigation Measures and BMPs

No potentially significant adverse impacts to visual resources have been identified from the proposed construction or operation of Alternative 1. The primary visual changes are due to the visibility and contrast of flood reduction elements within the existing visual environment. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- Use of screening fences in a similar color to the natural environment during construction activities to block the view of construction equipment and other materials.
- Use of vegetated screening and/or material colors that blend into the existing environment to promote natural harmony and project coherence among flood reduction measures and the existing environment.
- Use of materials that are non-reflective and similar to existing structures within the visual environment to reduce changes in viewer awareness to the Alternative 1 elements.
- Use of native vegetation, whenever possible, when creating, enhancing, or restoring vegetated areas within the Alternative 1 footprint.
- Use of sealants on concrete structures that allow for the effective removal of graffiti.
- Consultation with the NJHPO concerning the protection and management of cultural and aesthetic components within the viewshed (see **Section 4.6**).

4.3.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following direct impacts:

- ***Short-term, less-than-significant, adverse*** impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 2 (Residential Area), Landscape Unit 4a (Commercial/Industrial Area) and Landscape Unit 5 (Hackensack River Waterfront Area) from the presence of construction equipment and materials.
- ***Long-term, beneficial*** impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 2 (Residential Area), Landscape Unit 4a (Commercial/Industrial Area) and Landscape Unit 5 (Hackensack River Waterfront Area) from the proposed waterfront improvements (e.g., parks, and natural landscaping).

Alternative 2 would result in the following indirect impacts:

- ***Long-term, beneficial*** impacts to the visual sensitivity of the viewing population to visual resources within Landscape Unit 2 (Residential Area), Landscape Unit 4a (Commercial/Industrial Area) and Landscape Unit 5 (Hackensack River Waterfront Area) from the increased exposure and awareness of these resources generated by the establishment of viewing platforms, riverside pathways, and parks.
- ***Long-term, beneficial*** effects to visual resources within all landscape units due to increased flood protection against inland flooding.

The following subsections provide greater detail.

Direct Impacts

Under Alternative 2, no impacts would occur to views within Landscape Unit 1 (Wetland Mitigation Area), Landscape Unit 3 (Airport Area), and Landscape Unit 4b (Commercial/Industrial Area) because the Alternative 2 elements would not be visible within these landscape units.

Construction

During the construction phase, ***short-term, less-than-significant adverse*** impacts to natural harmony, cultural order, and visual quality would occur due to the presence of construction equipment and activities within Landscape Unit 2 (Residential Area), Landscape Unit 4a (Commercial/Industrial Area), and Landscape Unit 5 (Hackensack River Waterfront Area). Construction equipment and materials would be aesthetically incompatible with the existing natural, built, and aesthetic environments because of their contrast in material, form, and color. Because the duration of the equipment and materials is temporary, impacts are anticipated to be minor. In addition, views within Landscape Unit 1 (Wetland/Mitigation Area), Landscape Unit 3 (Airport Area), and Landscape Unit 4b (Commercial Industrial Area) are blocked by existing built elements from many vantage points. To minimize impacts during the construction phase, screening fences of a similar color to the natural environment would be used to block the view of construction equipment and other materials.

Operation

As noted above, Alternative 2 would not be visible within Landscape Units 1, 3, and 4b; thus, no impacts in the visual quality, character, or viewer response in these landscape units would occur. Long-term impacts of Alternative 2 on visual compatibility within landscape units were assessed based on four characteristics: natural harmony, cultural order, project components, and change to visual quality. **Table 4.3-3** below provides a summary of these potential effects by landscape unit.

Table 4.3-3: Long-Term Direct Impacts on Visual Compatibility

#	Landscape Unit	Natural Harmony	Cultural Order	Project Components	Change to Visual Quality
1	Wetland Mitigation Area	No Impact	No Impact	No Impact	No Impact
2	Residential Area	Beneficial	Beneficial	Beneficial	Beneficial
3	Airport Area	No Impact	No Impact	No Impact	No Impact
4a	Commercial/ Industrial Area	Beneficial	Beneficial	Beneficial	Beneficial
4b		No Impact	No Impact	No Impact	No Impact
5	Hackensack River Waterfront Area	Beneficial	Beneficial	Beneficial	Beneficial

Landscape Unit 2: Residential Area

Within Landscape Unit 2 (Residential Area), Alternative 2 would place green infrastructure features such as bioswales, rain gardens, and storage trenches along roadways near DePeyster Creek, Park Street, and Main Street. In cases where sidewalks are present, green infrastructure elements would be placed alongside sidewalks. These changes would maintain and enhance the existing vegetated area through the addition of more vegetation and native plants. These changes would be similar in form, scale, and materials to the existing conditions and would maintain existing view corridors.

Proposed improvements to Willow Lake Park, the Little Ferry Municipal Building and Library, Little Ferry Public Schools, Robert Craig Elementary School, and Joseph Street Park would include expanded trails, open space, native plantings, and recreation areas. An example of the proposed change in visual resources between existing and proposed conditions at Washington Elementary School is depicted in **Figure 4.3-3**. The proposed modifications would include open space improvements that would provide new access to visual resources by upgrading existing facilities and replacing pavement or largely open grass areas with more natural landscapes and native species. The built elements such as fields, trails, and recreation areas would be similar in scale, form, and materials to the existing natural, built, and aesthetic environment.

Grey infrastructure improvements would include the construction of two new pump stations (see **Figure 2.5-19**). Losen Slote pump station A would be constructed behind a small commercial building on Liberty Street, and would be placed in an area that is currently surrounded by trees, a fence, and a parking lot access road. Losen Slote pump station C would be located within an industrial parking lot on Park Street, adjacent to existing trees. The pump stations would introduce new built elements within the site, but would be compatible in scale, form, and materials to the area's existing natural, built, and aesthetic environment. Moreover, adjacent existing features would substantially block the views of these pump stations. Viewers of the Alternative 2 elements would primarily be travelers along roads, who would be present in this landscape unit for a short duration or residents using recreation facilities for a longer duration. Therefore, Alternative 2 would result in an overall ***long-term, beneficial*** impact on visual quality within Landscape Unit 2 due to a change in the visual resources associated with the natural and built environments.

Existing Conditions **Proposed Conditions (Alternative 2 Rendering)**

Figure 4.3-3: View of Washington Elementary School looking Northwest under Existing and Proposed Conditions

Landscape Unit 4a: Commercial/Industrial Area

Within Landscape Unit 4a (Commercial/Industrial Area), Alternative 2 would place green infrastructure features such as bioswales and storage trenches along roadways near Carol Place. The green infrastructure elements would be placed alongside the sidewalks. The changes would maintain and enhance the existing vegetated area by adding more vegetation and native plants. The changes would also be similar in form, scale, and materials to the existing conditions and would maintain existing view corridors.

In addition, Alternative 2 would include new park creation in Caesar Place Park and Avanti Park. These two park spaces would provide natural areas, elevated walkways, open space, and wetlands. **Figure 4.3-4** illustrates the change in visual resources between existing and proposed conditions for the proposed Avanti Park. The proposed modifications would improve public space and design, provide new access to visual resources, or become new visual resources themselves. Most of the alterations would be made near industrial areas with accessible views along roadways, as the majority of Landscape Unite 4a consists of industrial land use. These changes would add elements that are low in scale and consistent with the natural, built, and aesthetic environment. While the materials may contrast in form with the natural environment, they would be compatible with the built and aesthetic environments, both of which contain built elements with little natural harmony.

Existing Conditions **Proposed Conditions (Alternative 2 Rendering)**

Figure 4.3-4: View of Avanti Park looking North under Existing and Proposed Conditions

Grey infrastructure features are also proposed within this landscape unit along East Riser Ditch that include dredging, culvert replacement, and channel improvements, as well as habitat enhancements and revegetation with native species. These changes would improve the natural environment and would be consistent with the cultural and aesthetic environment due to the compatibility of the plantings in terms of form, scale, and materials.

Viewers of the Alternative 2 elements would primarily be commuters who are only present in this landscape unit for a short duration. Overall, Alternative 2 would result in a ***long-term, beneficial*** impact on visual quality within Landscape Unit 4b due to a change in the visual resources associated with the natural and built environments.

Landscape Unit 5: Hackensack River Waterfront Area

Within Landscape Unit 5 (Hackensack River Waterfront Area), Alternative 2 would alter existing open grass areas along roadways near the intersections of Bergen Turnpike and both Valley Road and Sylvan Avenue by installing rain gardens as part of green infrastructure improvements. These plantings would have a natural appearance and be several feet in height. The plantings would be compatible with the existing aesthetic environment by enhancing the existing vegetation at the site while simultaneously not altering the overall materials, scale, or form of the view from along the roadway.

Also within Landscape Unit 5, Alternative 2 would include new park creation, which would include Fluvial Park, Riverside Park, and DePeyster Creek Park. These park spaces would provide a variable mix of wetlands, common and green spaces, seating, and vegetated spaces. **Figure 4.3-5** illustrates the change in visual resources between existing and proposed conditions at DePeyster Creek Park. The proposed modifications would improve public space and design, provide new access to visual resources, or become new visual resources themselves. While most of the alterations would be made along industrial areas that are not publicly accessible, there would be some accessible views along roadways, such as at Bergen Turnpike east of Washington Avenue, and from the creation of the proposed parks. These changes would add elements that are low in scale, compatible with the linear form of the river, and consistent with the natural, built, and aesthetic environment. The materials may contrast in form with the natural environment, but would be compatible with the built and aesthetic environments, both of which contain built elements with little natural harmony.

Existing Conditions **Proposed Conditions (Alternative 2 Rendering)**

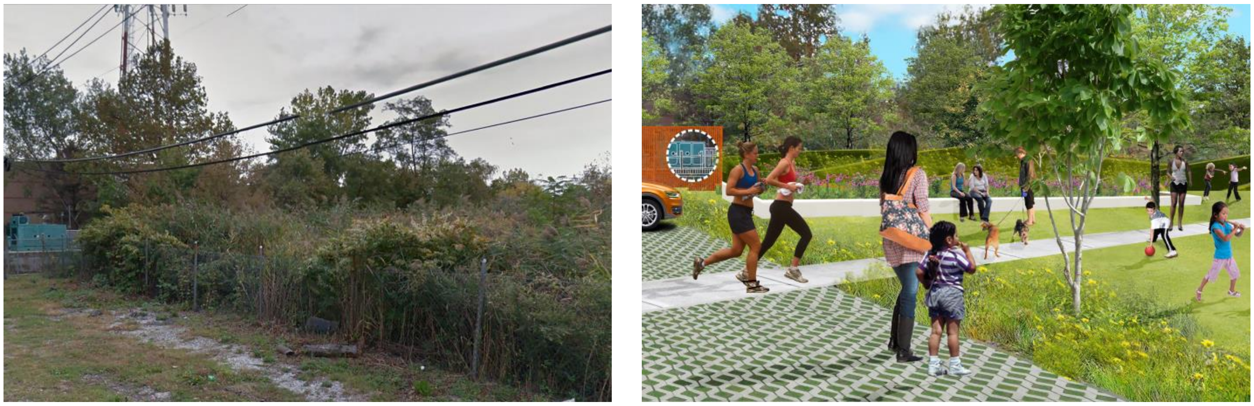


Figure 4.3-5: View of DePeyster Creek Park looking Southeast of Existing and Proposed Conditions

Viewers of the Alternative 2 elements would primarily be commuters who are only present in this landscape unit for a short duration. Overall, Alternative 2 would result in a ***long-term, beneficial*** impact on visual quality within Landscape Unit 5 due to a change in the visual resources associated with the natural and built environments.

Indirect Impacts

The proposed installation of features designed around accessibility to visual resources along the riverfront and the additions of new visual resources throughout Landscape Units 2, 4a, and 5 would draw attention to the intrinsic visual quality of the Proposed Project. This increased attention would raise the viewer sensitivity of the area by increasing exposure, as more neighbors and travelers visit the area as viewers of these natural, built, and aesthetic environments. Therefore, ***long-term, beneficial*** effects would occur to the visual sensitivity of the viewing population within Landscape Units 2, 4a and 5.

Unlike Alternative 1, only Landscape Units 2, 4a, and 5 would experience ***long-term, beneficial*** effects from increased flood protection, with the greatest benefits occurring in areas that fall within the East Riser Ditch and Losen Slote drainage areas (see **Section 4.17.4.3**). Further, while Alternative 2 would reduce inland flooding from heavy precipitation events, it would not alleviate continued and increased coastal flooding from storm surges, which would continue to adversely affect the Project Area.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 1 (**Section 4.3.4.2**) would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2.

4.3.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint and fewer stormwater improvement projects. Alternative 3 would not include the creation of Fluvial Park and DePeyster Park within Landscape Unit 5 (Hackensack River Waterfront Area), or the development of Losen Slote pump station C and its associated force main in Landscape Unit 2 (Residential Area). Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2.

Direct Impacts

Compared to Alternative 2, Alternative 3 would have less ground-disturbing activities in Landscape Units 2 and 5. Therefore, ***short-term, less-than-significant, adverse*** impacts to natural harmony, cultural order, and visual quality due to the presence of construction equipment and activities would be slightly less within Landscape Units 2 and 5, and the same in Landscape Unit 4a (Commercial/Industrial Area).

Implementation of Alternative 3 would result in slightly less improvements and enhancements to the visual character and quality in the Project Area, specifically Landscape Unit 5 because Fluvial Park and DePeyster Creek Park would not be created along the waterfront. Therefore, in comparison to Alternative 2, ***long-term, beneficial*** impacts to the visual sensitivity of the viewing population to visual resources would be slightly less within Landscape Unit 5, and the same in Landscape Units 2 and 4a under Alternative 3.

Indirect Impacts

The proposed installation of features designed around accessibility to visual resources along the riverfront and the additions of new visual resources throughout Landscape Units 2, 4a, and 5 would draw attention to the intrinsic visual quality of the Proposed Project. This increased attention would raise the viewer sensitivity of the area by increasing exposure, as more neighbors and travelers visit the area as viewers of these natural, built, and aesthetic environments. However, under Alternative 3, the benefits associated with the creation of Fluvial Park and DePeyster Park would not be recognized in Landscape Unit 5. Therefore, ***long-term, beneficial*** effects on the visual sensitivity of the viewing population would be slightly less within Landscape Unit 5, and the same within Landscape Units 2 and 4a.

Similar to Alternative 2, only Landscape Units 2, 4a, and 5 would experience ***long-term, beneficial*** effects from increased flood protection with the greatest benefits occurring in areas that fall within the East Riser Ditch and Losen Slote drainage areas (see **Section 4.17.4.4**). Further, while Alternative 3 would reduce inland flooding from heavy precipitation events, it would not alleviate continued and increased coastal flooding from storm surges, which would continue to adversely affect the Project Area. Beneficial impacts would be slightly less under Alternative 3 because Losen Slote pump station C would not be constructed.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternatives 1 and 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3.

4.4 Socioeconomics, Community/Populations, and Housing

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative to socioeconomic conditions, as described in **Section 3.4**, in and around the Project Area. Impacts to socioeconomic resources, which include human population and economic activity, can be either direct or indirect. A direct impact would occur if the Proposed Project would directly change the existing socioeconomic conditions of the study area, such as by creating jobs or displacing persons or housing units. An indirect impact would occur if the Proposed Project would induce other changes that could affect local socioeconomic conditions. For example, an indirect impact would occur if the Proposed Project would lead to longer commute times for residents in the Project Area as a result of construction or operational activities associated with a Build Alternative.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to change the socioeconomic conditions of the affected environment during both construction and operational activities. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.4.1 Definition of Study Area

As described in **Section 3.4**, the study area for socioeconomics is defined as the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to socioeconomic resources in accordance with 40 CFR 1508.27. As described in the analysis, however, the study area for estimating potential economic impacts includes 16 counties[43] from which goods and services would likely be purchased during construction and maintenance of the Proposed Project. These 16 counties represent the regional study area for the purposes of the economic impact analysis; this study area is larger than that of the Project Area, as it includes Bergen County plus other New Jersey and New York counties.

4.4.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect socioeconomic resources effects of the alternatives are shown in **Table 4.4-1**.

4.4.3 Analysis Methodology

Each of the Build Alternatives and the No Action Alternative was evaluated to determine its potential to cause changes to the existing socioeconomic conditions of the Project Area; these conditions are described in **Section 3.4**. The principal issue of concern to socioeconomic resources is whether an alternative would result in potentially significant adverse demographic, economic, or social impacts and/or adversely affect the community character of the Project Area.

The potential direct and indirect impacts associated with any proposed displacement of persons and housing units were analyzed. US Census Bureau data were used to better understand the demographic characteristics of potentially displaced people. The Proposed Project's design plans were examined to determine the location of housing units that may be affected.

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[43] The study area encompasses 11 counties in New Jersey (Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, and Union) and 5 counties in New York (Bronx, Orange, Richmond, Rockland, and Westchester).

Table 4.4-1: Socioeconomics Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Socioeconomic Change	• Would not result in isolation or displacement of residents • Would not result in isolation, displacement, demolition, acquisition, or other adverse change to housing units and local businesses • Would not create or displace jobs
	Indirect Socioeconomic Change	• Would not change property values, rental fees, and/or vacancy rates • Would not induce changes to demographic composition • Would not change journey-to-work/commute times
	Applies to All Effect Types	• No discernable changes to the socioeconomic conditions in the region or locality • Would alter socioeconomic conditions for only an indiscernible or negligible period of time
Less-than-Significant	Direct Socioeconomic Change	• Would result in only temporary isolation and/or displacement of residents • Would result in only temporary isolation and/or displacement of housing units and/or local businesses • Would result in only temporary changes in employment levels
	Indirect Socioeconomic Change	• Would result in only temporary changes in property values, rental fees, and/or vacancy rates • Would result in only temporary changes in journey-to-work/commute times
	Applies to All Effect Types	• Socioeconomic conditions would be altered for only a short, finite period • Impacts would be localized in specific areas and would not substantially affect socioeconomic conditions or resources
Potentially Significant	Direct Socioeconomic Change	• Would result in isolation and/or displacement of residents; physical barriers or limited access would insulate neighborhoods or population groups • Would result in isolation, displacement, demolition, and/or acquisition of housing units and/or local businesses • Would adversely change access to a business and/or a business's customer service area • Would result in loss of jobs and employment opportunities
	Indirect Socioeconomic Change	• Would adversely change property values, rental fees, and/or vacancy rates • Would change journey-to-work/commute times of residents over the long-term
	Applies to All Effect Types	• Would result in adverse socioeconomic impacts observed throughout affected communities • Would permanently adversely alter socioeconomic conditions in the study area

Impact Level	Type of Effect	Impact Description
Beneficial	Direct Socioeconomic Change	• Would create jobs/increase employment levels • Would increase property values and/or reduce flood insurance premiums/risk of flood damage • Would improve vehicular, transit, and/or pedestrian connections within the study area
	Indirect Socioeconomic Change	• Would provide a strong sense of safety and increased level of flood protection • Would provide an increased sense of social connectedness and/or maintain a sense of connection to the community; increase sense of identity or feeling of pride in the community • Would provide an increased sense of participation in community outcomes and decision-making
	Applies to All Effect Types	• Would result in socioeconomic benefits observed throughout affected communities • Would result in long-term beneficial alterations to socioeconomic conditions in the study area

Economic impacts were determined in terms of jobs and earnings that would result from spending associated with the Proposed Project. Jobs and earnings were determined by taking the amount spent (construction and operating costs) and applying multipliers to determine direct, indirect, and induced jobs and earnings impacts. An example of a direct effect is the hiring of employees to construct the Proposed Project, while an indirect impact is a change in earnings or jobs for sectors that supply goods and services to the construction industry. An induced effect comes from the spending of household earnings by construction workers, other employees working directly on the Proposed Project, and employees working for the vendor firms (NJDEP 2018). When assessing economic impact, the multiplier effect is considered, which refers to the increase in earnings that arise from any new injection of spending. For this analysis, the Bureau of Economic Analysis (BEA) Regional Input-Output Modeling System (RIMS II) 2015 multipliers were used to estimate jobs and earning effects resulting from the construction and operation of the Proposed Project. Multipliers were developed to reflect the structure of economies in the 16 counties from which goods and services would likely be purchased during construction and maintenance of Alternative 1. These 16 counties represent the regional study area for the purposes of the economic impact analysis; this study area is larger than that of the Project Area, as it includes Bergen County along with several other New Jersey and New York counties (see **Section 4.1.1**). RIMS II multipliers measure the total change (i.e., direct + indirect effects) in output, employment, and earnings that results from an incremental change to a particular industry[44]. The RIMS II multipliers used in this report represent the most updated version available at the time this analysis was prepared. (NJDEP 2018).

The potential direct and indirect impacts to businesses and employment levels associated with the proposed loss or relocation of businesses and employees were also examined. Design plans were examined to understand the location of businesses that may be affected. Indirect impacts on the study area's economy were evaluated as these impacts may result from changes in land use patterns, changes in growth rate or population densities, or changes in the built environment. Further, determinations were made to assess potential changes in the journey-to-work time of residents in the study area as a result of construction and operational activities associated with each of the Build Alternatives. Where potential adverse effects were identified, the analysis recommended mitigation measures, as appropriate.

Potential socioeconomic impacts associated with the No Action Alternative were also assessed. These impacts may include operating losses for businesses from flooding, associated lost wages, loss of tax revenue from flooded buildings, and the cost to restore flood-damaged buildings. Property tax data from county databases, including the MOD-IV data[45] for property assessments and characteristics, were examined.

4.4.4 Impact Analysis

The following subsections assess potential direct and indirect socioeconomic impacts associated with the implementation of the Build Alternatives, including proposed construction and operational activities, and the No Action Alternative.

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[44] The multiplier effect refers to the increase in final income arising from any new injection of spending.

[45] The New Jersey Property Tax System, known as MOD-IV, provides for the uniform preparation, maintenance, presentation, and storage of the property tax information required by the Constitution of the State of New Jersey, the New Jersey Statutes, and the rules promulgated by the Director of the Division of Taxation (NJAC 18:12-2 and 3) (State of New Jersey 2016b).

4.4.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented and the socioeconomic conditions of the study area would not be altered by construction or operational activities associated with the Proposed Project. Accordingly, there would be no project-related impacts to demographic composition, housing, employment, local businesses, or journey-to-work times in the study area. Additionally, there would be no potential short-term economic benefit to the State of New Jersey from project-related construction employment.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, potentially significant adverse*** impacts on socioeconomic conditions by changing demographic composition, housing, employment conditions, and journey-to-work times. Relating to the significance criteria, the No Action Alternative:

- *Could increase long-term risk of human population and economic activity to identifiable hazards, such as flooding*
- *Could induce job loss/displacement/reduced employment levels as businesses leave the Project Area from increased flooding events*
- *Could change access to businesses (temporarily or permanently)*
- *Could reduce the number of services provided by businesses, as well as reduce estimated sales value, and number and size of businesses*
- *Could change demographic composition as populations that have financial resources to leave the Project Area could do so, thereby shifting the racial and age structure, increasing population below the poverty level, and reducing median household income*
- *Could increase journey-to-work times as a result of increased flooding.*

Increased flooding of the Project Area in the future could significantly damage residential and commercial properties, impact health care facilities, and disrupt critical power, transportation, water, and sewer infrastructure. These impacts have the potential to significantly adversely affect the community character and change the demographic, housing, and employment conditions of the Project Area and its residents. Increased future flooding in the area may lead to both temporary and permanent displacement and relocation of persons affected by the event. Some individuals could decide to permanently relocate outside the Project Area, potentially shifting the demographic profiles of the communities affected. Closure of businesses during flooding events could lead to a loss of jobs and incomes, as well as increased levels of underemployment and unemployment. These, in turn, would affect the quality of life for persons in the Project Area. Some of the housing that might be damaged during natural disasters may not be re-built, leading to changes in the housing stock, which could alter patterns of home ownership. Recurring flooding events also have the potential to lower property values. Finally, potentially reduced population levels and property values could subsequently reduce tax revenue for the municipalities, further impacting their ability to provide services to residents. Therefore, the No Action Alternative, coupled with effects of climate change and SLR, has the potential to cause ***potentially significant, long-term*** changes in the community character of the Project Area.

4.4.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Short-term and long-term, less-than-significant, adverse*** impacts to businesses and residents in the Project Area from land acquisition, traffic/limited access, dust, noise, and vibration during the construction phase.
- ***Long-term, less-than-significant, adverse*** impacts to vacant buildings (i.e., within the proposed K-Town Park) due to necessary demolition during the construction phase.
- ***Short-term and long-term, beneficial*** impacts to employment in the Project Area from necessary project-related jobs during the construction and operation/maintenance phases.
- ***Long-term, beneficial*** effects on social amenities through increased accessible greenspace and access to the Hackensack River waterfront.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against coastal storm surges, which would thereby reduce damages to community infrastructure and provide a stronger sense of safety.
- ***Long-term, beneficial*** effects on property values and resident/visitor perception due to increased accessible greenspace and access to the Hackensack River waterfront.
- ***Long-term, beneficial*** potential increases in property values and long-term employment opportunities in the Project Area, as residents would be less likely to leave the area because of flooding.

The following subsections provide greater detail.

Direct Impacts

The following subsections assess potential direct socioeconomic impacts associated with proposed construction activities, land acquisition, and operational activities.

<u>Construction</u>

Employment

Construction of Alternative 1 would result in ***short-term beneficial*** impacts to employment, as it would create 990 construction job-years[46] (see **Table 4.4-2**). As required under Section 3 of the Housing and Urban Development Act of 1968, recipients of HUD funding would direct new employment and contracting opportunities to low-income residents within the local community. The NJDCA has a Section 3 compliance program in place that includes a Compliance Coordinator. The NJDCA's July 2015 Implementation Policy requires the Proposed Project to comply with Section 3 and encourages outreach and collaboration with stakeholders, as well as training and dissemination of information to businesses on how to register with HUD as a Section 3 Business. Therefore, certain benefits would be provided to the Project Area as a result of using locally sourced labor; however, the extent of those benefits would depend on how many workers are within the local area. ***Short-term beneficial*** impacts would also be expected from the presence of construction workers through incidental spending in local businesses.

[46] A job-year is defined as one full-time job for one person for one year.

As described in **Section 4.4.3**, the BEA RIMS II 2015 multipliers were used to estimate jobs and earning effects resulting from the construction of Alternative 1. **Table 4.4-2** presents the anticipated economic effects from the construction of Alternative 1.

Table 4.4-2: Summary of Construction-Related Jobs Created and Associated Earnings under Alternative 1

Construction	Value
Construction Jobs (*direct* job-years)	490
Construction Jobs (*indirect and induced* job-years)	500
Construction Jobs (*total* job-years)	990
Construction Earnings (2017 in $MM)	$53.9
Average Earnings Per Job (2017 in $)	$55,600

(NJDEP 2018)

The construction of Alternative 1 would result in 990 total job-years, of which 490 would be direct and 500 would be indirect and induced job-years. The difference between total and direct employment is indirect and induced employment, or jobs that are created or supported in other industries due to construction employee spending in the region. The total earnings for the 990 job-years would be $53.9 million, or an average of $55,600 per job-year for those employed by all industries in the study area for jobs created as a result of construction spending. These would be one-time impacts that are anticipated to last for the duration of the construction phase (NJDEP 2018).

As stated above, new employment and contracting opportunities associated with the construction of Alternative 1 would be directed to low-income residents within the local community. In the event that some workers from other areas in the region take up residence in the Project Area, there are available housing units. Within the Project Area, two communities with vacancy rates that could likely absorb this temporary workforce include Little Ferry (3.6 percent and 5.4 percent for homeowner and rental vacancy rates, respectively) and Moonachie (5.4 percent and 0 percent for homeowner and rental vacancy rates[47]). It is not anticipated that this indirect impact would have any adverse socioeconomic effects on the existing levels of community cohesion in the Project Area.

Other potential direct socioeconomic impacts associated with Alternative 1 include effects related to proposed construction-related road closures within the Project Area, dust, noise, and vibration impacts during construction, and land acquisition. Each of these is discussed below in separate subsections.

Temporary Road Closures

Construction of Alternative 1 would result in temporary, lane-specific closures of certain roads within the Project Area. The need for, and duration of, these proposed closures will not be fully known until the project design progresses. Some of the locations where traffic restrictions may be necessary include:

- Main Street, East of Bergen Turnpike, at the “K-Town” Site

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[47] Data gathered from the US Census Bureau 2011-2014 American Communities Survey; current percentages may be slightly different.

- Riverside Avenue, South of Washington Avenue, at the “Riverside Landing” Site
- Dietrich Street, East of Maiden Lane
- Commerce Boulevard

It is anticipated that construction of the proposed sheet pile floodwall and bird watching platforms along the south side of Commerce Boulevard would be located away from the roadway and curb; as such, it is unlikely that traffic on Commerce Boulevard would need to be re-routed. However, temporary lane realignment and parking restrictions on Commerce Boulevard may be required to accommodate construction of this portion of Alternative 1. The duration of these restrictions is anticipated to be less than one year and would be expected to be in place 24 hours per day.

On the other roads identified above, lane closures would likely be required to allow for the safe entry and exit of construction-related traffic at various portions of Alternative 1. These lane closures are anticipated to be needed throughout the duration of construction at each related portion of the LOP, but are anticipated to only be needed intermittently during active working hours; traffic on these roads would be appropriately rerouted. Additionally, construction workers would use staging areas and available legal street parking to minimize effects.

Overall, potential construction-related impacts to traffic and parking areas would be expected to result in ***short-term, less-than-significant adverse*** impacts to journey-to-work/commute times and access to businesses and/or a business’ customer service areas. It is further anticipated that impacts would be localized in specific areas and would not substantially affect socioeconomic conditions or resources within the Project Area. Such effects would be further reduced with implementation of transportation-related mitigation measures identified in **Section 4.7**.

Dust, Noise, and Vibration Impacts

Construction of Alternative 1 would involve a combination of land-based and water-based equipment. There is potential for elevated dust, noise, and vibration levels from construction equipment along with an increase in construction-related vehicular traffic within the Project Area. However, these effects would be minimized if windows of residential units and businesses near the proposed alignment were closed. Specifically, residential buildings near the proposed alignment have air conditioning units, so windows in these buildings would not need to be open during summer-time construction activities. Additionally, two staging areas are proposed approximately 50 feet from two different apartment complexes:

- Deluxe International Trucks parking lot staging area (adjacent to the North Villages I Apartments)
- Undeveloped public land adjacent to the Winant Avenue staging area (adjacent to the Waterside Plaza Apartments).

Therefore, there is the potential for increased dust, noise, and vibration to affect these residences and businesses proximate to the construction areas. This would be a ***short-term, less-than-significant adverse*** impact, potentially resulting in lower desirability and reduced land and rental values during construction. To reduce the potential for disturbance (and associated socioeconomic impacts) to inhabited structures near the proposed alignment, mitigation measures to reduce dust, noise, and vibration impacts would be implemented (see **Sections 4.8** and **4.9**).

Protection of Children

In accordance with EO 13045, construction of Alternative 1 would not lead to increased risks for children in the Project Area. Construction and staging areas, including all equipment and hazardous materials, would be secured to prevent unauthorized access. Potential noise and air quality impacts would be reduced to the extent practical, as described above, and a Public Safety Plan would be developed and implemented to further minimize health and safety risks to the general public.

Land Acquisition

Implementation of Alternative 1 would require acquisition of land through both permanent and temporary easements[48]. The following identifies the proposed land acquisitions associated with Alternative 1 and, based on affected land use types (i.e., residential, commercial, and industrial), the potential resultant socioeconomic effects. For this analysis, only the proposed acquisition of residential, commercial, and industrial land use types are considered in the impact analysis for socioeconomics. All land acquisition (e.g., including wetlands, open space, and public land uses) proposed under Alternative 1 is presented and analyzed in **Section 4.2**.

Under Alternative 1, a total of 37 residential, commercial, and industrial parcels would be affected by proposed permanent easements and/or temporary easements (see **Table 4.4-3**):

- Alternative 1 would require the *permanent easement* of approximately 2.7 acres of residential parcels, 2.2 acres of commercial parcels, and 7.3 acres of industrial parcels (i.e., a total of 12.2 acres), composed of five full parcel acquisitions and 28 partial parcel acquisitions.
- Construction of Alternative 1 would require *temporary easements* over approximately 1.6 acres of residential parcels, 1.3 acres of commercial parcels, and 0.7 acre of industrial parcels (i.e., a total of 3.6 acres), including no full parcel temporary easements and 34 partial parcel temporary easements.

Greater detail regarding proposed land acquisition within the Project Area is presented in **Section 4.2.4** and **Table 4.2-2**.

Proposed Permanent Easements

The majority (i.e., 28 out of 33 residential, commercial, and industrial parcels) of permanent easements associated with Alternative 1 would be partial takes; no residences or businesses would be displaced.

Implementation of Alternative 1 would require five permanent *full* parcel acquisitions (i.e., 5 out of 33). Specifically, the implementation of Alternative 1 would require the permanent easement of: one full residential parcel for the proposed development of Riverside Park; three full commercial parcels for the proposed development of K-Town Park; and one industrial parcel for the proposed Berry's Creek storm surge barrier/pumping station (see **Table 4.4-3**):

- The one residential property affected by the proposed full parcel acquisition (i.e., located at 4 Mehrhof Lane, off Riverside Avenue in Little Ferry) includes 0.2 acre of vacant land with no

[48] A temporary easement is acquired to provide access during the construction period, with the affected land restored and returned to the property owner immediately following construction. A permanent easement is a fee simple acquisition of all rights to a parcel in perpetuity.

residence; no residents would be displaced. The proposed conversion of this parcel would exclude this parcel from residential use in the future, which would constitute a ***long-term, less-than-significant adverse*** socioeconomic impact. However, it is anticipated that compensation for this acquisition would offset any adverse effect.

- The three commercial properties that would be affected by the full parcel acquisition include a vacant parking lot, a vacant parking lot with sheds, and a vacant building associated with the proposed K-Town Park. Although there are no active businesses on the three parcels, the proposed conversion of these locations to a public park would exclude these parcels from commercial use in the future, which would be a ***long-term, less-than-significant adverse*** socioeconomic impact that would be offset by compensation for the acquisition.
- The one industrial property proposed for full parcel acquisition, currently used as a truck repair shop and parking[49] (i.e., located at 200 Paterson Plank Road in East Rutherford), would be required for the proposed Berry's Creek storm surge barrier/pumping station. One structure is present on the parcel proposed for acquisitions. This proposed acquisition would result in the only displacement under Alternative 1. However, based on preliminary visual analysis of the area, this loss could be replaced by utilizing nearby vacant land. Therefore, this displacement would be considered a ***long-term, less-than-significant adverse*** socioeconomic impact, as similarly described for the parcels listed above.

Proposed *partial* parcel permanent easements and associated socioeconomic effects are summarized in **Table 4.4-3**. These acquisitions would not displace any structures or critical functions; therefore, ***less-than-significant adverse*** effects are anticipated. These acquisitions include small portions of the following:

- Residential parcels, including North Villages I & II Apartments at River Street Extension in Little Ferry; Waterside Plaza Apartments at Waterside Drive in Little Ferry; six single-family residences in Little Ferry; and one vacant residential lot at Riverside Avenue in Little Ferry (i.e., 9 parcels). Overall, the residential land acquired by permanent easements would include small sections along the edges of property lines, with no residences displaced.
- Commercial properties, including parking lots and undeveloped land. This land is located behind various commercial structures along the alignment; acquisition would result in no impacts to business operations and only minor impacts to visitor and employee parking and the loading and unloading of equipment and materials.
- Industrial parcels, including land used for truck and heavy machinery parking and materials storage. However, business operations at these locations would be unaffected as there are ample alternate parking spaces and material storage areas present on each affected parcel; no structures would be impacted.

[49] The assumed current tenant is a truck repair shop that leases the property from a realty company. While the tenant would have to move, the owner would not be displaced.

Table 4.4-3: Potential Socioeconomic Effects Associated with Proposed Land Acquisitions under Alternative 1

Land Use		Number of Parcels	Parcel Size (acres)	Affected Acreage	Current Use/Structures	Proposed Use	Potential Effect*
Permanent Easements							
Full Parcels	Residential	1	0.2	0.2	Vacant residential lot	Riverside Park	2
	Commercial	3	0.3	0.3	Vacant parking lot	K-Town Park	2
			0.8	0.8	Vacant parking lot with sheds	K-Town Park	2
			0.1	0.1	Vacant building	K-Town Park	2
	Industrial	1	3.5	3.5	Truck repair shop and parking lot	Berry's Creek Storm Surge Barrier/Pumping Station	4
Partial Parcels	Residential	9	0.8	0.1	Residential undeveloped lot/Industrial scrapyard	Riverside Park	2
			0.6	0.1	Undeveloped lot	Riverside Park	2
			0.4	0.1	Undeveloped lot	Riverside Park	2
			0.4	<0.1	Backyard lot	Riverside Park	2
			0.8	0.1	Backyard lot	Riverside Park	2
			0.5	0.1	Backyard lot	Riverside Park	2
			6.5	<0.1	Vacant land	Riverwalk	2
			10.2	0.5	Mixed use: undeveloped residential, rip rap, vegetation, and sea wall	Riverwalk	2
			15.6	0.8	Mixed use: undeveloped residential, rip rap, vegetation, fence, and drainage ditch; residential housing and residential open space	Riverwalk	2
	Commercial	8	4.1	<0.1	Paved path and undeveloped land	Riverwalk	2
			2.8	0.1	Undeveloped land	Riverwalk	2
			3.6	0.2	Paved lot	Riverwalk	2
			1.5	0.1	Auto body shop	Riverwalk	2
			1.8	0.1	Undeveloped land	Riverwalk	2
			4.6	0.4	Undeveloped land and parking/paved lot	Riverwalk	2
			5.2	0.1	Storage facility/undeveloped land	Riverwalk/K-Town Park	2
			14.2	<0.1	Parking lot between Lowe's Home Improvement and Chili's Bar and Grill	Regrading	2

Land Use		Number of Parcels	Parcel Size (acres)	Affected Acreage	Current Use/Structures	Proposed Use	Potential Effect*
Partial Parcels	Industrial	11	5.3	1.3	Vacant lot	Fluvial Park	2
			2.6	0.3	Vacant paved lot	Cantilever Riverwalk	2
			0.8	0.6	Abandoned storage lot	Riverside Park	2
			2.3	0.3	Industrial office lot	LOP	2
			1.8	0.2	Industrial materials storage lot	LOP	2
			2.3	0.2	Industrial storage lot	LOP	2
			1.7	0.2	Industrial storage lot	LOP	2
			2.7	0.1	Industrial storage lot	LOP	2
			5.4	<0.1	Paved open space	DePeyster Creek Park	2
			8.2	0.2	Industrial storage lot	LOP	2
			4.6	0.7	Industrial storage lot	LOP	2
Temporary Easements							
Full Parcels	Residential	0	---	---	---	---	1
	Commercial	0	---	---	---	---	1
	Industrial	0	---	---	---	---	1
Partial Parcels	Residential	13	6.5	<0.1	Open developed space	Riverwalk	3
			10.2	0.6	Mixed use: undeveloped residential, rip rap, vegetation, and sea wall	Riverwalk	3
			15.6	0.5	Mixed use: undeveloped residential, rip rap, vegetation, fence, and drainage ditch; Residential housing and residential open space	Riverwalk	3
			0.8	<0.1	Residential undeveloped lot/Industrial scrapyard	Riverside Park	3
			0.6	0.1	Undeveloped lot	Riverside Park	3
			0.4	0.1	Undeveloped lot	Riverside Park	3
			0.2	<0.1	Vacant residential lot	Riverside Park	3
			0.4	0.1	Backyard lot	Riverside Park	3
			0.8	<0.1	Backyard lot	Riverside Park	3
			0.5	<0.1	Backyard lot	Riverside Park	3
			0.2	<0.1	Residential side yard	DePeyster Creek Park	3
			0.2	<0.1	Residential backyard	DePeyster Creek Park	3
			0.2	<0.1	Residential backyard	DePeyster Creek Park	3
			0.2	<0.1	Residential backyard	LOP	3

Land Use		Number of Parcels	Parcel Size (acres)	Affected Acreage	Current Use/Structures	Proposed Use	Potential Effect*
Partial Parcels	Commercial	10	4.1	<0.1	Paved path and undeveloped land	Riverwalk	3
			2.8	0.1	Undeveloped land	Riverwalk	3
			3.6	0.1	Paved lot	Riverwalk	3
			1.5	0.1	Auto body shop	Riverwalk	3
			1.8	0.1	Undeveloped land	Riverwalk	3
			4.6	0.6	Undeveloped land and parking/paved lot	Riverwalk	3
			5.2	0.3	Storage facility/undeveloped land	Riverwalk/K-Town Park	3
			1.5	<0.1	Undeveloped land	K-Town Park	3
			14.2	<0.1	Parking lot between Lowe's Home Improvement and Chili's Bar and Grill	Regrading	3
			<0.1	<0.1	Fence and vacant paved lot	K-Town park	3
	Industrial	10	5.3	0.1	Vacant lot	Fluvial Park	3
			2.6	0.1	Vacant paved lot	Cantilever Riverwalk	3
			0.8	<0.1	Vacant storage lot	Riverside Park	3
			2.3	0.1	Industrial office lot	LOP	3
			1.8	0.1	Industrial materials storage lot	LOP	3
			2.3	0.1	Industrial storage lot	LOP	3
			1.7	0.1	Industrial storage lot	LOP	3
			2.7	0.1	Industrial storage lot	LOP	3
			5.4	<0.1	Paved open space	DePeyster Creek Park	3
			4.6	0.2	Industrial storage lot	LOP	3

Mathematical inconsistencies due to rounding.
*Note:
1 = No impact.
2 = ***Long-term, less-than-significant adverse*** impacts; has the potential to result in minor property devaluations and the need to replace displaced potential functions. However, it is anticipated that compensation for easement would offset any adverse effects.
3 = ***Short-term, less-than-significant adverse*** impacts; has the potential to result in minor temporary property devaluations and the need to temporarily replace displaced potential functions. However, it is anticipated that compensation for easement would offset any adverse effects.
4 = Displacement with ***long-term, less-than-significant adverse*** impacts. While the tenant would have to move, the owner would not be displaced and it is anticipated that compensation for easement would offset any adverse effects.

Proposed Temporary Easements

All (i.e., 33 out of 33 residential, commercial, or industrial parcels) of the proposed temporary easements associated with Alternative 1 include edges of parcels; no full parcel temporary easements are proposed. No displacement of residences or businesses would occur. Proposed temporary easements and associated socioeconomic effects are summarized in **Table 4.4-4**. These easements would not displace any structures or critical functions; therefore, ***less-than-significant adverse*** effects are anticipated. These easements include small portions of 13 residential properties 10 commercial parcels, and 10 industrial parcels.

Operation

Implementation of Alternative 1 would create jobs and earnings as a result of ongoing O&M expenditures. **Table 4.4-4** presents the anticipated economic impacts from the operation of Alternative 1.

Table 4.4-4: Summary of Operation-Related Jobs Created and Associated Earnings under Alternative 1

O&M	Value
Annual O&M Jobs (average annual *direct* jobs)	12
Annual O&M Jobs (average annual *indirect* and *induced* jobs)	8
Annual O&M Jobs (average annual *total* jobs)	20
Total Annual Earnings (2017$ MM)	$0.8
Average Earnings Per Job (2017$)	$42,100

Under Alternative 1, annual O&M activities would result in 20 average annual total jobs, of which 12 would be direct and 8 would be indirect and induced. The annual total earnings for these 20 jobs would be approximately $0.8 million, or an average of $42,100 per job for those employed by all industries in the study area for jobs created as a result of annual O&M spending. These would be ***long-term beneficial*** annual impacts that would continue for the life of the infrastructure of Alternative 1, providing a socioeconomic benefit to the community (NJDEP 2018).

Implementation of Alternative 1 would not displace any households within the Project Area, and therefore would not reduce any specific population that is an integral component of a vibrant community. In addition, Alternative 1 would not create any physical barriers between residential uses, precluding the creation of isolated groups or neighborhoods within the Project Area. Therefore, ***no*** impact to the demographic composition of the Project Area is expected during operation of Alternative 1.

Similarly, the racial and age structure and pattern of the Project Area would not likely be impacted, nor is it anticipated that children within the Project Area would suffer disproportionately from environmental health and safety risks under Alternative 1.

As there would be no displacement of any businesses in the Project Area, no direct adverse impacts are anticipated under Alternative 1 to the labor force or industry sectors, the types of services provided, the numbers and sizes of businesses, or their estimated sales values and revenues. Maintenance workers would conduct routine long-term inspections along the LOP, resulting in minor and ***long-term beneficial*** impacts to employment during the operation of Alternative 1.

Alternative 1 would create approximately 10.1 acres of new public parks and open spaces within the Project Area, directly benefitting all residents by providing additional opportunities to engage in passive and active recreation activities, such as bird-watching and cycling. The proposed new parks would be located within 0.25 mile of approximately 8,400 residents in the Project Area (NJDEP 2018). Alternative 1 would further directly enhance pedestrian access and connections within the Project Area near the LOP, specifically associated with the proposed riverwalk/cantilever system along the Hackensack River waterfront. More expansive and well-connected pedestrian networks would provide opportunities for pedestrians, runners, and cyclists to enjoy direct benefits associated with engaging in nature, exercising, and interacting with the community. Therefore, Alternative 1 would result in ***long-term beneficial*** effects on social amenities through increased accessible greenspace and access to the Hackensack River waterfront.

Indirect Impacts

Construction

Construction of Alternative 1 would not result in any indirect socioeconomic effects, aside from the 500 indirect and induced job-years created as identified in **Table 4.4-2**. This would be a ***long-term beneficial*** economic effect.

Operation

Operation of Alternative 1 would result in eight indirect and induced jobs, as identified in **Table 4.4-4**. This would be a ***long-term beneficial*** economic effect.

In addition, implementation of Alternative 1 would enhance the economic stability of, and sense of safety within the Project Area through provision of increased flood protection. The reduction of costly damages to property and community infrastructure associated with coastal storm surges, therefore, would have a ***long-term beneficial*** impact on existing development.

Conditions would likely be indirectly created for the long-term maintenance of property values as the LOP under Alternative 1 would offer increased protection from flooding events and provide additional local amenities in the form of improved recreational areas, green space, and river access. While property values are influenced by a wide range of factors, properties within 500 feet of proposed new parks or in close proximity to new tree plantings could see a slight increase in value over time (NJDEP 2018). The new social amenities and easily accessible green spaces in the Project Area would further serve to indirectly strengthen community cohesion, increase community appeal, provide important health benefits, improve resident and visitor perception, and lead to an overall sense of improved quality of life and well-being. When more open space areas are provided, it is likely that residents would use these amenities and improve their health and quality of life.

Furthermore, long-term employment for businesses in the Project Area would be more secure as workers would be less likely to leave the area after a flood event. It would also serve to reduce the potential for increased, sustained damage to housing within the Project Area, as well as the potential for fluctuations in the affordability of housing.

Mitigation Measures and BMPs

No potentially significant adverse impacts to socioeconomic conditions of the Project Area have been identified from the proposed construction or operation of Alternative 1. Proposed mitigation measures to minimize local traffic/limited access effects, as well as noise, dust, and vibration effects during construction have been described elsewhere in this EIS (see **Sections 4.7**, **4.8**, and **4.9**). Implementation of these measures would concurrently reduce related socioeconomic effects.

The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase, the need for both temporary and permanent easements would be minimized to the extent possible.
- A Public Safety Plan would be developed and implemented in coordination with the local authorities to provide for safety of the public, including children, during construction activities.
- Coordination with businesses would occur to address accessibility concerns during construction. Impacts during construction would be minimized by signage and provision of temporary access ways to affected businesses.
- During the construction planning phase, coordination with local emergency services (including fire, police, and ambulance services) would occur to ensure that access to critical facilities is maintained during construction and operation of Alternative 1. This would also require consideration for accessibility in the event a storm occurs while Alternative 1 is still under construction.

4.4.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding in the Project Area, but continued and increased flooding from coastal storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term and long-term, less-than-significant, adverse*** impacts to businesses, schools, municipal facilities, and residents in the Project Area from land acquisition, traffic/limited access, dust, noise, and vibration during the construction phase.
- ***Short-term and long-term, beneficial*** impacts to employment in the Project Area from necessary project-related jobs during the construction and O&M phases.
- ***Long-term, beneficial*** effects on social amenities through increased accessible greenspace and access to the Hackensack River waterfront.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by improving stormwater drainage in the Project Area, which would thereby reduce damages to community infrastructure.
- ***Long-term, beneficial*** effects on property values and resident/visitor perception due to increased accessible greenspace and access to the Hackensack River waterfront.

The following subsections provide greater detail.

Direct Impacts

The following subsections assess potential direct socioeconomic impacts associated with proposed construction activities, land acquisition, and operational activities.

Construction

Employment

Construction of Alternative 2 would result in ***short-term beneficial*** impacts to employment, as it would create 1,000 construction job-years (see **Table 4.4-5**). In comparison, Alternative 1 would create approximately 990 job-years; thus, beneficial impacts would be similar to those described in **Section 4.4.4.2**. As required under Section 3 of the Housing and Urban Development Act of 1968, recipients of HUD funding would direct new employment and contracting opportunities to low-income residents within the local community. The NJDCA has a Section 3 compliance program in place that includes a Compliance Coordinator. The NJDCA's July 2015 Implementation Policy requires the Proposed Project to comply with Section 3 and encourages outreach and collaboration with stakeholders, as well as training and dissemination of information to businesses on how to register with HUD as a Section 3 Business. Therefore, certain benefits would be provided to the Project Area as a result of using locally sourced labor; however, the extent of those benefits would depend on how many workers are within the local area. Similar to Alternative 1, ***short-term beneficial*** impacts would further be expected from the presence of construction workers through incidental spending in local businesses.

As described in **Section 4.4.3**, the BEA RIMS II 2015 multipliers were used to estimate jobs and earning effects resulting from the construction of Alternative 1. **Table 4.4-5** below presents the anticipated economic effects from the construction of Alternative 2.

Table 4.4-5: Summary of Construction-Related Jobs Created and Associated Earnings under Alternative 2

Construction	Value
Construction Jobs (*direct* job-years)	500
Construction Jobs (*indirect* and *induced* job-years)	500
Construction Jobs (*total* job-years)	1,000
Construction Earnings (2017 in $MM)	$54.3
Average Earnings Per Job (2017 in $)	$55,200

The construction of Alternative 2 would result in 1,000 total job-years, of which 500 would be direct and 500 would be indirect and induced job-years. The total earnings for the 1,000 job-years would be $54.3 million, or an average of $55,200 per job-year. These would be one-time impacts that are anticipated to last for the duration of the construction phase (NJDEP 2018). Compared to Alternative 1 (**Section 4.4.4.2**), the construction of Alternative 2 would result in 10 more direct job-years, the same number of indirect job-years, and $0.4 million more in construction earnings. Average earnings per job are nearly equivalent at $55,600 for Alternative 1 and $55,200 for Alternative 2.

As stated above, new employment and contracting opportunities associated with the construction of Alternative 2 would be directed to low-income residents within the community. Also, in the event that workers from other areas in the region take up residence in the Project Area, there is available housing. It is not anticipated that this indirect impact would have an adverse socioeconomic effect on existing levels of community cohesion in the Project Area.

Other potential direct socioeconomic impacts associated with Alternative 2 include effects related to proposed construction-related road closures within the Project Area, dust, noise, and vibration impacts during construction, and land acquisition. Each of these is discussed below in separate subsections.

Temporary Road Closures

Construction of Alternative 2 would result in temporary, lane closures within the Project Area. The need for, and duration of, these proposed closures will not be fully known until the project design progresses, including potential closures for gray infrastructure components.

Generally, construction and staging within public rights-of-way would be contained within parking or shoulder lanes, and thus would not impact circulation within the Project Area. However, in some circumstances, parking lanes or shoulders are not available (e.g., along Moonachie Avenue and Empire Boulevard), so partial lane closures would be necessary to accommodate construction. Partial lane, sidewalk, and driveway closures may be required for construction of green infrastructure systems. Additionally, Losen Slote force mains A and C would both be constructed along existing public roads. While these force mains are being installed, single lane closures would be expected; these lane closures would most likely affect 200-foot sections of road at a time. Overall, each force main would likely require 10 weeks or fewer for installation. Further, construction of the force mains and some green infrastructure systems would require trenching along residential and commercial streets. This would result in some driveways being inaccessible from the road during both the initial trenching process and the repaving process, but each driveway would not be impacted for longer than one day during each of these processes. Dredging activities at East Riser Ditch would require removal and replacement of culverts beneath both Amor Avenue and West Commercial Avenue, as well as removal and replacement of the railroad bridge supporting the NJ Transit Seaman Lead. These roads and railroad tracks would be temporarily closed for approximately 5 weeks or fewer during these construction activities. Finally, construction personnel would be expected to park their personal vehicles at the construction staging areas or at available public parking spaces on-street or in lots near the work sites.

Overall, potential construction-related impacts to traffic and parking areas would be expected to result in ***short-term, less-than-significant, adverse*** impacts in access to residences, businesses and/or a business' customer service area, schools, or other municipal community facilities, as well as to journey-to-work/commute times, similar to Alternative 1. Further, because impacts would be localized in specific areas and short in duration, they would not be expected to substantially affect socioeconomic conditions or resources within the Project Area. Such effects would be further reduced with the implementation of transportation-related mitigation measures and BMPs identified in **Section 4.7**.

Dust, Noise, and Vibration Impacts

Construction of Alternative 2 would involve a combination of land-based and water-based equipment. There is potential for elevated dust, noise, and vibration levels from construction equipment along with an increase in construction-related vehicular traffic within the Project Area. However, these effects would be minimized if windows of residential units and businesses near the proposed alignment were closed.

Staging for the proposed parks and open space improvements would be fully contained within those sites, while staging for green infrastructure components would primarily occur in parking lanes or shoulders adjacent to those construction sites, or in nearby park/open space improvement sites. The following streets would be used for staging during construction of nearby green infrastructure systems:

- Monroe Street (near intersection with Bertolotto Avenue)
- Commercial Avenue (near intersection with Moonachie Avenue)
- Concord Street (near intersection with Moonachie Avenue)
- Charles Street (near intersection with Main Street)
- Marshall Avenue (near intersection with Main Street)
- Frederick Avenue (near intersection with Main Street)
- Garden Street (near intersection with Moonachie Road)
- Park Street (near intersection with Bruno Street)
- Oxford Drive (near intersection with Redneck Avenue)

Staging for the grey infrastructure components would occur both in parking lots adjacent to the proposed pump stations, and in the Caesar Place Park property for channel dredging activities. In order to minimize impacts on residents, businesses, and property owners, non-park locations, such as parking lanes or private parking lots, would be used for access and staging only as long as necessary to complete the project components proximal to those specific locations. More information on access and staging during the construction phase can be found in **Sections 2.5.3.2** and **4.7.4.3**.

Therefore, there is the potential for increased dust, noise, and vibration to affect residences and businesses proximate to the construction staging areas. However, similar to Alternative 1, ***short-term, less-than-significant, adverse*** impacts would be expected. To reduce the potential for disturbance (and associated socioeconomic impacts) to inhabited structures near the proposed Alternative 2 footprint, mitigation measures and BMPs to reduce dust, noise, and vibration impacts would be implemented (see **Sections 4.8** and **4.9**).

Protection of Children

In accordance with EO 13045, construction of Alternative 2 would not lead to increased risks for children in the Project Area. Although Alternative 2 would include alterations to school properties and more construction work in residential areas, the same preventative measures would be implemented as for Alternative 1. Construction and staging areas, including all equipment and hazardous materials, would be secured to prevent unauthorized access, and potential noise and air quality impacts would be reduced to the extent practical (see mitigation measures and BMPs in **Sections 4.8.2.3** and **4.9.4.3**). Finally, Alternative 2 would also develop and implement a Public Safety Plan would be developed and implemented to further minimize health and safety risks to the general public.

<u>Land Acquisition</u>

Implementation of Alternative 2 would require acquisition of land through both permanent and temporary easements. The following identifies the proposed land easements associated with Alternative 2 and, based on affected land use types (i.e., residential, commercial, and industrial), the potential resultant socioeconomic effects. As in Alternative 1, this analysis only considers the proposed easement of residential, commercial, and industrial land use types for socioeconomic effects. All of the green infrastructure improvements would be located within existing roadways. As such, no direct impact to parcel boundaries would occur as result of the construction of these components; direct impacts would be solely within the roadway rights-of-way. All land acquisition (e.g. wetlands, open space, roadways, and public land uses) proposed under Alternative 2 is presented and discussed in **Section 4.2.4.3**.

Under Alternative 2, a total of 29 residential, commercial, and industrial parcels would be affected by proposed permanent and/or temporary easements (see **Table 4.4-6**):

- Construction of Alternative 2 would require the permanent easement of approximately 1.7 acres of residential parcels, 3.2 acres of commercial parcels, and 6.0 acres of industrial parcels (i.e., a total of 10.9 acres), composed of one full permanent parcel easement and 28 partial parcel easements.
- Construction of Alternative 2 would require the temporary easement of approximately 0.1 acre of residential parcels, 0.3 acre of commercial parcels, and 2.1 acres of industrial parcels (i.e., a total of 2.5 acres) composed of no full temporary parcel easements and 20 partial parcel temporary easements.

Proposed Permanent Easements

Implementation of Alternative 2 would require only one permanent full parcel easement in association with the proposed Riverside Park (i.e., 1 out of 29). This is the same residential parcel required under Alternative 1. This residential property (i.e., located at 4 Mehrhof Lane, off Riverside Avenue in Little Ferry) includes 0.2 acre of vacant land with no residence; no residents would be displaced. The proposed conversion of this parcel would exclude this parcel from residential use in the future; therefore, a ***long-term, less-than-significant adverse*** socioeconomic impact would be expected. However, it is anticipated that compensation for this acquisition would offset any adverse effect.

Proposed partial permanent easements and socioeconomic effects under Alternative 2 are summarized in **Table 4.4-6**. These easements would not displace any structures or critical functions; therefore, no potentially significant adverse effects are anticipated. These acquisitions include small parts of:

- Residential parcels, comprised of vacant land and one parking area, that small sections along the edge of property lines, with no residences displaced. Easements at these locations would accommodate Riverside Park, Little Ferry Municipal Improvements, East Riser Ditch Improvements, and Losen Slote pump station and force main A.
- Commercial properties, including areas around parking lots and open, undeveloped land. Easements at these locations would accommodate the proposed improvements near the Little Ferry Library and Municipal Building, Little Ferry Public Schools, East Riser Ditch, and Losen Slote pump station and force main A.
- Industrial parcels, including land that is currently vacant and/or undeveloped. Easements at these locations would result in the development of Fluvial Park, Riverside Park, DePeyster Creek Park, East Riser Ditch, and Losen Slote pump station and force main C.

Proposed Temporary Easements

Similar to Alternative 1, no full parcel temporary easements would be anticipated under Alternative 2. All of the proposed temporary easements (i.e., 20 parcels) include edges of parcels; no displacement of residences or businesses would occur. Proposed partial parcel temporary easements and resultant socioeconomic effects are presented in **Table 4.4-6**. Proposed easements would not displace any structures or critical functions; therefore, no potentially significant impacts are anticipated.

Table 4.4-6: Potential Socioeconomic Effects Associated with Proposed Land Acquisitions under Alternatives 2 and 3

Land Use		Number of Parcels	Parcel Size (Acres)	Affected Acreage	Current Use/Structures	Proposed Use under Alternatives 2 and 3	Potential Effect**
Permanent Easements							
Full Parcels	Residential	1	0.2	0.2	Abandoned storage lot	Riverside Park	2
	Commercial	0	---	---	---	---	1
	Industrial	0	---	---	---	---	1
Partial Parcels	Residential	6	0.6	0.2	Vacant land at water's edge	Riverside Park	2
			0.4	0.2	Vacant land at water's edge	Riverside Park	2
			1.6	0.9	Parking lot	Little Ferry Municipal Improvements	2
			10.9	0.1	Edge of mobile home park along Moonachie Avenue	East Riser Ditch	2
			0.3	<0.1	Open undeveloped land at the end of Lorena Street	Losen Slote pump station / force main A	2
			0.3	0.1	Edge of residential lawn along Lorena Street	Losen Slote pump station / force main A	2
	Commercial	6	0.4	0.2	Parking lot	Little Ferry Municipal Improvements	2
			7.8	1.7	Open undeveloped land	Little Ferry Public Schools	2
			2.1	1	Playground, blacktop, parking lot	Little Ferry Public Schools	2
			0.1	<0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	2
			0.7	0.2	Vegetated edge of East Riser Ditch	East Riser Ditch	2
			0.7	0.1	Parking lot	Losen Slote pump station / force main A	2

Land Use		Number of Parcels	Parcel Size (Acres)	Affected Acreage	Current Use/Structures	Proposed Use under Alternatives 2 and 3	Potential Effect**
Partial Parcels	Industrial	16	5.3	1.3	Vacant industrial area	Fluvial Park ***(Alt 2 only)***	2
			0.8	0.7	Vacant land at water's edge	Riverside Park	2
			5.4	0.3	Open undeveloped land	DePeyster Creek Park ***(Alt 2 only)***	2
			0.1	0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	2
			0.3	0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	2
			3.3	0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	
			2	0.3	Vegetated edge of East Riser Ditch	East Riser Ditch*	2
			10.9	0.9	Vegetated edge of East Riser Ditch	East Riser Ditch*	2
			2.1	0.2	Vegetated edge of East Riser ditch, parking lot	East Riser Ditch*	2
			5.2	0.23	Vegetated edge of East Riser ditch, parking lot	East Riser Ditch*	2
			1.3	<0.1	Vegetated edge of East Riser ditch, parking lot	East Riser Ditch	2
			0.5	0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	2
			3.1	0.4	Vegetated edge of East Riser Ditch	East Riser Ditch+	2
			3.1	0.7	Vegetated edge of East Riser Ditch	East Riser Ditch+	2
			4.48	0.46	Vegetated edge of East Riser Ditch, parking lot	East Riser Ditch+	2
			10.6	0.1	Edge of parking lot	Losen Slote pump station / force main C ***(Alt 2 only)***	2

Land Use		Number of Parcels	Parcel Size (Acres)	Affected Acreage	Current Use/Structures	Proposed Use under Alternatives 2 and 3	Potential Effect**
Temporary Easements							
Full Parcels	Residential	0	--	--	--	--	1
	Commercial	0	--	--	--	--	1
	Industrial	0	--	--	--	--	1
Partial Parcels	Residential	2	10.9	0.1	Edge of mobile home park along Moonachie Avenue	East Riser Ditch	3
			0.3	<0.1	Edge of residential lawn along Lorena Street	Losen Slote pump station and force main A	3
	Commercial	5	7.8	0.1	Open developed land	Little Ferry Public Schools	3
			2.1	<0.1	Playground, blacktop, parking lot	Little Ferry Public Schools	3
			0.7	<0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	3
			0.7	<0.1	Parking lot	Losen Slote pump station and force main A	3
			3.1	<0.1	Vegetated edge of Losen Slote	Losen Slote pump station and force main C ***(Alt 2 only)***	3
	Industrial	13	0.1	<0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	3
			0.3	<0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	3
			3.3	0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	3
			2	<0.1	Vegetated edge of East Riser Ditch	East Riser Ditch*	3
			10.9	0.2	Vegetated edge of East Riser Ditch	East Riser Ditch*	3
			2.1	0.1	Vegetated edge of East Riser ditch, parking lot	East Riser Ditch*	3

Land Use		Number of Parcels	Parcel Size (Acres)	Affected Acreage	Current Use/Structures	Proposed Use under Alternatives 2 and 3	Potential Effect**
Partial Parcels	Industrial	13 *(continued)*	5.2	<0.1	Vegetated edge of East Riser ditch, parking lot	East Riser Ditch*	3
			1.3	<0.1	Vegetated edge of East Riser ditch, parking lot	East Riser Ditch	3
			0.5	<0.1	Vegetated edge of East Riser Ditch	East Riser Ditch	3
			3.1	0.5	Vegetated edge of East Riser Ditch	East Riser Ditch+	3
			3.1	0.8	Vegetated edge of East Riser Ditch	East Riser Ditch+	3
			4.5	0.3	Vegetated edge of East Riser Ditch, parking lot	East Riser Ditch+	3
			10.6	<0.1	Edge of parking lot	Losen Slote pump station and force main C ***(Alt 2 only)***	3

Mathematical inconsistencies due to rounding.
**Note:
1 = No impact.
2 = ***Long-term, less-than-significant, adverse*** impacts; has the potential to result in minor property devaluations and the need to replace displaced potential functions. However, it is anticipated that compensation for easement would offset any adverse effects.
3 = ***Short-term, less-than-significant, adverse*** impacts; has the potential to result in minor temporary property devaluations and the need to temporarily replace displaced potential functions. However, it is anticipated that compensation for easement would offset any adverse effects.
4 = Displacement with ***long-term, less-than-significant, adverse*** impacts. While the tenant would have to move, the owner would not be displaced and it is anticipated that compensation for easement would offset any adverse effects.
*The location of East Riser Ditch at West Commercial Avenue
+The location of East Riser Ditch at Amor Avenue

<u>Operation</u>

Implementation of Alternative 2 would create jobs and earnings as a result of ongoing O&M expenditures. **Table 4.4-7** presents the anticipated economic impacts from the operation of Alternative 2.

Table 4.4-7: Summary of Operation-Related Jobs Created and Associated Earnings under Alternative 2

O&M	Value
Annual O&M Jobs (average annual *direct* jobs)	13
Annual O&M Jobs (average annual *indirect* and *induced* jobs)	9
Annual O&M Jobs (average annual *total* jobs)	22
Total Annual Earnings (2017 in $MM)	$0.9
Average Earnings Per Job (2017 in $)	$42,100

Alternative 2 would result in 22 average annual total jobs, of which 13 would be direct and 9 would be indirect and induced. Total annual earnings for the 22 jobs would be $0.9 million, or an average of $42,100 per job. In general, O&M related jobs and earnings would very similar to Alternative 1. This would be a ***long-term beneficial*** annual impact that would continue for the life of the infrastructure of Alternative 2, providing a socioeconomic benefit to the community. All O&M values for Alternative 2 are slightly greater than the corresponding values for Alternative 1; however, average earnings per job under Alternative 1 and Alternative 2 would be the same (i.e., $42,100).

Similar to Alternative 1, implementation of Alternative 2 would not displace any households within the Project Area, and therefore would not reduce any specific population that is an integral component of a vibrant community. In addition, Alternative 2 would not create any physical barriers between residential uses, precluding the creation of isolated groups or neighborhoods within the Project Area. Therefore, ***no*** impact to the demographic composition of the Project Area is expected during operation of Alternative 2. Similarly, the racial and age structure and pattern of the Project Area would not likely be impacted, nor is it anticipated that children within the Project Area would suffer disproportionately from environmental health and safety risks under Alternative 2.

As there would be no displacement of any businesses in the Project Area, ***no impacts*** are anticipated under Alternative 2 to the labor force or industry sectors, the types of services provided, the numbers and sizes of businesses, or their estimated sales values and revenues. Maintenance workers would conduct routine long-term inspections of the stormwater improvements, resulting in minor and ***long-term, beneficial*** impacts to employment during the operation of Alternative 2.

Alternative 2 would provide five new parks, comprising approximately 20.0 acres, and approximately 11.2 acres of improvements to existing open spaces/public amenities within the Project Area that would provide a direct benefit to residents through additional opportunities to engage in recreational activities, such as fishing and kayaking. Approximately 7,300 residents currently live within 0.25 mile of these proposed new parks. Furthermore, pedestrian access within the Project Area would be directly enhanced through proposed trails and walkways within these parks and open spaces. In comparison to Alternative 1, Alternative 2 would provide approximately 9.2 acres more of new park land, along with improvements to the existing open spaces/public amenities. However, unlike Alternative 1, the proposed trails would each function primarily as individual features within their designated park footprint, and would not be integrated and connected along the Hackensack River. Therefore, Alternative 2 would result in ***long-term beneficial*** effects on social amenities.

Indirect Impacts

Construction

Construction of Alternative 2 would not result in any indirect socioeconomic effects, aside from the 500 indirect and induced job-years created as identified in **Table 4.4-5**. This would be a ***long-term beneficial*** economic effect, just as in Alternative 1.

Operation

Operation of Alternative 2 would result in nine indirect and induced jobs as identified in **Table 4.4-5**. This would be a ***long-term beneficial*** economic effect.

In addition, implementation of Alternative 2 would additionally enhance and improve stormwater drainage infrastructure in the Project Area that would reduce the costly damages to property and community infrastructure associated with inland flooding; therefore, Alternative 2 would have a ***long-term beneficial*** impact.

Conditions would likely be indirectly created for the long-term maintenance of property values as a result of the stormwater improvements under Alternative 2 to divert stormwater, and additional local amenities in the form of new recreational areas, green spaces, open space/public amenity improvements, and river access. As noted under Alternative 1, properties within 500 feet of new parks could experience a slight increase in value over time. The new social amenities and easily accessible green spaces in the Project Area would further serve to indirectly strengthen community cohesion, increase community appeal, provide important health benefits, improve resident and visitor perception, and lead to an overall sense of improved quality of life and well-being. When more open space areas are provided, it is likely that residents would use these amenities and improve their health and quality of life.

However, unlike Alternative 1, Alternative 2 would not provide storm surge protection. As such, the potential effects associated with coastal flooding and SLR, and identified under the No Action Alternative (see **Section 4.4.4.1**), would have the potential to impact the socioeconomic conditions in the Project Area. There would also be potential for residents to suffer adverse health effects associated with standing flood waters as a result of certain coastal storm surge events under Alternative 2.

Mitigation Measures and BMPs

No potentially significant adverse effects to socioeconomic conditions have been identified under Alternative 2. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***potentially significant, adverse*** impacts under Alternative 2 (see **Section 4.4.4.2**).

4.4.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer stormwater improvements due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects the socioeconomic environment, and thus would not change the impact analysis.

Because of the overall similarity in design between Alternative 2 and Alternative 3, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would generally be the same or slightly less than under Alternative 2, although construction-related economic impacts would be substantially less than under Alternative 2. The following subsections provide greater detail on the specific differences between the alternatives.

Direct Impacts

Construction

Employment

Construction of Alternative 3 would result in ***short-term beneficial*** impacts to employment, as it would create 640 total job-years, of which 320 would be direct and 320 would be indirect and induced job-years. The total earnings for the 640 job-years would be $34.7 million, or an average of $55,500 per job-year (NJDEP 2018), for those employed by all industries in the study area for jobs created as a result of construction spending (see **Table 4.4-8**). The number of job-years and total earnings would be approximately 64 percent less than Alternatives 1 and 2. However, average earnings per job would be similar. Therefore, beneficial impacts to employment and earnings within the Project Area would be less under Alternative 3.

Table 4.4-8: Summary of Construction-Related Jobs Created and Associated Earnings under Alternative 3

Construction	Value
Construction Jobs (*direct* job-years)	320
Construction Jobs (*indirect* and *induced* job-years)	320
Construction Jobs (*total* job-years)	640
Construction Earnings (2017 in $MM)	$34.7
Average Earnings Per Job (2017 in $)	$55,500

In comparison to Alternative 2, less ground-disturbing activities would occur under Alternative 2. Therefore, under Alternative 3, ***short-term, less-than-significant, adverse*** impacts to businesses and residents in the Project Area from traffic/limited access, dust, noise, and vibration during the construction phase would be less than those described under Alternative 2 (see **Section 4.4.4.3**). Similarly, potential risks to children would be as described under Alternative 2.

Land Acquisition

Implementation of Alternative 3 would require only one permanent *full* parcel easement in association with the proposed Riverside Park. This is the same residential parcel required under Alternatives 1 and 2.

Proposed *partial* permanent easements and socioeconomic effects under Alternative 3 are summarized in **Table 4.4-6**. The partial permanent easements of residential and commercial parcels under Alternative 3 would the same as Alternative 2. However, under Alternative 3, three fewer industrial parcels, comprising approximately 1.7 acres, would be required due the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote pump station and force main C.

Similar to Alternatives 1 and 2, no *full* parcel temporary easements would be anticipated under Alternative 3. However, due to the exclusion of Losen Slote pump station and force main C, only 18 of the 20 proposed *partial* temporary easements, identified under Alternative 2, would be required. These parcels include one commercial parcel and one industrial parcel, comprising less than 0.1 acre.

Operation

Implementation of Alternative 3 would create jobs and earnings as a result of ongoing O&M expenditures. **Table 4.4-9** presents the anticipated economic impacts from the operation of Alternative 3.

Table 4.4-9: Summary of Operation-Related Jobs Created and Associated Earnings under Alternative 3

O&M	Value
Annual O&M jobs (average annual *direct* jobs)	10
Annual O&M Jobs (average annual *indirect* and *induced* jobs)	6
Annual O&M Jobs (average annual *total* jobs)	16
Total Annual Earnings (2017 $MM)	$0.7
Average Earnings Per Job (2017 in $)	$42,100

Alternative 3 would result in 16 average annual total jobs, of which 10 would be direct and 6 would be indirect and induced. Total annual earnings for the 16 jobs would be $0.7 million, or an average of $42,100 per job. In general, O&M related jobs and earnings would be very similar to Alternatives 1 and 2. This would be a ***long-term beneficial*** annual impact that would continue for the life of the infrastructure of Alternative 2, providing a socioeconomic benefit to the community. All O&M values for Alternative 3 are slightly lower than the corresponding values for Alternatives 1 and 2; however, average earnings per job under Alternative 1, Alternative 2, and Alternative 3 would be the same (i.e., $42,100).

Alternative 3 would only create approximately 7.6 acres of new parks due to the exclusion of Fluvial Park and DePeyster Park, in comparison to 10.1 acres for Alternative 1 and 20.0 acres for Alternative 2. However, the new parks would still be within 0.25 mile of approximately 5,000 residents. While the total overall acreage of new parks is less than Alternative 1, Alternative 3 would also provide 11.2 acres of improvements to existing open spaces/public amenities. Therefore, Alternative 3 would provide in ***long-term beneficial*** effects on social amenities. However, these beneficial effects would be expected to be greater than Alternative 1, but less than those described under Alternative 2.

Indirect Impacts

Construction

Construction of Alternative 3 would not result in any indirect socioeconomic effects, aside from the 320 indirect and induced job-years created as identified in **Table 4.4-8**. This would be a ***long-term beneficial*** economic effect, the same as identified in previous Alternatives.

Operation

Operation of Alternative 3 would result in six indirect and induced jobs as identified in **Table 4.4-8**. This would be a ***long-term beneficial*** economic effect.

As described in **Section 4.4.4.3**, ***long-term, beneficial*** impacts are anticipated to result from the proposed stormwater drainage improvements. As such, a reduction in costly damages to property and community infrastructure associated with inland flooding would occur, as well as indirectly create conditions for the long-term maintenance of property values from the increased infrastructure and additional, but fewer, overall social amenities such as parks. However, because Alternative 3 includes fewer stormwater improvements, beneficial impacts would be expected to be slightly less than Alternative 2.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternatives 1 and 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.4.4.2**).

4.5 Environmental Justice

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on EJ concerns, as described in **Section 3.5**, in and around the Project Area. Impacts to EJ can be either direct or indirect. An example of a direct impact would be the displacement of residents, housing units, and businesses that disproportionally affect minority, low-income, and/or LMI populations. An example of an indirect impact would be changes in property values, rental fees, and/or vacancy rates that disproportionally affect EJ communities.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to produce EJ effects to the study area during both construction and operational activities. This analysis also identifies the location of impacts and quantifies potential effects, to the extent possible.

4.5.1 Definition of Study Area

As described in **Section 3.5**, the study area for minority and low-income populations is defined as the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to EJ conditions and concerns.

However, the study area for LMI populations is defined in accordance with HUD’s CDBG program requirements, and herein is referred to as the service area. HUD defines the service area as the geographic area receiving benefits from the CDBG-assisted activity (HUD 2017). For the Proposed Project, the service area includes the block groups within the Project Area that directly and/or indirectly receive benefits under the three Build Alternatives. Direct benefits would be anticipated in block groups where Proposed Project components (e.g., parks) are constructed. Indirect benefits would be anticipated to occur for block groups receiving flood reduction as a result of the Proposed Project components. Of the 15 block groups within the Project Area, 12 would be anticipated to receive direct and/or indirect benefits; these 12 block groups comprise the service area, illustrated in **Figure 4.5-1**.

4.5.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect EJ effects of the alternatives are shown in **Table 4.5-1**.

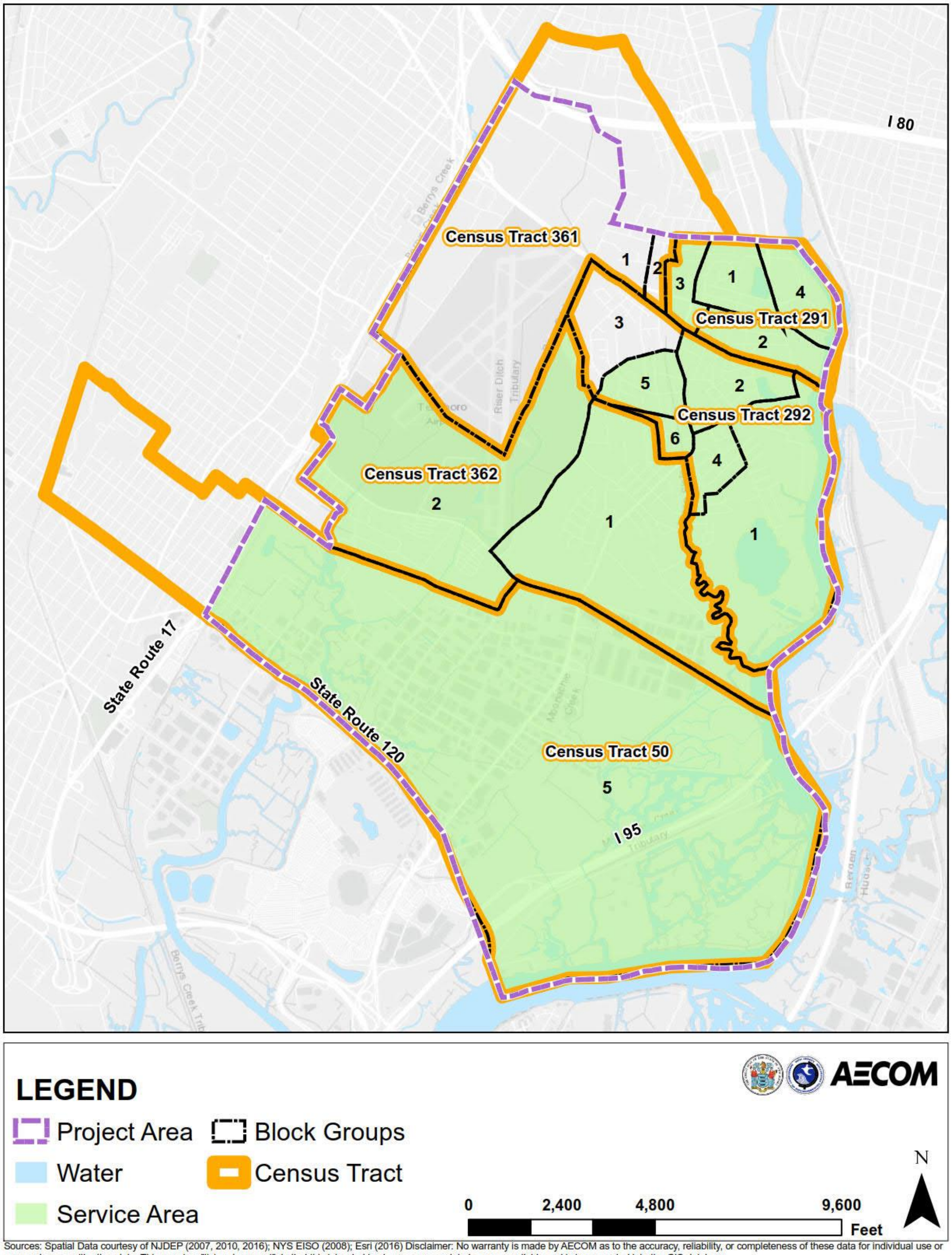


Figure 4.5-1: HUD Service Area for the Proposed Project

Table 4.5-1: Environmental Justice Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct EJ Change	• Would not result in disproportionately high and adverse human health/environmental effects (e.g., from air, noise, and water pollution) borne predominately by minority, low-income, and LMI populations • Would not result in destruction or disruption of community cohesion, or access to available facilities and services • Would not result in displacement of residents, housing units, and/or local businesses • Would not create or displace jobs
	Indirect EJ Change	• Would not result in changes in property values, rental fees, and/or vacancy rates • Would not induce changes to demographic composition
	Applies to all Effect Types	• Would not result in discernable changes to EJ concerns in the region or locality • Would alter EJ conditions for only an indiscernible or negligible period of time
Less-than-Significant	Direct EJ Change	• Would result in only temporary changes to community cohesion, or access to available facilities and services (public and private) • Would result in only temporary displacement of residents, housing units, and/or local businesses • Would result in only temporary changes in employment levels
	Indirect EJ Change	• Would result in only temporary changes in property values, rental fees, and/or vacancy rates • Would result in only temporary changes to demographic composition
	Applies to All Effect Types	• EJ conditions would be altered for only a short, finite period • Impacts would be localized in specific areas and not substantially affect EJ conditions
Potentially Significant	Direct EJ Change	• Would result in disproportionately high and adverse human health/environmental effects borne predominately by minority, low-income, and LMI populations, such as noise, dust, and traffic pollution from construction or operational activities • Would result in loss of community cohesion, or access to available facilities and services (public and private) • Would displace residents, housing units, and/or local businesses; would place physical barriers or provide limited access that insulates neighborhoods or population groups • Would result in loss of jobs or employment opportunities
	Indirect EJ Change	• Would result in adverse changes in property values, rental fees, and/or vacancy rates • Would result in long-term changes to demographic composition
	Applies to All Effect Types	• Would result in adverse EJ impacts observed throughout affected communities • Would permanently adversely alter EJ conditions in the study area

Impact Level	Type of Effect	Impact Description
Beneficial	Direct EJ Change	• Would result in disproportionately high and beneficial human health/environmental effects borne predominately by minority, low-income, and LMI populations (e.g., improved water quality or increased flood protection) • Would improve and strengthen community cohesion, or access to available facilities and services, including emergency services • Would increase jobs and employment opportunities
	Indirect EJ Change	• Would increase property values • Would include full and fair participation by EJ communities in the decision-making process, and/or would prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority, low-income, and LMI populations
	Applies to All Effect Types	• Would result in EJ benefits observed throughout affected communities • Would result in long-term beneficial alterations in EJ conditions in the study area

4.5.1 Analysis Methodology

As discussed in **Section 3.5.3**, EJ communities of concern include places that are home to high concentrations of minority, low-income, and LMI populations that equal to or exceed a given threshold. Bergen County data were used to establish a threshold for comparison to determine communities of concern in the Project Area. Based on the analysis, *the entire Project Area is considered an EJ community of concern* (please see **Section 3.5.3.4** and **Figure 3.5-5**).

The Build Alternatives, including the No Action Alternative, were evaluated to determine potential effects to EJ conditions and concerns; existing conditions are described in **Section 3.5**. The principal EJ focus is the existing minority and low-income populations in the study area, and LMI populations within the service area.

To determine the magnitude of any potential direct or indirect impacts on EJ populations, the EJ analysis was conducted using the results from several other Technical Resource area analyses including Land Use and Land Use Planning (**Section 4.2**); Visual Quality/Aesthetics (**Section 4.3**); Socioeconomics, Community/Populations, and Housing (**Section 4.4**); Transportation and Circulation (**Section 4.7**); Noise and Vibration (**Section 4.8**); Air Quality and Greenhouse Gas Emissions (**Section 4.9**); Recreation (**Section 4.11**); Utilities and Service Systems (**Section 4.12**); Public Services (**Section 4.13**); Biological Resources (**Section 4.14**); Water Resources, Water Quality, and WOUS (**Section 4.16**); Hydrology and Flooding (**Section 4.17**), and Hazards and Hazardous Materials (**Section 4.20**).

An analysis of potentially disproportionately high and adverse effects to EJ populations for each of the considered alternatives was prepared, and measures to mitigate identified adverse impacts are recommended, where reasonable and available[50]. An alternative with disproportionately high and adverse effects to minority, low-income, and LMI populations may only be selected if further mitigation measures are identified as not practicable. To determine whether a measure is "practicable," the social, economic, and environmental effects of mitigating the adverse EJ effects have been considered and presented in this analysis.

The HUD CDBG program requires that each CDBG-funded activity "must either principally benefit LMI persons, aid in the prevention or elimination of slums or blight, or meet a community development need having a particular urgency" (HUD 2017). Further, these activities must benefit all residents in the service area, and at least 51 percent must be LMI persons (HUD 2017). However, as described in **Section 3.5.2**, CDBG law authorizes an exception criterion. Based on the 2006-2010 American Community Survey LMI data, HUD determined that the LMI exception threshold is 39.57 percent for FY 2017 grantees (HUD 2017). Therefore, the Proposed Project's service area must benefit at least 39.57 percent LMI persons (see **Figure 4.5-1**).

Using 2006-2010 American Community Survey LMI data (HUD 2017), the percentage of LMI persons within the Proposed Project's service area was calculated by dividing the total number of LMI persons within the 12 block groups comprising the service area by the total number of persons in those block groups. Based on this analysis, the percentage of LMI persons within the Proposed Project's service area was determined to be 43.3 percent, which is greater than the exception threshold for Bergen County (39.57 percent). Therefore, the Proposed Project qualifies as principally benefiting LMI persons

[50] If necessary, any final mitigation strategies to address adverse EJ impacts may be developed using input from the community, as appropriate.

and meets the CDBG program requirements. For additional, more specific information regarding the percentage of LMI persons in each block group, refer to **Appendix D**.

4.5.2 Impact Analysis

The following subsections assess potential direct and indirect EJ impacts associated with the implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented and the EJ conditions of the study area would not be altered by construction or operation activities associated with the Proposed Project. Therefore, no project-related impacts to the minority, low-income, and LMI populations would occur in the study area.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, potentially significant adverse impacts*** on EJ populations by changing housing; access to community facilities; employment conditions; demographic composition for minority, low-income, and LMI persons; and increasing the long-term risk of these persons to hazards such as flooding. Relating to the significance criteria, the No Action Alternative:

- *Could induce job loss/reduced employment levels for EJ persons as employers leave the Project Area due to increased flooding events.*
- *Could reduce access to community facilities (temporarily or permanently).*
- *Could increase the long-term risk of EJ populations to identifiable hazards, such as flooding.*
- *Could change demographic composition as populations that have financial resources to leave the Project Area could do so, thereby shifting the racial and age structure, increasing population below the poverty level, and reducing median household income*.

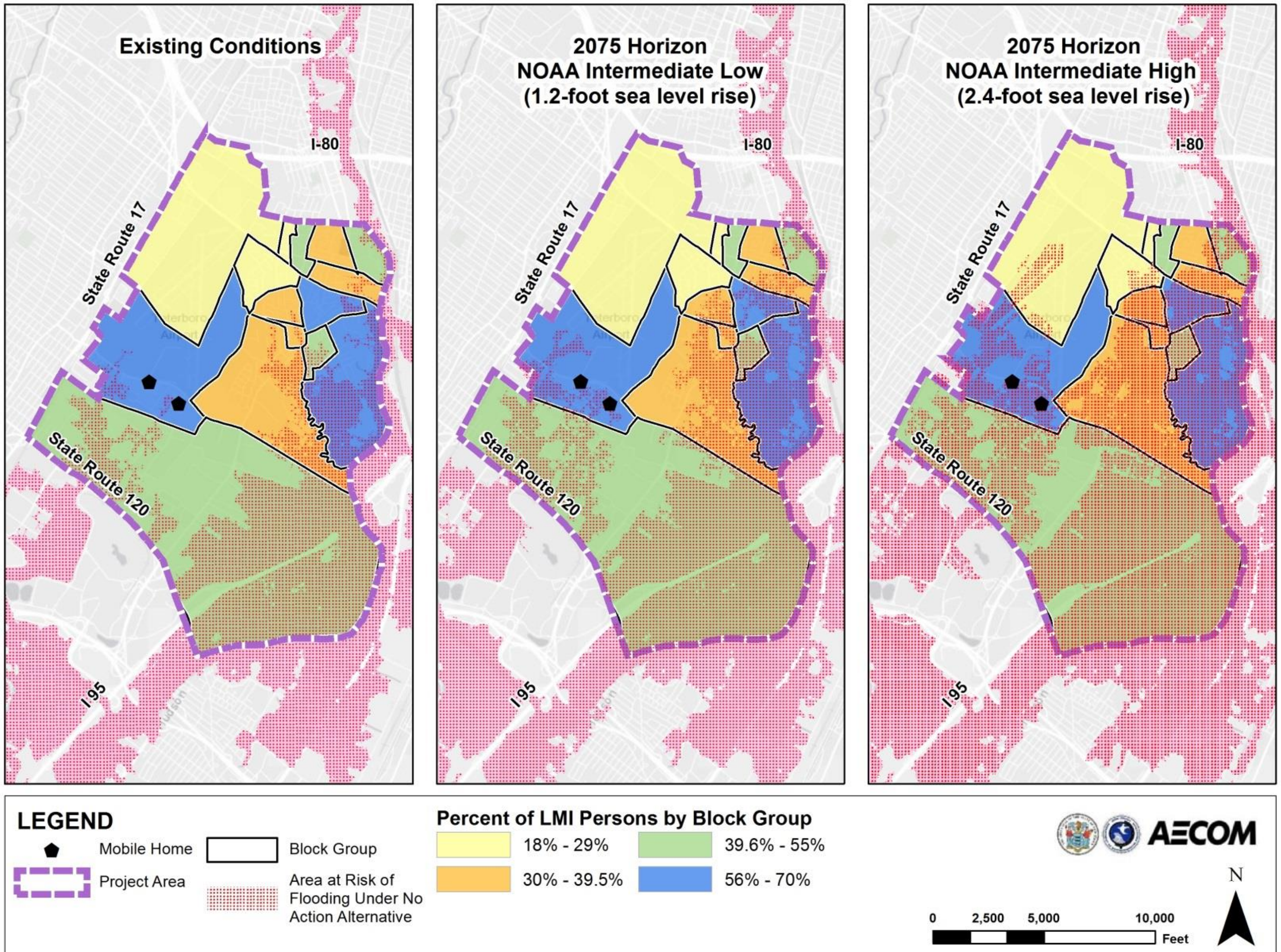
Based on the locations of LMI persons within the Project Area at this point in time, a large portion of the area with LMI persons has the potential for increased flooding in the future under the No Action Alternative (see **Figure 4.5-2**).

Ongoing and increased flooding within the Project Area may increasingly affect properties either owned or rented by low-income and minority persons. Additionally, businesses that have low-income and minority persons as part of their workforce would also experience potentially adverse impacts that would affect the standard of living and quality of life of such persons in the Project Area. Therefore, any long-term damage to these assets has the potential to adversely affect the community character for minority, low-income, and LMI persons and adversely change their demographic, housing, and employment conditions.

Low-income individuals are more vulnerable to disruptions of their livelihoods, employment, and negative health effects associated with flooding; therefore, the No Action Alternative has the potential to adversely affect these populations significantly and disproportionately as compared to other sections of society.

In addition, adverse public health effects would substantially increase under the No Action Alternative. According to the Centers for Disease Control and Prevention (CDC), health risks from flood waters include infectious diseases, injuries, and death (CDC 2017a). The CDC generally recommends that the public “avoid standing water, areas saturated with floodwater, and areas with visible debris” (CDC 2017b) as these areas present the greatest hazards for microbial exposure and injury. As such, continued and increased flooding events in the future would cause infectious disease, injuries, and death; mold growth and associated aggravation of respiratory and lung conditions; as well as mental health issues, including stress, depression, anxiety disorders, and sleeplessness.

A 2016 community-wide Health Impact Assessment survey conducted by Rutgers University and administered to residents of Hoboken, New Jersey for rainfall flooding found that 36 percent of respondents (including those that are low-income, older, and disabled, referred to as “vulnerable populations”) reported being impacted every time it floods, compared to 20 percent of the general population (Carnegie, *et al.* 2016). Of those impacted by flooding in the past two years, 24 percent of vulnerable populations reported that their housing structure was damaged compared to 13 percent of the general population (Carnegie, *et al.* 2016). In addition, with regard to disruption of their daily livelihoods, low-income residents without vehicles were more likely to report difficulty carrying out day-to-day activities including grocery shopping and getting to work or school due to flooding events.



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.5-2: LMI Communities in the Project Area at Risk of Flooding During the Normal Tide Under the No Action Alternative (Existing and Future Conditions)

4.5.2.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to EJ populations and neighborhoods in the Project Area from dust, noise, and vibration during the Alternative 1 construction phase.
- ***Short-term, less-than-significant, adverse*** impacts to EJ populations and neighborhoods in the Project Area from traffic restrictions and access limitations during the construction phase.
- ***Short-term, beneficial*** effects to employment within EJ communities of the Project Area from available project-related jobs during the construction and operation/maintenance phases of Alternative 1.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against coastal storm surges, which would thereby reduce damages to EJ community infrastructure, provide a stronger sense of safety, and reduce the potential for fluctuations in the affordability of housing and property values.
- ***Long-term, beneficial*** effects on conditions for long-term employment opportunities in the Project Area as businesses would be less likely to leave the area because of flooding.

The following subsections provide greater detail.

Direct Impacts

The EJ communities within the Project Area would be subject to both adverse and beneficial direct impacts; as identified in this analysis, none of these effects would be significant.

<u>Construction</u>

Construction of Alternative 1 would involve a combination of land-based and water-based equipment. During construction, there is some potential for elevated dust, noise, and vibration levels from construction equipment along with an increase in construction-related vehicular traffic within the Project Area. A total of 13 residences occur within 100 feet of the proposed alignment; none of these residences would be displaced. All 13 residential units are located in areas where the percentage of minority persons and persons in poverty are higher than the County thresholds, and the number of LMI persons also exceeds the county average. Therefore, there is a potential for localized and temporary impacts due to construction of Alternative 1 on minority or low-income persons within the Project Area. This would be a ***short-term, less-than-significant, adverse*** impact to these residences.

As discussed in **Section 4.7**, construction of Alternative 1 would result in short-term traffic restrictions, lane closures, and access restrictions at various locations in the Project Area to accommodate construction activities and construction-related traffic. As the entirety of the Project Area is considered an EJ community, this would result in ***short-term, less-than-significant, adverse*** impacts to traffic circulation within the Project Area.

The entire Project Area, however, would likely experience ***short-term, beneficial*** effects to employment from available project-related jobs during the construction phase of Alternative 1. As required under Section 3 of the Housing and Urban Development Act of 1968 (Public Law [PL] 90-448), recipients of HUD funding would direct new employment and contracting opportunities to low-income residents within the local community. Therefore, certain benefits would be provided to the Project Area as a result of using locally sourced labor; however, the extent of those EJ benefits would depend on how many workers are within the local area. ***Beneficial*** impacts to the local community would also be expected from the presence of construction workers through incidental spending in local establishments.

Operation

Alternative 1 would not require the displacement of any residents or business from the Project Area. Therefore, it would not result in any direct, disproportionately high or adverse human health/ environmental effects that would be borne predominately by minority, low-income, or LMI populations. Moreover, no disruption or destruction of community cohesion or access to available facilities and services would occur under Alternative 1.

Anticipated traffic volumes resulting from the O&M phase of Alternative 1 would not noticeably change existing traffic volumes on local area roadways. Similarly, there would be minimal discernible additional noise or dust generated during proposed O&M activities.

Indirect Impacts

Construction

Construction of Alternative 1 would not result in any indirect EJ effects.

Operation

Alternative 1 would reduce the potential risk of flooding from coastal storm surges to the Project Area as described in **Section 4.1.2.1**; this would beneficially impact EJ communities of concern. With the implementation of Alternative 1, there would be a decrease in the number of flood events that impact EJ communities. This would mean a decreased likelihood that these populations would be displaced from their homes, or that they would have to contend with costly repairs associated with flood damages.

This increased protection would reduce the likelihood of damage to housing that is either owned or rented by low-income or minority persons, preserving property values and housing affordability. In turn, this would provide a stronger sense of safety and reduce the potential for fluctuations in the affordability of housing and property values. Alternative 1 would also indirectly affect long-term employment opportunities for EJ populations in the Project Area, as the potential for increased, sustained damage to locations of employment would be minimized, and businesses would be less likely to leave the area because of flooding.

Increased flood protection would also be provided to community facilities, such as the Meadowlands Family Success Center and Bergen’s Place Youth Shelter, and to basic infrastructure required to maintain a good quality of life and standard of living within the Project Area. Overall, an atmosphere would be created to foster a greater sense of safety and security due to the increased flood protection.

In addition, indirect public health benefits would be provided to residents within the Project Area that would no longer be flooded during certain coastal storm surge events. Public health benefits would include a reduction in infectious disease, injuries, and death; decreased mold growth and associated aggravation of respiratory conditions and lung infections; and a reduction in flood-induced mental health issues including stress, depression, anxiety disorders, and sleeplessness. Additional public health benefits would be realized from protected utility infrastructure that would be less susceptible to interruptions, thereby providing continued access to clean water, electricity, and emergency services.

Mitigation Measures and BMPs

No potentially significant adverse impacts to minority, low-income, and/or LMI residents of the Project Area have been identified from the proposed construction or operation of Alternative 1. However, measures to reduce construction-related effects to local air quality, noise, and traffic are discussed in **Sections 4.9**, **4.8**, and **4.7**, respectively.

The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts:

- Prior to construction, a Public Safety Plan would be developed, which would establish protocol for coordination with representatives of EJ communities to ensure that construction activities occurring close to residences would have the least possible impact on pedestrian and vehicle traffic patterns, and that construction noise and dust would be reduced to the extent practicable.
- BMPs and standard measures would be implemented to maintain access and traffic and control noise, vibration, and dust (see **Sections 4.7**, **4.8**, and **4.9**).
- The Proposed Project would comply with HUD Section 3, and to the greatest extent possible, and provide job training, employment, and contract opportunities for low-income and LMI residents in connection with projects and activities in their neighborhoods. The Proposed Project would document all actions taken to comply with the requirements of Section 3 and submit a Section 3 Annual Summary Report (Form HUD-60002) for all covered funding to the Office of Fair Housing and Equal Opportunity. The Proposed Project would also comply with NJDCA Section 3 requirements, including submitting Quarterly Section 3 reports throughout the entire project, pursuant to NJDCA Policy 2.10.22 Section VIII.

4.5.2.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to EJ populations and neighborhoods in the Project Area from dust, noise, and vibration during the Alternative 2 construction phase.
- ***Short-term, less-than-significant, adverse*** impacts to EJ populations and neighborhoods in the Project Area from traffic restrictions and access limitations during the construction phase.
- ***Short-term, beneficial*** effects to employment within EJ communities of the Project Area from available project-related jobs during the construction and operation/maintenance phases of Alternative 2.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects from reduced inland flooding from heavy precipitation events, which would thereby reduce damages to EJ community infrastructure.

The following subsections provide greater detail.

Direct Impacts

<u>Construction</u>

During construction, there would be potential for elevated noise, dust, and vibration levels from construction equipment and the potential for an increase in construction-related vehicular traffic within the Project Area. A total of 385 residential units (which includes apartments and other residences) occur within 100 feet of the proposed Alternative 2 footprint; none of these residences would be displaced. In comparison, only 13 residential units occur within 100 feet of the proposed alignment under Alternative 1. Of the 385 total units within 100 feet of proposed features, 219 units are located in areas where the percentage of persons in poverty is higher than the county threshold; 287 units are located in areas where the percentage of minority persons is greater than the county threshold, and 383 units are located in areas where the percentage of LMI persons exceeds the county threshold.

As shown in **Figure 3.5-5**, one location in the Project Area exceeds the Bergen County thresholds for all three EJ indicators: a portion of the Borough of Little Ferry that extends northward to Main Street, westward to Redneck Avenue, and along the municipal boundary of the Borough of Moonachie. In this area, 218 residential units occur within 100 feet of proposed Alternative 2 features. Therefore, there is potential for localized and temporary impacts during construction activities on minority, low-income, and LMI persons within the Project Area. This would be a ***short-term, less-than-significant, adverse*** impact to these residences.

As discussed in **Section 4.7**, construction of Alternative 2 would result in short-term traffic restrictions, lane closures, and access restrictions at various locations in the Project Area to accommodate construction activities and construction-related traffic. As the entirety of the Project Area is considered an EJ community, this would result in ***short-term, less-than-significant, adverse*** impacts to traffic circulation within the Project Area, similar to Alternative 1.

Similar to Alternative 1, the entire Project Area, however, would likely experience ***short-term, beneficial*** effects to employment from available project-related jobs during the Alternative 2 construction phase. As required under Section 3 of the Housing and Urban Development Act of 1968 (Public Law [PL] 90-448), recipients of HUD funding would direct new employment and contracting opportunities to low-income residents within the local community. Therefore, certain benefits would be provided to the Project Area as a result of using locally sourced labor; however, the extent of those EJ benefits would depend on how many workers are within the local area. ***Short-term, beneficial*** impacts to the local community would also be expected from the presence of construction workers through incidental spending in local establishments.

<u>Operation</u>

Similar to Alternative 1, Alternative 2 would not require the displacement of any residents or business from the Project Area. Therefore, it would not result in any direct, disproportionately high or adverse human health/environmental effects that would be borne predominately by minority, low-income, or LMI populations. Moreover, no disruption or destruction of community cohesion or access to available facilities and services would occur under Alternative 2.

Anticipated traffic volumes resulting from the O&M phase of Alternative 2 would not noticeably change existing traffic volumes on local area roadways. Similarly, there would be minimal discernible additional noise or dust generated during proposed O&M activities.

Indirect Impacts

<u>Construction</u>

Construction of Alternative 2 would not result in any indirect EJ effects.

Operation

Alternative 2 would reduce inland flooding from heavy precipitation events, but continued and increased coastal flooding from storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**). Therefore, the potential effects associated with coastal flooding, identified under the No Action Alternative (see **Section 4.5.2.1**), would have the potential to adversely impact EJ populations in the Project Area.

With the implementation of Alternative 2, there would be a decrease in the number of inland flood events that impact EJ communities; this would provide ***long-term, beneficial*** impacts to EJ communities of concern. In addition, stormwater conveyance capacity improvements would occur in the East Riser Ditch and Losen Slote drainage areas, which encompass EJ communities with LMI, poverty, and minority levels above the county threshold. In addition, stormwater infiltration and treatment improvements would be recognized throughout these communities as well. This would mean a decreased likelihood that these populations would be displaced from their homes, or that they would have to contend with costly repairs associated with flood damages. This increased level of protection would reduce the likelihood of damage to housing that is either owned or rented by low-income or minority persons, maintaining housing affordability and property values.

In addition, indirect public health benefits would be provided to residents within the Project Area that would no longer be flooded during heavy precipitation events. Public health benefits would include a reduction in infectious disease, injuries, and death; decreased mold growth and associated aggravation of respiratory conditions and lung infections; and a reduction in flood-induced mental health issues including stress, depression, anxiety disorders, and sleeplessness. Additional public health benefits would be realized from protected utility infrastructure that would be less susceptible to interruptions, thereby providing continued access to clean water, electricity, and emergency services.

Mitigation Measures and BMPs

No potentially significant adverse impacts to minority, low-income, and/or LMI residents of the Project Area have been identified from the proposed construction or operation of Alternative 1. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2 (see **Section 4.5.2.2**).

4.5.2.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer stormwater improvements. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects EJ communities of concern, and thus would not change the impact analysis. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2.

Direct and indirect impacts on EJ communities would be the same as Alternative 2, with the exception of the following impacts:

- Under Alternative 3, a total of 339 residential units occur within 100 feet of proposed features (46 units less than Alternative 2); none of these units would be displaced. Of the 339 total units within 100 feet of proposed features, 204 units are located in areas where the percentage of persons in poverty is higher than the county threshold; 264 units are located in areas where the percentage of minority persons is greater than the county threshold, and 337 units are located in areas where the percentage of LMI persons exceeds the county threshold. Therefore, there is still potential for localized, temporary impacts due to the construction of Alternative 3 on minority, low-income, and LMI persons within the Project Area; however, these ***short-term, less-than-significant, direct*** impacts would be slightly less than Alternative 2.

- Due to fewer construction activities under Alternative 3, ***short-term, less-than-significant, direct adverse*** impacts to EJ populations and neighborhoods in the Project Area from dust, noise, and vibration during the construction phase of Alternative 3 would be less than Alternative 2.
- Due to less construction activities under Alternative 3, ***short-term, less-than-significant, direct adverse*** impacts to EJ populations and neighborhoods in the Project Area from traffic restrictions and access limitations during the construction phase would be less than Alternative 2.
- ***Short-term, direct beneficial*** effects to employment within EJ communities of the Project Area from available project-related jobs during the construction and operation/maintenance phases of the Proposed Project would be less because fewer construction jobs would be generated under Alternative 3.
- ***Long-term, indirect beneficial*** effects from reduced inland flooding during heavy precipitation events would be slightly less because Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and force main C would not be constructed.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternatives 1 and 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3.

4.6 Cultural and Historical Resources

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on cultural resources, as described in **Section 3.6**, in and around the Project Area. Impacts to cultural resources can be either direct or indirect. A direct impact would occur if the Proposed Project would directly change a cultural resource within the Project Area, through the demolition of a historic structure or the destruction of an archaeological resource. An indirect impact would occur if the Proposed Project would induce other changes that could affect cultural resources. For example, should the Proposed Project potentially contribute to future increased development of the study area that could produce impacts to significant historic properties, an indirect impact would occur. Similarly, an indirect impact could occur by altering the viewshed or acoustic environment of a historic building.

Analysis of effects and definition of significance thresholds presented in this section are based upon standards established by NEPA; Section 106 of the NHPA, as amended [36 CFR Part 800.4(a)(1) and 36 CFR Part 800.4(b)(1)]; and guidelines outlined in the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716). This legislation requires consideration of the effect(s) of any federally assisted undertaking on "historic properties," defined as a prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the NRHP, during the project planning process.

This analysis specifically addresses the potential for the Proposed Project's considered alternatives to affect historic properties during both construction and operational activities, either by affecting them directly or by causing indirect effects that would alter their quality. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.6.1 Definition of Study Area

As described in **Section 3.6.1**, the study area for cultural resources includes the portions of the Project Area that would be directly affected (e.g., through ground disturbance or emplacement of modifications), as well as areas from which the Proposed Project components could be seen or heard; the former is considered the direct APE and the latter is considered the indirect APE. Overall, the APE includes the geographic area within which the Proposed Project may cause direct or indirect changes in the character or use of historic properties. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to cultural resources, in accordance with 40 CFR 1508.27.

4.6.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives to cultural resources are shown in **Table 4.6-1**. In the context of NEPA and Section 106 of the NHPA, cultural resources and historic properties are considered significant if they meet the criteria for listing in the NRHP. The resource under evaluation must meet the following criteria requirements, as defined in 36 CFR 60.4. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

- That are associated with events that have made a significant contribution to the broad patterns of our history;
- That are associated with the lives of persons significant in our past;
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- That have yielded, or may be likely to yield, information in prehistory or history.

4.6.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for impacts to the existing conditions of cultural resources within the defined study area. To conduct this analysis, each considered alternative was compared to areas of archaeological sensitivity, locations of historic properties, and relevant data obtained from background research and review of historic maps. Proposed changes within the direct and indirect APEs were thereby identified and analyzed. Effects due to proposed construction and operational activities were considered, including both direct and indirect effects.

Table 4.6-1: Cultural Resources Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Cultural Resources Change	• Would not result in a direct change to, or impact on, any historic property listed on or identified as eligible or potentially eligible for listing on the NRHP
	Indirect Cultural Resources Change	• Would not alter the viewshed, acoustic environment, or general environment of any historic property
	Applies to All Effect Types	• Would result in no discernable changes to historic properties in the region or locality • Would only alter historic properties for an indiscernible or negligible period of time
Less-than-Significant	Direct Cultural Resources Change	• Would result in only a temporary impact to a historic property
	Indirect Cultural Resources Change	• Would result in only a temporary impact to the viewshed, acoustic environment, or general environment of a historic property
	Applies to All Effect Types	• Historic properties would only be altered for a short, finite period • Impacts would not exceed significance thresholds identified in 36 CFR Part 800
Potentially Significant	Direct Cultural Resources Change	• Would result in substantial change to the character-defining features of a historic property listed on, or identified as potentially eligible for listing on, the NRHP • Would result in physical destruction or damage to a historic or archeological resource • Would damage or disturb human remains, whether historic or prehistoric
	Indirect Cultural Resources Change	• Would result in substantial alteration of a historic property's viewshed, acoustic environment, or other environmental component, notably affecting an element that contributes to the significance of a historic property • Would substantially increase traffic volume in the vicinity of a historic property
	Applies to All Effect Types	• Would result in impact that would exceed significance thresholds identified in 36 CFR Part 800
Beneficial	Direct Cultural Resources Change	• Would increase the protection of a historic property over the long-term
	Indirect Cultural Resources Change	• Would remove or reduce existing visual, acoustic, or other environmental component currently degrading a historic property
	Applies to All Effect Types	• Would enhance or improve the cultural resources environment of, or cultural resources within, the study area

As described in **Section 3.6**, five historic resources have been previously inventoried within the Project Area: the US Route 46 Bascule Bridge, the Outwater Cemetery, the Gethsemane Cemetery, the Moonachie Streetscape district, and the dwelling at 69 Bruno Street in the Borough of Moonachie. These historic architectural resources are detailed in **Section 3.6**.

Historic architectural fieldwork in support of this analysis was performed; this work was restricted to the portions of the direct and indirect APEs located outside of the Historic Preservation Exclusion Green Zones[51]. In addition, a Phase IA archaeological survey was conducted of the direct APE for Alternative 3 (Walker, et al. 2018). Alternatives 1 and 2 were also assessed for archaeological sensitivity. The Historic Structures Survey Report and Phase IA Archaeological Report for the Proposed Project are included in **Appendix E**. The NJDEP received concurrence from the NJHPO on the Phase 1A Archaeological Survey Report and Historic Structures Survey Report on June 15 and 28, 2018, respectively. A copy of the concurrence letters is included in **Appendix A**.

As the design of the Build Alternatives proceeds, additional intensive-level archaeological field surveys and a detailed historic structures survey[52], as needed and determined through consultation with the NJHPO, will be completed. Using these future data, this impact analysis will apply the criteria of adverse effect to all historic properties, including archaeological resources and historic architectural resources (i.e., historic buildings), located within the direct and indirect APEs pursuant to 36 CFR Part 800 – *Protection of Historic Properties*. Further, to determine the potential for indirect effects, data from **Sections 4.2** and **4.7** will be used to identify potential visual and acoustic changes, respectively, within the indirect APE that could affect historic properties. For potentially significant effects, mitigation measures consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* will be developed in consultation with the NJHPO and consulting parties.

4.6.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to cultural resources associated with the implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.6.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be constructed and no changes would occur to existing cultural resources from activities associated with the Proposed Project. As such, there would be no direct impacts to cultural resources from the No Action Alternative.

However, continued and increased flooding in the Project Area over time, as summarized in **Section 4.1.1**, could have ***indirect, potentially significant adverse*** impacts on cultural resources by altering historic architecture, changing the environment around historic properties, and potentially impacting archaeological resources. Per the significance criteria identified in **Table 4.6-1**, the No Action Alternative:

- *Could result in an induced change to the character-defining features of a historic resource(s)*

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[51] Areas and resources located within a *Historic Preservation Green Zone* were previously surveyed by NJHPO for NRHP eligibility in the years following Hurricane Sandy; thus, these areas did not require re-survey for historic architecture for the purposes of this analysis.

[52] A Historic Architectural Survey/Determination of Eligibility Report will be prepared for submission to the NJHPO for the Preferred Alternative and become an appendix to the EIS (Everett 2017).

- *Could result in substantial alteration of a historic property's viewshed, acoustic environment, or other environmental component, notably affecting an element that contributes to the significance of a historic property.*

Under the No Action Alternative, ongoing and increased flooding within the Project Area would continue to impact cultural resources. Overall, the greatest impacts to historic properties would be expected to result from coastal storm surges and fluvial flooding from the Hackensack River, Berry's Creek, and associated ditches during substantial storm events. Depending on the frequency and severity of these events, impacts to historic properties could be significant, and could include substantial changes to the character-defining features of historic architectural resources (e.g., through flood-related damage, abandonment or neglect, or other adverse changes to historic structures), as well as potentially changes to the environment of historic architectural structures (e.g., more regular inundation of an area, changes in adjacent properties, and the like). Erosion from coastal storm surge, fluvial flooding, and SLR could also significantly impact archaeological resources overtime through erosion or other flood-related disturbances.

4.6.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding of the Project Area from high tides and coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts to cultural resources:

- ***Long-term, potentially significant adverse*** effects where excavation and construction is proposed within or near archaeological sites or unanticipated archaeological discoveries.
- ***Long-term, potentially significant adverse*** effects to the US Route 46 Bascule Bridge, an NRHP-eligible historic architectural resource, due to the establishment of the proposed Fluvial Park.
- ***Short-term, less-than-significant adverse*** effects to the US Route 46 Bascule Bridge from dust, noise, and vibration associated with construction activities.

Alternative 1 would result in the following **indirect** impacts to cultural resources:

- ***Long-term, potentially significant adverse*** effects to the US Route 46 Bascule Bridge due to substantial changes associated with the viewshed as associated with the proposed Fluvial Park.
- ***Short-term, less-than-significant adverse*** effects to the physical and acoustic environment of potentially NRHP-eligible historic architectural resources within the indirect APE due to noise, dust, vibrations, and use of heavy equipment during construction.
- ***Long-term, less-than-significant adverse*** effects to the viewshed surrounding potentially NRHP-eligible historic architectural resources in the Project Area.
- ***Long-term beneficial*** effects on the protection of archaeological and historic architectural resources due to a reduction of flooding within the Project Area.

The following subsections provide greater detail.

Direct Impacts

Archaeological Resources

Most of the direct APE has been impacted by prior earth-moving activities associated with the construction of buildings, roads, and other development unrelated to the Proposed Project. No *known* archaeological resources are located within the direct APE. However, areas with a high potential to contain prehistoric and historic period archaeological resources (i.e., high archaeological sensitivity areas) were identified for portions of the direct APE based on background research, historic maps, aerial photographs, and a site visit. The five areas of *high archaeological sensitivity* include the Fluvial Park, K-Town Park, DePeyster Creek Park, BCUA, and Berry's Creek Archaeological Sensitivity Areas[53]. Descriptions of these *high archaeological sensitivity* areas and the activities proposed in these areas under Alternative 1 are provided below[54], and summarized in **Table 4.6-2**.

- The **Fluvial Park Archaeological Sensitivity Area** is associated with the former location of the West Ridgefield Boat Club; the former Boat Club is depicted on a 1915 United States Coastal and Geodetic Survey map (United States Coast and Geodetic Survey Map 1915). The Boat Club building is no longer standing; however, a wooden utility pole and wooden piers remain and there is high sensitivity for additional archaeological materials. The location is currently undeveloped and overgrown with vegetation. Under Alternative 1, vegetation clearing and the construction of an elevated walkway as part of the proposed Fluvial Park would occur in the vicinity of the former location of the Boat Club.
- The **K-Town Park Archaeological Sensitivity Area** is associated with the former location of a toll booth, store, and other structures depicted on 19th century maps. This site, located adjacent to the Bergen Turnpike, currently contains one vacant building, three vacant sheds, and a paved parking lot. The direct APE at the proposed K-Town Park area has a high sensitivity for historic archaeological resources associated with this historic use, coupled with a limited amount of subsequent development at this location. Under Alternative 1, activities in this area would include the construction of a 1.4-acre park called K-Town Park, a cantilever system, a walkway, and boat dock/kayak launch.
- The **DePeyster Creek Park Archaeological Sensitivity Area**, located south of Dietrich Street and east of Maiden Lane, currently consists of undeveloped land adjacent to a tributary of the Hackensack River. Under Alternative 1, establishment of the proposed DePeyster Creek Park would include vegetation clearing and construction of a drainage swale, floodwall, and viewing platform. Based on the proximity to the tributary and lack of prior earth-moving in this area, the proposed DePeyster Creek Park has a high sensitivity for Native American archaeological resources.
- The **BCUA Archaeological Sensitivity Area** is located along the Hackensack River in the northern portion of the BCUA property where the Nicholas Mehrhof Brickyard operated from the

[53] Fluvial Park, K-Town Park, and DePeyster Creek Park are proposed elements under Alternative 1, as described in **Section 2.5.2**.

[54] If Alternative 1 is identified as the Preferred Alternative, AECOM recommends that a Phase IB archaeological survey be completed if feasible in the direct APE for the Fluvial Park, K-Town Park, DePeyster Creek Park, BCUA, and Berry's Creek Archaeological Sensitivity Areas. However, hazardous material conditions and landowner access may affect the ability to complete the Phase IB archaeological fieldwork. The Phase IB survey would determine if potentially significant archaeological resources are located in the Alternative 1 direct APE.

second half of the 19th century through the early 20th century. This area is currently undeveloped. Under Alternative 1, activities in this area would include the construction of a floodwall and drainage swale. This portion of the direct APE has a high sensitivity for remains of the Nicholas Mehrhof Brickyard.

- The **Berry's Creek Archaeological Sensitivity Area** is located on the east side of Berry's Creek, south of the Paterson Plank Road. Historic research and mapping indicate that, in the late 19th and early 20th century, the Berry's Creek Casino and Hotel was present in this portion of the direct APE (Bromley 1913); a high sensitivity for historic period archaeological deposits related to the casino and hotel exist. The buildings associated with the casino and hotel are no longer standing. This portion of the direct APE is currently vegetated. Under Alternative 1, activities in this area would include the construction of the Berry's Creek Surge Barrier and associated appurtenances.

Table 4.6-2: Archaeological Sensitivity Areas for Alternative 1

Archaeological Sensitivity Area	Proposed Activity	Location	Municipality	Archaeological Sensitivity
Fluvial Park	Vegetation clearing and elevated walkway as part of 3.5-acre Fluvial Park	On Hackensack River, 300 feet north of Route 46 Bridge	Borough of Little Ferry	Early 20th century West Ridgefield Boat Club, high sensitivity
K-Town Park	1.4 acre of public park (K-Town Park), boat dock, walkways	Bergen Turnpike and Hackensack River	Borough of Little Ferry	19th century buildings, high sensitivity
DePeyster Creek Park	0.4 acre of public park (DePeyster Creek Park)	Southeast of the intersection of Dietrich Street and Maiden Lane	Borough of Little Ferry	Native American archaeological resources, high sensitivity
BCUA	Floodwall and drainage swale	BCUA property along Hackensack River	Borough of Little Ferry	19th century Nicholas Mehrhof Brickyard, high sensitivity
Berry's Creek	Berry's Creek Surge Barrier	Southern side of Paterson Plank Road on east side of Berry's Creek	Borough of East Rutherford	Late 19th to early 20th century Berry's Creek Casino and Hotel, high sensitivity

The potential direct impacts to archaeological resources, if present, in the five areas of *high archaeological sensitivity* would be from construction activities. Heavy equipment used to grade terrain would disturb archaeological deposits, archaeological features, and mix artifacts. Excavations during construction would remove archaeological remains. The installation of sheet piles and timber piles into the ground would impact archaeological features. Compaction of the terrain would damage archaeological features and deposits near the ground surface. If NRHP-eligible archaeological resources are present in these areas, such construction-related disturbance would be a ***long-term, potentially significant adverse*** impact to these archaeological resources.

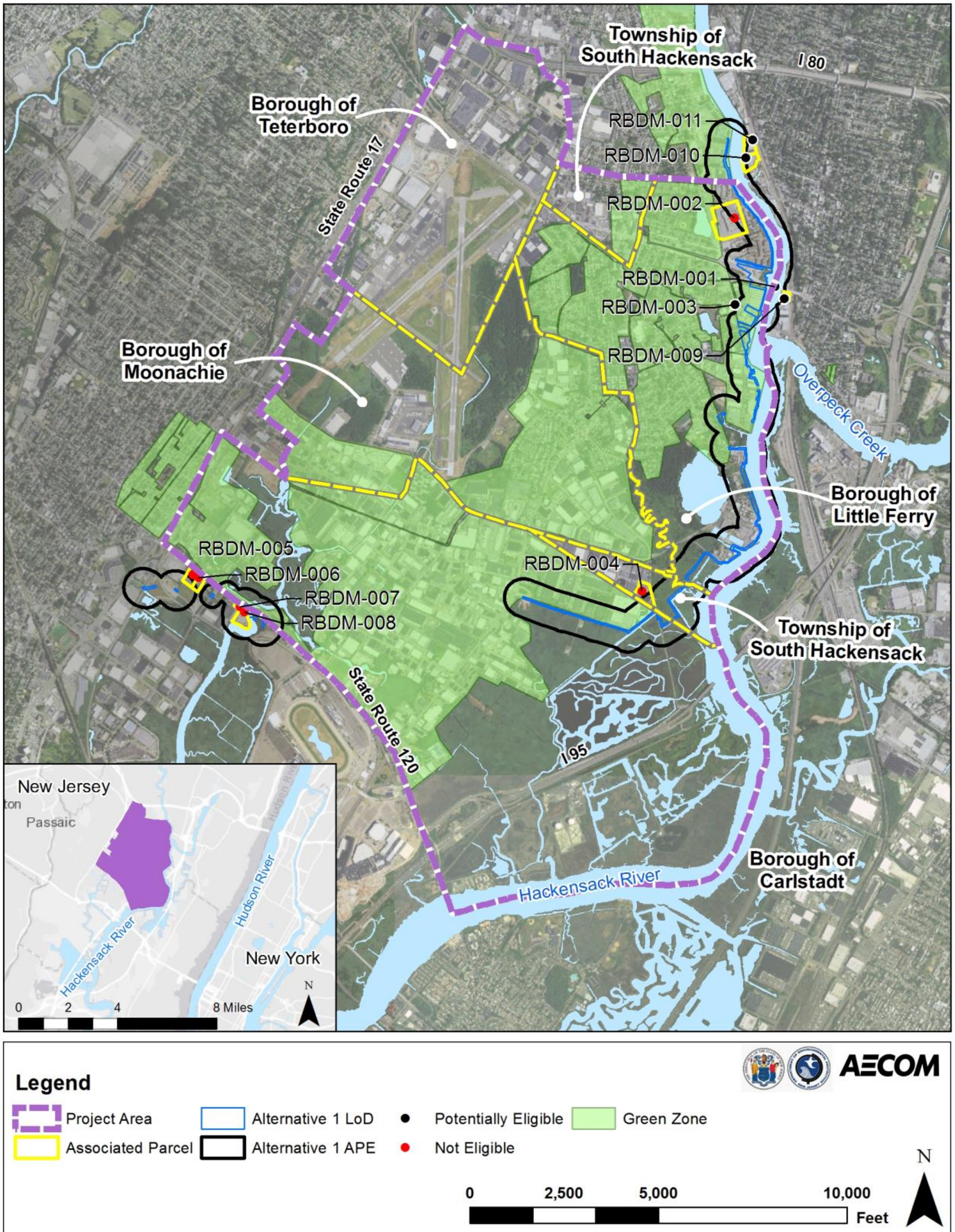
Historic Architectural Resources

A reconnaissance-level cultural resources survey, including historic architectural fieldwork, identified historic architectural resources within the Alternative 1 APE that are more than 45 years of age. The historic architectural fieldwork was restricted to the portion of the Alternative 1 APE located outside of the Historic Preservation Exclusion Green Zones. As depicted in **Figure 4.6-1**, this APE includes the area within 500 feet of proposed construction activities, as well as all resources over 45 years of age within this area; these resources have the potential to be directly or indirectly impacted by Alternative 1.

A total of 11 historic architectural resources were recorded within the Alternative 1 APE (see **Table 4.6-3**). Of those 11 resources, one had been previously surveyed and identified through background research: the US Route 46 Bascule Bridge constructed in 1934 (determined to be NRHP-eligible on February 21, 1997). The remaining 10 historic architectural resources were identified through field survey; this work included preliminary assessment of each structure's eligibility for listing in the NRHP based on visual inspection, historic mapping analysis, and desktop research. Based on these preliminary assessments, four of the 10 newly identified resources were determined to be potentially NRHP-eligible.

Based on these data, Alternative 1 has the potential to directly impact one historic architectural resource: the NRHP-eligible US Route 46 Bascule Bridge. Effects to the four potentially NRHP-eligible historic architectural resources are anticipated to be indirect. A summary of anticipated direct and indirect effects to NRHP-eligible and potentially NRHP-eligible[55] historic architectural resources is provided in **Table 4.6-4**.

[55] For the four newly identified historic architectural resources that appear potentially eligible, an intensive-level survey is required before making a final recommendation on eligibility for listing in the NRHP.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.6-1:Historic Architectural Resources in the Alternative 1 APE

Table 4.6-3: Historic Architectural Resources in the Alternative 1 APE[56]

Survey No.	Current Name / Description	Address	Municipality	NRHP Status/ Eligibility Recommendation
RBDM-001	US Route 46 Bascule Bridge (SI&A #0221155)	US Route 46 over the Hackensack River	Borough of Little Ferry; Village of Ridgefield Park	Individually Eligible: 2/21/1997
RBDM-002	One-story commercial building	260 Bergen Turnpike	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-003	Little Ferry National Bank	2-10 Main Street	Borough of Little Ferry	No Previous Review; Potentially Eligible
RBDM-004	Bind Rite Services	10-34 Horizon Boulevard	Township of South Hackensack	No Previous Review; Not Eligible
RBDM-005	One-story light industrial building with office	890 Paterson Plank Road	Borough of East Rutherford	No Previous Review; Not Eligible
RBDM-006	One-story brick garage	880 Paterson Plank Road	Borough of East Rutherford	No Previous Review; Not Eligible
RBDM-007	Saccos Sales and Service	288 Paterson Plank Road	Borough of East Rutherford	No Previous Review; Not Eligible
RBDM-008	One-story brick auto repair shop	200 Paterson Plank Road	Borough of East Rutherford	No Previous Review; Not Eligible
RBDM-009	Large industrial complex	Industrial Avenue between US Route 46 and Bergen Turnpike	Village of Ridgefield Park	No Previous Review; Potentially Eligible
RBDM-010	Dowling Fuel Company	100 Industrial Avenue	Village of Ridgefield Park	No Previous Review; Potentially Eligible
RBDM-011	Former mill complex; Little Ferry Paper Co.	185 Industrial Avenue	Village of Ridgefield Park	No Previous Review; Potentially Eligible

Note: Shading identifies NRHP-eligible or potentially NRHP-eligible historic architectural resource.

[56] NRHP status on record with the NJHPO in Trenton, New Jersey; records also available online at the NJHPO website (http://www.nj.gov/dep/hpo/1identify/nrsr_lists.htm) and on NJ-GeoWeb (http://www.nj.gov/dep/gis/geowebsplash.htm).

Table 4.6-4: Potential Direct and Indirect Effects of Alternative 1 on NRHP-Eligible and Potentially NRHP-Eligible Historic Architectural Resources

Survey No.	Current Name / Description	Potential for Direct Adverse Effect	Potential for Indirect Adverse Effect
RBDM-001	US Route 46 Bascule Bridge (SI&A #0221155)	A ***long-term, potentially significant adverse*** effect is possible as a result of potential physical alterations associated with Fluvial Park.	***Short-term, less-than-significant adverse*** effects, including temporary vibration and acoustic effects, as a result of the construction phase of the Fluvial Park; however, more research is necessary to determine the degree of impact due to construction activities. Operation of the Fluvial Park could also introduce visual elements into the resource's setting and cause a ***long-term, potentially significant adverse*** effect.
RBDM-003	Little Ferry National Bank	None	***Short- and long-term, less-than-significant adverse*** effects to physical and acoustic environment during construction, and long-term changes to the viewshed.
RBDM-009	Large industrial complex	None	***Short- and long-term, less-than-significant adverse*** effects to physical and acoustic environment during construction, and long-term changes to the viewshed.
RBDM-010	Dowling Fuel Company	None	***Short- and long-term, less-than-significant adverse*** effects to physical and acoustic environment during construction, and long-term changes to the viewshed.
RBDM-011	Former mill complex; Little Ferry Paper Co.	None	***Short- and long-term, less-than-significant adverse*** effects to physical and acoustic environment during construction, and long-term changes to the viewshed.

Indirect Impacts

Archaeological Resources

No indirect adverse effects to archaeological resources are anticipated during the construction and operation of Alternative 1. However, implementation of Alternative 1 would provide increased protection of the Project Area from flooding. As such, ***long-term beneficial*** effects through the increased protection of archaeological resources within the Project Area from flooding would be anticipated.

Historic Architectural Resources

Implementation of Alternative 1 has the potential to result in ***long-term, potentially significant adverse*** effects to one historical architectural resource: the NRHP-eligible US Route 46 Bascule Bridge. Short-term, construction-related effects, including noise, dust, vibrations, and use of heavy equipment during construction of the proposed Fluvial Park and floodwall, would be expected to be less than significant.

However, the proposed changes to the viewshed and historic context surrounding the bridge could be significant. It is unknown at this time whether indirect effects would result in some diminishment of the bridge's character-defining features; this will be determined through further consultation with the NJHPO.

Short- and long-term, less-than-significant adverse effects or ***no effects*** are anticipated for the remaining potentially NRHP-eligible historic architectural resources in the indirect APE; the proposed construction activities would occur at a considerable distance from these resources, the impact to their viewsheds and noise levels would be minimal, and the surrounding areas are heavily developed with commercial and industrial development and high-occupancy roadways that already generate considerable noise.

Operation of Alternative 1, however, would provide increased, long-term flood protection for historic architectural resources within the Project Area from coastal storm surges. This increased flood protection would reduce environmental wear on historic structures that quickens deterioration of materials and integrity. By reducing potential damage from continued and increased flooding over time, Alternative 1 would provide increased physical protection for built heritage in the Project Area, a ***long-term beneficial*** effect.

Mitigation Measures and BMPs

The following mitigation measures and/or BMPs would be implemented to reduce identified potentially significant adverse impacts to less-than-significant levels.

<u>Archaeological Resources</u>

- The NJDEP would consult with the NJHPO pursuant to 36 CFR § 800.5 of the NHPA to comply with Section 106 and minimize effects to NRHP-eligible <u>archaeological</u> resources. The following steps would be undertaken sequentially:
    - As part of the Section 106 process, the Phase IA archaeological survey report for the Proposed Project's direct APE would be submitted to the NJHPO for review.
    - After NJHPO's review of the Phase IA report, a Phase IB archaeological survey would be completed in areas of *high archaeological* sensitivity where access can be obtained and hand excavations can be conducted (i.e., provided hazardous soil conditions are not present). Archaeological monitoring during construction may be necessary in locations of high sensitivity where Phase IB testing cannot be completed.
    - If potentially significant archaeological resources are identified within the direct APE during the Phase IB work, a Phase II archaeological survey would be conducted in consultation with the NJHPO.
    - If, in consultation with the NJHPO, the Phase II archaeological survey determines that archaeological resources within the direct APE are NRHP-eligible, avoidance or mitigation measures would be developed in consultation with the NJHPO. Protective measures (e.g., matting and fencing) may also be necessary. In addition, Phase III archaeological data recovery or archaeological monitoring protocols would be developed in consultation with NJHPO for NRHP-eligible archaeological resources.

- An unanticipated discovery plan for archaeological resources would be developed in case significant archaeological resources are encountered during construction. This plan would be developed in consultation with NJHPO.
- For any new or additional project elements that would involve subsurface construction and for which the effects of such construction have not yet been analyzed as part of the NEPA process, potential effects on archaeological resources would be assessed by the NJDEP, following the consultation requirements set forth in 36 CFR Part 800.

Historic Architectural Resources

- The NJDEP would consult with the NJHPO pursuant to 36 CFR § 800.5 of the NHPA to comply with Section 106 and minimize effects to NRHP-eligible historic architectural resources. The following steps would be undertaken sequentially:
  - The NJDEP would consult with the NJHPO, pursuant to 36 CFR 800.4 of the NHPA, to obtain concurrence on the APE.
  - The NJDEP would consult with the NJHPO, pursuant to 36 CFR 800.4 of the NHPA, to obtain concurrence on the identification and evaluation of historic architectural resources, including their NRHP eligibility.
  - The NJDEP would prepare a Historic Architectural Survey/Determination of Eligibility Report and submit to the NJHPO for review and concurrence.
  - Using the above data, and pursuant to 36 CFR § 800.5 of the NHPA, the NJDEP would apply the criteria of adverse effect to NRHP-eligible properties, and determine potential effects.
  - In consultation with the NJHPO, the NJDEP would mitigate identified adverse effects in accordance with the requirements of Section 106 of the NHPA.
    - Short-term adverse effects to the US Route 46 Bascule Bridge may be mitigated by limiting the degree and magnitude of the construction activities as they encroach on the structure. Mitigation to address potential long-term (significant) adverse effects to the bridge would be determined through consultation with NJ HPO pursuant to 36 CFR § 800.5.
    - Potential visual effects to historic architectural resources resulting from Alternative 1 could be mitigated by selection of materials that are compatible with surroundings in terms of composition, color, texture, and overall appearance, in consultation with the NJHPO.

4.6.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Long-term, potentially significant adverse*** effects where excavation and construction is proposed within or near archaeological sites or unanticipated archaeological discoveries.
- ***Long-term, potentially significant adverse*** effects to the US Route 46 Bascule Bridge, an NRHP-eligible historic architectural resource, due to the establishment of the proposed Fluvial Park.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, potentially significant adverse*** effects to the US Route 46 Bascule Bridge due to substantial changes associated with the viewshed.
- ***Short-term, less-than-significant adverse*** effects to the physical and acoustic environment of potentially NRHP-eligible historic resources identified within the indirect APE due to noise, dust, vibrations, and use of heavy equipment during construction.
- ***Long-term, less-than-significant adverse*** effects to the viewshed surrounding potentially NRHP-eligible historic architectural resources in the Project Area.
- ***Long-term, beneficial*** effects on the protection of archaeological and historic architectural resources due to a reduction of inland flooding within the Project Area.

The following subsections provide greater detail.

Direct Impacts

Archaeological Resources

The majority of activities proposed in Alternative 2 would occur in previously disturbed locations such as within active roadways and sidewalks, therefore reducing the potential for direct impacts to possible archaeological resources over those proposed in Alternative 1. No *known* archaeological resources are located within the direct APE. However, areas with a high potential to contain prehistoric period archaeological resources (i.e., *high archaeological sensitivity* areas) were identified for portions of the direct APE based on background research, historic maps, aerial photographs, and a site visit. The three areas of *high archaeological sensitivity* include the DePeyster Creek Park, Avanti Park, and Caesar Place Park Archaeological Sensitivity Areas. Descriptions of these *high archaeological sensitivity* areas and the activities proposed in these areas under Alternative 2 are provided below,[57] compared with the archaeological sensitivity areas identified in proposed Alternate 1 in **Table 4.6-5**. None of the archaeological sensitivity areas identified under Alternative 1 would be affected.

- The **DePeyster Creek Park Archaeological Sensitivity Area**, located south of Dietrich Street and east of Maiden Lane, currently consists of undeveloped land adjacent to a tributary of the Hackensack River. Under Alternative 2, establishment of the proposed DePeyster Creek Park would include vegetation clearing and construction of a drainage swale, floodwall, walking trails, and plazas. Based on the proximity to the tributary and lack of prior earth-moving in this area, the northern extent of the proposed DePeyster Creek Park has a high sensitivity for Native American archaeological resources.
- The **Avanti Park Archaeological Sensitivity Area**, located east of Moonachie Road (Route 503) and south of Carol Place, currently consists of undeveloped lawn adjacent to First Presbyterian Church of Moonachie. Under Alterative 2, establishment of the proposed Avanti Park would include construction of wetlands, elevated walkways, and other improvements. Based on the proximity to

[57] If Alternative 2 is constructed, a Phase IB archaeological survey should be completed if feasible in the direct APE for the DePeyster Creek Park, Avanti Park, and the Caesar Place Park Archaeological Sensitivity Areas. The Phase IB survey would determine if potentially significant archaeological resources are located in the Alternative 2 direct APE.

an historic drainage, the proposed Avanti Park has a high sensitivity for Native American archaeological resources.

- The **Caesar Place Park Archaeological Sensitivity Area**, located between Caesar Place and East Riser Ditch, is currently undeveloped and covered in upland successional shrubland vegetation. Activities proposed under Alternative 2 include vegetation clearing and construction of play areas, an elevated boardwalk and viewing platforms, and road-adjacent rain gardens. The proposed Caesar Place Park landform has a high sensitivity for Native American resources, based upon its proximity to East Riser Ditch and position adjacent to a relic wetland.

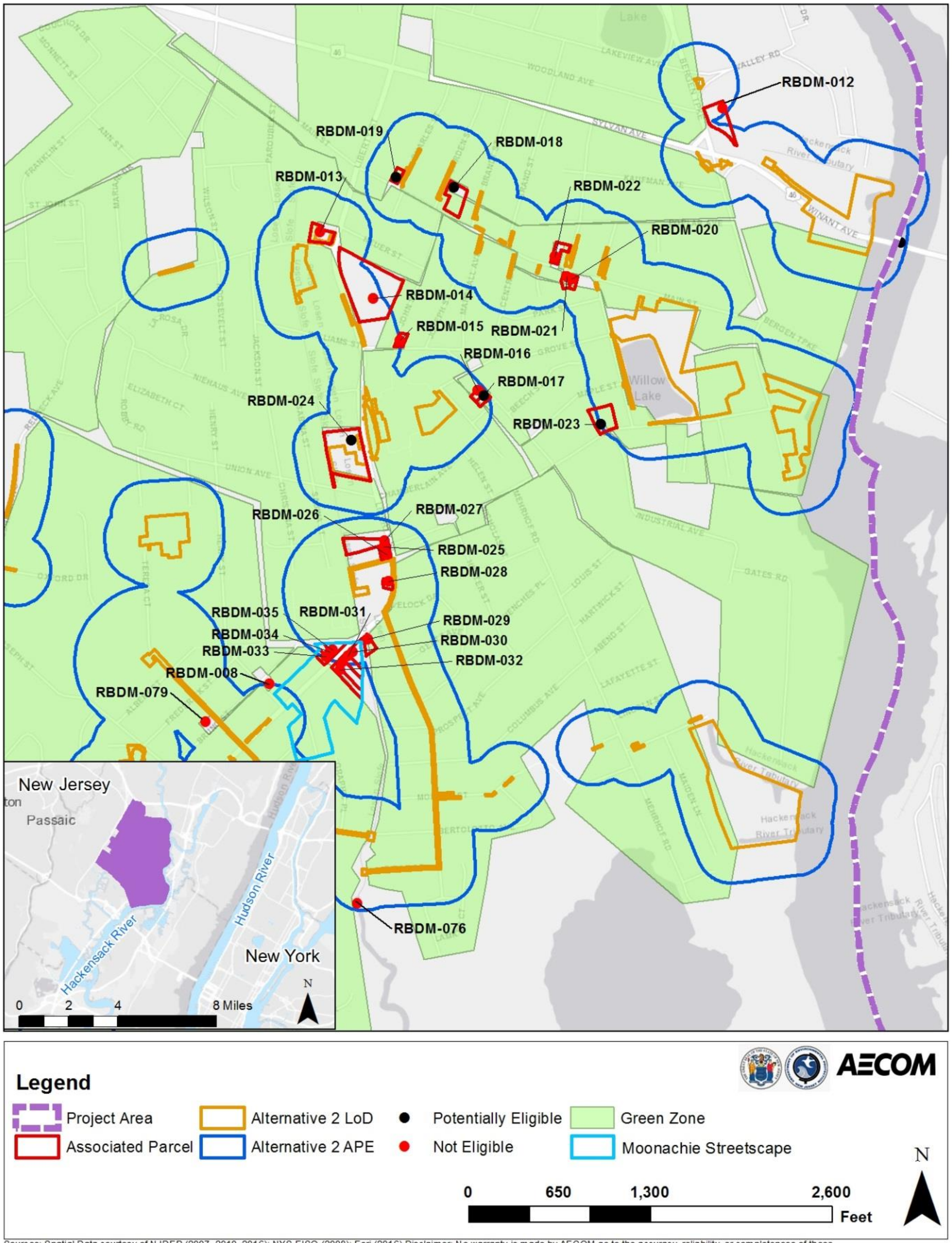
Table 4.6-5: Archaeological Sensitivity Areas for Alternative 2

Archaeological Sensitivity Area	Location	Municipality	Archaeological Sensitivity
DePeyster Creek Park	Southeast of the intersection of Dietrich Street and Maiden Lane	Borough of Little Ferry	Native American archaeological resources, high sensitivity
Avanti Park	Southeast of the intersection of Moonachie Road and Carol Place	Borough of Moonachie	Native American archaeological resources, high sensitivity
Caesar Place Park	Between Caesar Place and East Riser Ditch	Borough of Moonachie	Native American archaeological resources, high sensitivity

The potential direct impacts to archaeological resources, if present, in the three areas of *high archaeological sensitivity* would be from construction activities, similar to Alternative 1 (see **Section 4.6.4.2**). If NRHP-eligible archaeological resources are present in these areas, such construction-related disturbance would be a ***long-term, potentially significant adverse*** impact to these archaeological resources.

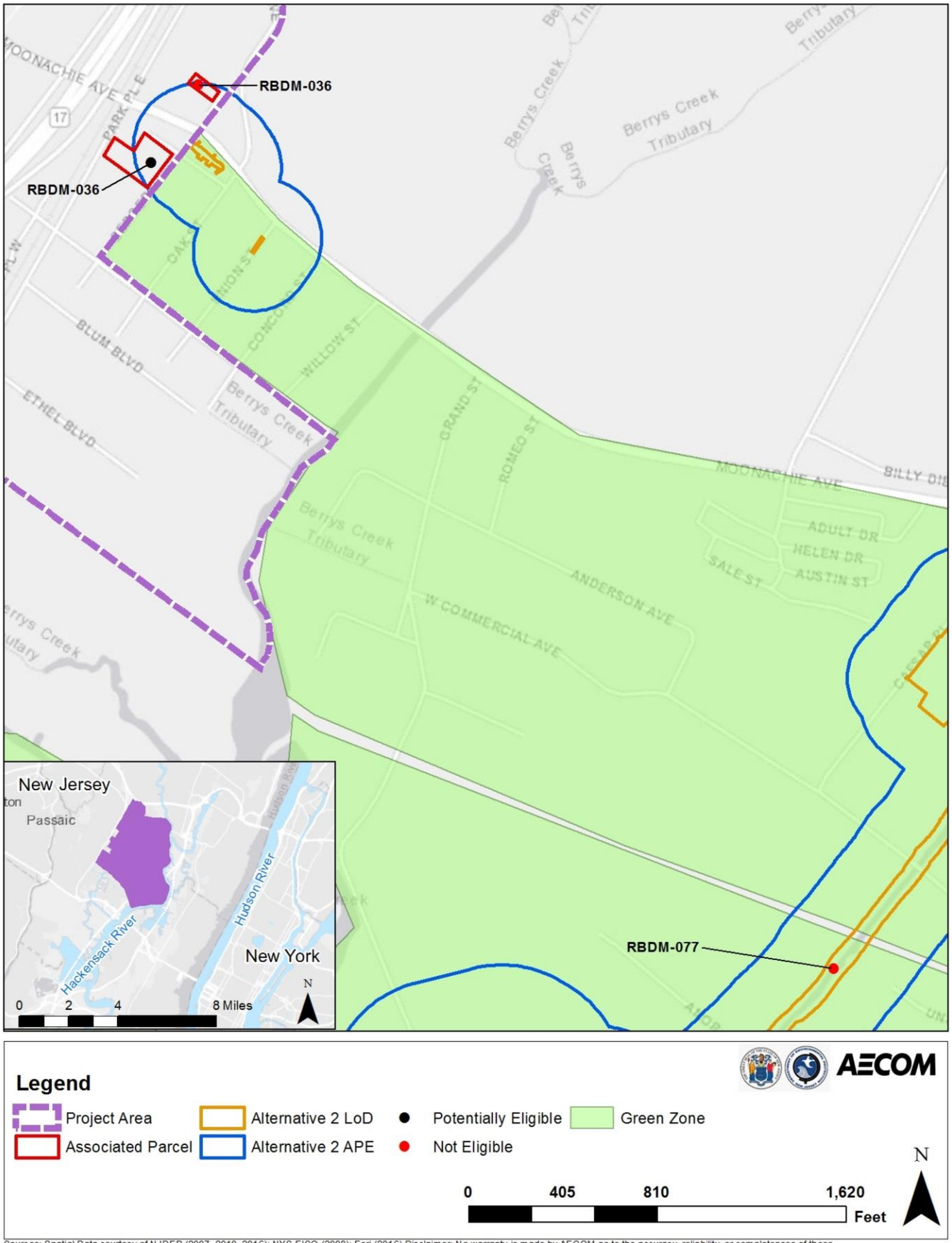
Historic Architectural Resources

A reconnaissance-level cultural resources survey, including historic architectural fieldwork, identified historic architectural resources within the Alternative 2 APE that are more than 45 years of age. The historic architectural fieldwork was restricted to the portion of the Alternative 2 APE located outside of the Historic Preservation Exclusion Green Zones. As depicted in **Figure 4.6-2** and **Figure 4.6-3**, this APE includes the area within 250 feet of proposed at-grade green and grey infrastructure improvements and within 500 feet of proposed above-grade grey infrastructure improvements, including pump stations and floodwalls, as well as all resources over 45 years of age within this area; these resources have the potential to be directly or indirectly impacted by Alternative 2.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.6-2: Historic Architectural Resources in the Alternative 2 APE (Figure 1 of 2)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.6-3: Historic Architectural Resources in the Alternative 2 APE (Figure 2 of 2)

A total of 32 historic architectural resources were recorded within the Alternative 2 APE (see **Table 4.6-6**). Of those 32 resources, three had been previously surveyed and identified through background research: the US Route 46 Bascule Bridge constructed in 1934 (determined to be NRHP-eligible on February 21, 1997); the Moonachie Streetscape (identified on June 1, 1981); and 69 Bruno Street (identified on January 1, 2005). The remaining 29 resources were identified through field survey; this work included preliminary assessment of each structure's eligibility for listing in the NRHP based on visual inspection, historic mapping analysis, and desktop research. Based on preliminary assessments, 8 of the 32 resources were determined to be potentially NRHP-eligible. Intensive-level survey was conducted for the eight potentially eligible resources. Only one of the eight is recommended eligible. The American Sokol Little Ferry is recommended eligible for the NRHP under Criterion A for its association with the Czech Sokol movement and the growth of the Czech immigrant community in Little Ferry in the late nineteenth and early twentieth century.

Based on these data, Alternative 2 has the potential to directly impact one historic architectural resource: the NRHP-eligible US Route 46 Bascule Bridge. Effects to the American Sokol Little Ferry are anticipated to be indirect and not adverse. In comparison to Alternative 1, Alternative 2 has a lower potential to indirectly impact historic architectural resources. Although the Alternative 2 components are located within dense historic neighborhoods and along historic commercial corridors with large concentrations of properties 45 years of age or older, the majority of these resources do not appear to be NRHP-eligible. In addition, the green and grey infrastructure improvements are lower in scale and height than the floodwalls proposed in Alternative 1, and thus have less potential for indirect visual effects. A summary of anticipated direct and indirect effects to NRHP-eligible and potentially NRHP-eligible historic architectural resources is provided in **Table 4.6-7**.

Table 4.6-6: Historic Architectural Resources in the Alternative 2 APE

Survey No.	Current Name / Description	Address	Municipality	NRHP Status/ Eligibility Recommendation
RBDM-001**	US Route 46 Bascule Bridge (SI&A #0221155)	US Route 46 over the Hackensack River	Borough of Little Ferry; Village of Ridgefield Park	Individually Eligible: 2/21/1997
--	Moonachie Streetscape	Moonachie Road	Borough of Moonachie	Identified: 6/1/1981 with 1/1/2005 update; Not Eligible
RBDM-079	69 Bruno Street	69 Bruno Street	Borough of Moonachie	Identified: 1/1/2005; Not Eligible
RBDM-008	29 Bruno Street	29 Bruno Street	Borough of Moonachie	No Previous Review; Not Eligible
RBDM-012	150 US Route 46 West	150 US Route 46 West	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-013	Little Ferry Free Public Library	239 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible

Survey No.	Current Name / Description	Address	Municipality	NRHP Status/ Eligibility Recommendation
RBDM-014	JS Popper Inc. / Material Imports	200 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-015	20 Kavrik Street	20 Kavrik Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-016	59 Marshall Avenue	59 Marshall Avenue	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-017	55 Marshall Avenue	55 Marshall Avenue	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-018**	Sokol Little Ferry	9-13 Garden Street	Borough of Little Ferry	No Previous Review; Potentially Eligible
RBDM-019	Louis C L'Heureux Real Estate	208 Main Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-020	Meyer's Auto Body	111 Main Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-021	119 Main Street	119 Main Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-022	Little Ferry Hook & Ladder Co	124 Main Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-023	96 Washington Avenue	96 Washington Avenue	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-024	Washington School	123 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-025	59 Liberty Street	59 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-026	55 Liberty Street	55 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible

Survey No.	Current Name / Description	Address	Municipality	NRHP Status/ Eligibility Recommendation
RBDM-027	63 Liberty Street	63 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-028	Law Offices of Dennis J Francis / Cronin Hardwood Floors	37 Liberty Street	Borough of Little Ferry	No Previous Review; Not Eligible
RBDM-029	2 Liberty Street	2 Liberty Street	Borough of Moonachie	Identified 1/1/2005; Not Eligible
RBDM-030	5 Moonachie Road	5 Moonachie Road	Borough of Moonachie	Identified 1/1/2005; Not Eligible
RBDM-031	7 Moonachie Road	7 Moonachie Road	Borough of Moonachie	Identified 1/1/2005; Not Eligible
RBDM-032	9 Moonachie Road	9 Moonachie Road	Borough of Moonachie	No Previous Review; Not Eligible
RBDM-033	12 Moonachie Road	12 Moonachie Road	Borough of Moonachie	Identified 1/1/2005; Not Eligible
RBDM-034	8 Moonachie Road	8 Moonachie Road	Borough of Moonachie	Identified 1/1/2005; Not Eligible
RBDM-035	6 Moonachie Road	6 Moonachie Road	Borough of Moonachie	Identified 1/1/2005; Not Eligible
RBDM-036	Nicks Towing Service	209 Berger Street	Borough of Wood-Ridge	No Previous Review; Not Eligible
RBDM-037	Praxair / Peter Brooks	179-185 Berger Street	Borough of Wood-Ridge	No Previous Review; Not Eligible
RBDM-076	Losen Slote Tide Gate	Birch Street at Losen Slote Creek	Borough of Moonachie	No Previous Review; Not Eligible
RBDM-077	Rail Bridge over East Riser Ditch	Amor Avenue at East Riser Ditch	Borough of Carlstadt	No Previous Review; Not Eligible

**Note: Shading identifies NRHP-eligible or potentially NRHP-eligible historic architectural resource.

Table 4.6-7: Potential Direct and Indirect Effects of Alternative 2 on NRHP-Eligible and Potentially NRHP-Eligible Historic Architectural Resources

Survey No.	Current Name / Description	Potential for Direct Adverse Effect	Potential for Indirect Adverse Effect
RBDM-001	US Route 46 Bascule Bridge (SI&A #0221155)	A ***long-term, potentially significant adverse*** effect is possible as a result of potential physical alterations associated with Fluvial Park.	***Short- and long-term, less-than-significant adverse*** effects to physical and acoustic environment during construction, and long-term changes to the viewshed. Operation of Fluvial Park could also introduce visual elements into the resource's setting and cause a ***long-term, potentially significant adverse*** effect.
RBDM-18	American Sokol Little Ferry	None	***Short- and long-term, less-than-significant adverse*** effects to physical and acoustic environment during construction, and long-term changes to the viewshed.

Indirect Impacts

Archaeological Resources

No indirect adverse effects to archaeological resources are anticipated during the construction and operation of Alternative 2. However, implementation of Alternative 2 would provide increased protection of the Project Area from flooding. As such, ***long-term beneficial*** effects through the increased protection of archaeological resources within the Project Area from flooding would be anticipated.

Historic Architectural Resources

Implementation of Alternative 2 has the potential to result in ***long-term, potentially significant adverse*** effects to one historic architectural resource: the NRHP-eligible US Route 46 Bascule Bridge. Short-term, construction-related effects, including noise, dust, vibrations, and use of heavy equipment during construction of the stormwater drainage improvements would be expected to be less than significant. However, the proposed changes to the viewshed and historic context surrounding the bridge could be significant. It is unknown at this time whether indirect effects would result in some diminishment of its character-defining features; this will be determined through further consultation with the NJHPO.

Short- and long-term, less-than-significant adverse effects or ***no effect*** are anticipated for the American Sokol Little Ferry; the proposed construction activities would occur outside the property limits and the impact to its viewshed, the general historic environment, setting, and noise levels are expected to be temporary and minimal.

Operation of Alternative 2, however, would provide increased, long-term flood protection for historic architectural resources within the Project Area from inland flooding from heavy precipitation events. This increased flood protection would reduce environmental wear on historic structures that quickens deterioration of materials and integrity. By reducing potential damage from continued and increased flooding over time, Alternative 2 would provide increased physical protection for built heritage in the Project Area, a ***long-term, beneficial*** effect.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 1 would be implemented to reduce the identified ***potentially significant, adverse*** impacts on archaeological and historic architectural resources under Alternative 2 (see **Section 4.6.4.2**).

4.6.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects archaeological or historic architectural resources, and thus would not change the impact analysis. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2.

Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences.

Direct Impacts

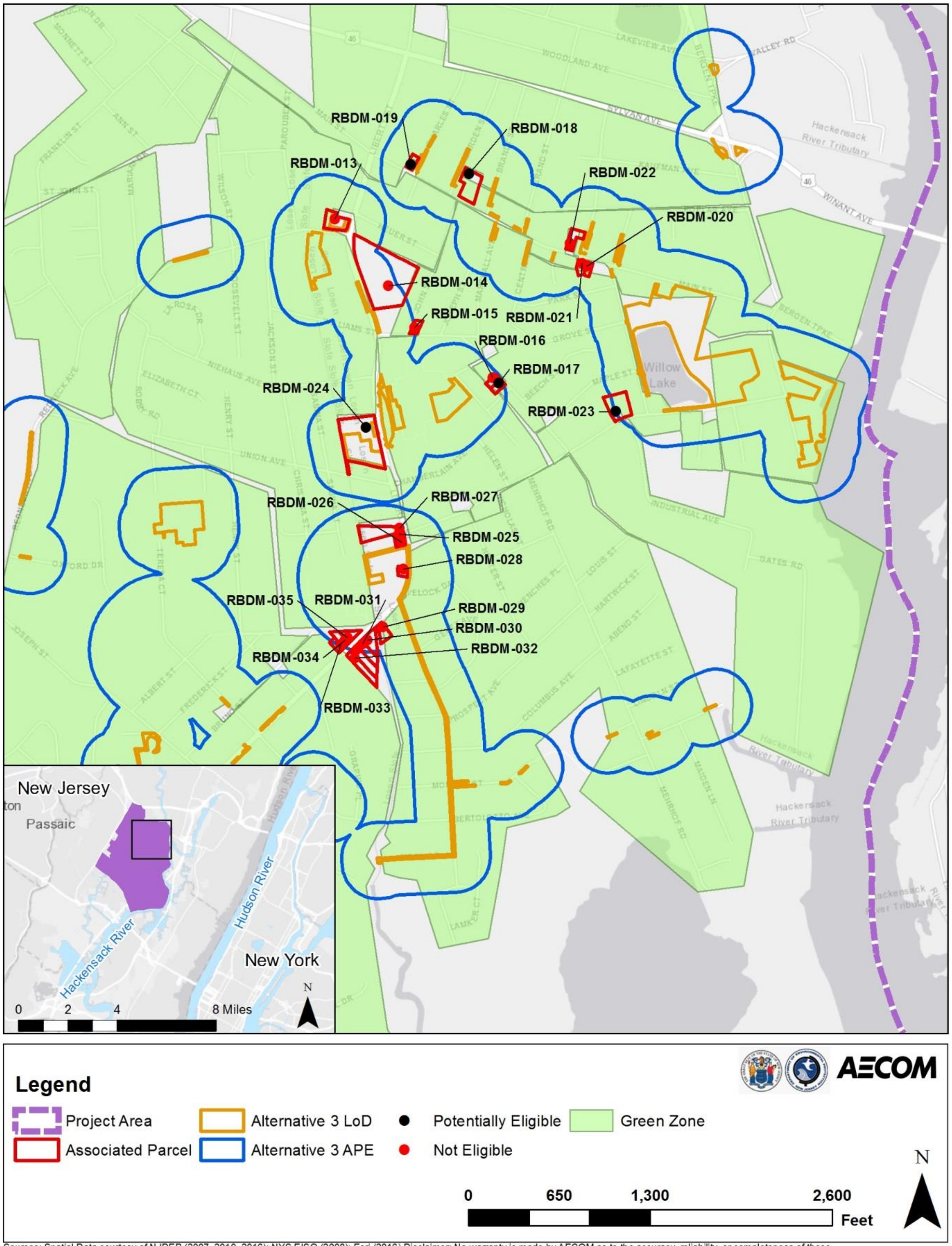
Archaeological Resources

None of the archaeological sensitive areas identified under Alternative 1 would be affected. Only two areas of high archaeological sensitivity would be impacted because DePeyster Creek Park would not be constructed under Alternative 3 (see **Table 4.6-5**). Alternative 1 has a greater potential to impact archaeological resources, while Alternative 2 has a slightly greater potential to impact archaeological resources than Alternative 3.

Historic Architectural Resources

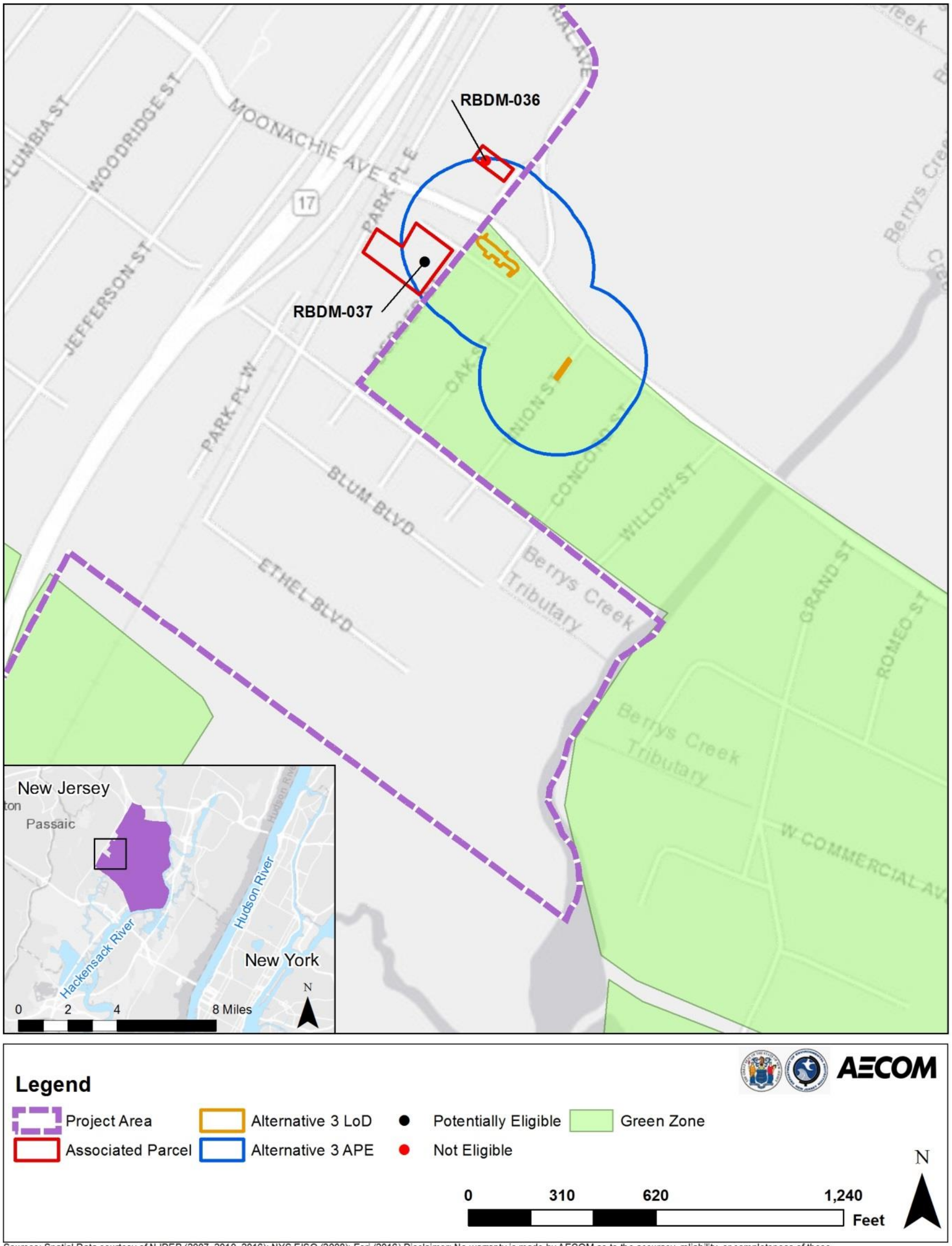
A total of 31 historic architectural resources were identified within the Alternative 3 APE (see **Figure 4.6-4** and **Figure 4.6-5**). Two of these 31 resources had been previously surveyed and identified through background research: the Moonachie Streetscape (identified on June 1, 1981) and 69 Bruno Street (identified on January 1, 2005). The remaining 29 resources were identified through field survey; this work included preliminary assessment of each structure's eligibility for listing in the NRHP based on visual inspection, historic mapping analysis, and desktop research. Based on these preliminary assessments, 8 of the 31 resources were determined to be potentially NRHP-eligible (see **Table 4.6-6**). Intensive-level survey was conducted for the eight potentially eligible resources. Only one of the eight is recommended eligible. The American Sokol Little Ferry is recommended eligible for the NRHP under Criterion A for its association with the Czech Sokol movement and the growth of the Czech immigrant community in Little Ferry in the late nineteenth and early twentieth century.

Alternative 3 has a lower potential than Alternatives 1 and 2 to directly impact historic architectural resources because the only NRHP-eligible historic architectural resource in the Project Area – the US Route 46 Bascule Bridge – is outside the APE for this alternative.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.6-4: Historic Architectural Resources in the Alternative 3 APE (Figure 1 of 2)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.6-5: Historic Architectural Resources in the Alternative 3 APE (Figure 2 of 2)

Indirect Impacts

Archaeological Resources

Similar to Alternatives 1 and 2, no indirect adverse effects to archaeological resources are anticipated during the construction and operation of Alternative 3.

Historic Architectural Resources

Indirect impacts would be similar to Alternative 2; however, ***no impact*** to the NRHP-eligible US Route 46 Bascule Bridge would occur. Short-term, construction-related effects are anticipated to be same as those for Alternative 2 (see **Section 4.6.4.3**). ***Short- and long-term, less-than-significant adverse*** effects to the American Sokol Little Ferry would be the same as Alternative 2 (see **Section 4.6.4.3**).

Operation of Alternative 3 would also provide increased, long-term flood protection for historic architectural resources within the Project Area from coastal storm surges. However, these ***long-term beneficial*** effects would be slightly less than Alternative 2 because Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and its associated force main would not be constructed.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 1 would be implemented to reduce the identified ***potentially significant, adverse*** impacts on archaeological and historic architectural resources under Alternative 3 (see **Section 4.6.4.2**).

4.7 Transportation and Circulation

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on traffic and circulation in and around the Project Area, including conditions related to vehicular traffic, parking, pedestrian and bicycle facilities, freight facilities, ancillary transportation facilities, safety, and transportation accessibility. Transportation-related impacts can be either direct or indirect. For example, a direct impact would occur if a considered alternative would directly result in construction or operational related decreases in an intersection's LOS. An indirect impact would occur if a considered alternative would temporarily close a road (e.g., from a flood gate) and thereby reroute traffic that would result in transportation delays or an increase in demand for transit, freight operations, or on-street parking in other areas.

4.7.1 Definition of Study Area

As described in **Section 3.7**, the study area for traffic and circulation is bounded by I-80 to the north, the Hackensack River to the east, State Route 120 (Paterson Plank Road) to the south, and State Route 17 to the west. The regional roadway network is connected to the Project Area by three major interstate routes, two US routes, and several State routes, including I-80, I-95, and I-280; US Route 1-9 and US Route 46; and State Routes 3, 7, 17, 120, and 495. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects on traffic and circulation.

4.7.2 Thresholds of Significance

The significance criteria used to evaluate the potential direct and indirect effects of the alternatives on traffic and circulation in the study area are shown in **Table 4.2-1**. In determining significance, LOS standards established by the New Jersey State Highway Access Management Code (NJAC 16:47-4.24 to 4.29) were used. The LOS criteria are summarized in **Table 3.7-3** in **Section 3.7.3.1**.

Table 4.7-1: Transportation and Circulation Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Transportation and Circulation Change	• Would not result in a change to an existing transportation or circulation condition
	Indirect Transportation and Circulation Change	• Would not induce other changes that could increase traffic congestion, decrease safety, decrease on-street parking supply, alter pedestrian and bicycle facilities, change demand for transit services and facilities, or change the movement patterns of freight goods
	Applies to All Effect Types	• Would not result in discernable changes to the transportation and circulation conditions in the region or locality • Would only alter transportation-related conditions for an indiscernible or negligible period of time
Less-than-Significant	Direct Transportation and Circulation Change	• Would generate less than 100 new half-trips due to either short-term construction or long-term operational activities, and would not require LOS analysis • Would generate 100 or more new half-trips, and the LOS analysis results would meet one of the following criteria: ○ Would not increase the Build Alternative traffic delay by more than 25 percent of the difference between the No Action Alternative and the bottom of LOS E (80 seconds) at a signalized intersection, if the No Action Alternative LOS is at A, B, C, D, or E ○ Would not worsen the Build Alternative traffic delay at a signalized intersection, if the No Action Alternative LOS is at F or the V/C ratio exceeds 1.2 ○ Would not worsen the Build Alternative traffic delay beyond LOS B (15 seconds) at an unsignalized intersection, if the No Action Alternative LOS is at A or B ○ Would not increase the Build Alternative traffic delay by more than 5 seconds and would not worsen the Build Alternative beyond LOS E (50 seconds) at an unsignalized intersection, if the No Action Alternative LOS is at C, D, or E ○ Would not worsen the Build Alternative traffic delay at an unsignalized intersection, if the No Action Alternative LOS is at F • Would not result in a substantial decrease of on-street parking availability • Would result in only short-term disruptions to transit services or the movement of freight goods
	Indirect Transportation and Circulation Change	• Would induce minimal, short-term change to an existing transportation or circulation condition in the region • Would induce other changes that could result in a minimal, short-term increase in traffic congestion, decrease in safety, decrease in on-street parking supply, alter pedestrian and bicycle facilities, change demand for transit services and facilities, or change the movement patterns of freight goods
	Applies to All Effect Types	• Transportation or circulation conditions would only be altered for a short, finite period and would not result in substantial delays • Impacts would be short-term and localized in specific areas

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Transportation and Circulation Change	• Would generate 100 or more new half-trips, and the LOS analysis results would meet the following criteria: o Would increase the Build Alternative traffic delay by more than 25 percent of the difference between the No Action Alternative and the bottom of LOS E (80 seconds) at a signalized intersection, if the No Action Alternative LOS is at A, B, C, D, or E o Would worsen the Build Alternative traffic delay at a signalized intersection, if the No Action Alternative LOS is at F or the V/C ratio exceeds 1.2 o Would worsen the Build Alternative traffic delay beyond LOS B (15 seconds) at an unsignalized intersection, if the No Action Alternative LOS is at A or B o Would increase the Build Alternative traffic delay by more than 5 seconds or would worsen the Build Alternative beyond LOS E (50 seconds) at an unsignalized intersection, if the No Action Alternative LOS is at C, D, or E o Would worsen the Build Alternative traffic delay at an unsignalized intersection, if the No Action Alternative LOS is at F • Would substantially decrease on-street parking availability. • Would result in short-term disruptions or changes to transit services or the movement of freight goods
	Indirect Transportation and Circulation Change	• Would induce a substantial, short- or long-term change to a transportation or circulation condition in the region • Would induce other changes that could result in a short- or long-term substantial increase in traffic congestion, decrease in safety, decrease in on-street parking supply, adversely alter pedestrian and bicycle facilities, change demand for transit services and facilities, or adversely affect the movement patterns of freight goods
	Applies to All Effect Types	• Would result in a substantial, short- or long-term impact on a transportation or circulation condition • Impact would be long-term and adverse, and/or could substantially affect regional conditions
Beneficial	Direct Transportation and Circulation Change	• Would decrease traffic delay or potentially improve LOS in a location • Would increase on-street parking supply • Would potentially improve transit services or the movement of freight goods
	Indirect Transportation and Circulation Change	• Would induce other changes that could result in a decrease in traffic congestion, increase in safety, increase in on-street parking supply, beneficial change in pedestrian and biking facilities, beneficial change in demand for transit services and facilities, or beneficial change in freight goods movement patterns
	Applies to All Effect Types	• Would result in transportation or circulation benefits observed throughout affected communities

4.7.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for impacts to the existing traffic and circulation conditions in the defined study area; these conditions are described in **Section 3.7**. The objective of this analysis was to determine the potential impacts associated with the proposed construction and operational activities of each considered alternative on the existing transportation infrastructure. The potential impacts may include effects to traffic operations, safety, parking, pedestrian and bicycle facilities, transit facilities and services, and freight goods movement. Based on the components and activities associated with each considered alternative, this analysis determines potential short- and long-term, direct and indirect effects to this infrastructure and recommends mitigation measures for adverse effects, as appropriate.

The No Action Alternative was analyzed to provide a basis for the Build Alternative analyses. The traffic projection for the No Action Alternative included: (1) a compounding background annual growth rate applied from 2016 to the full build-out year 2022, and (2) traffic anticipated from major future developments in the study area, as provided by the NJSEA. The NJDOT Access Permits Background Traffic Growth Rates 2015-2017 (NJAC 16:47-4.38) and the New Jersey Transportation Planning Authority Plan 2040 (NJTPA 2013) were used for this analysis. Using the process described in **Section 3.7.3.1**, capacity analyses were conducted at the intersection level using traffic analysis software – Trafficware Synchro (Version 8, build 806, revision 77) – for key intersections within the study area during typical weekday AM, MD, and PM peak hours. The use of the Synchro traffic analysis software allows the intersections within the study area to be analyzed as a connected, networked transportation system, instead of as isolated intersections. The use of Synchro also permits the traffic study to consider the timing optimization that results from the installation of an adaptive signal system.

Overall, the proposed Build Alternatives are not expected to generate significant amounts of new traffic demand or result in a need for long-term geometric changes to the roadways during operation. However, construction of the Build Alternatives would temporarily generate additional traffic demand. Consequently, this analysis first identified the peak month of construction of each Build Alternative (i.e., when the most daily construction traffic would be expected), and then projected construction traffic in the worst case scenario, a typical weekday AM peak hour. The determination of the common roadway peak hours are discussed in **Section 3.7.3.1**.

For each Build Alternative, if the projected construction or operational trips did not exceed the 100 new half-trip threshold as per NJAC 16:47-4:36 (State of New Jersey 2017)[58], the traffic impact of the Build Alternative was considered less-than-significant and only a qualitative assessment was conducted. To be conservative, this study assumed that the destination points of all the new trips generated by the Build Alternatives are far beyond the study area boundary; therefore, no new trips were discounted from the analysis as per the half-trip rule. Qualitative assessments were also conducted for parking, pedestrians and bicycles, transit, and freight. Additional information on the methodology employed for the transportation analysis for the three Build Alternatives and No Action Alternative is provided in **Appendix F**.

A quantitative assessment was conducted for each Build Alternative when the projected construction trips or operational trips exceeded the 100 new half-trip threshold as per NJAC 16:47-4:36 (State of

[58] NJ State Highway Access Management Code 16:47-1.1: One vehicle trip is defined as a vehicle moving from an origin point to a destination point. A half-trip is defined as a vehicle moving halfway between its origin point and its destination.

New Jersey 2017). Under this analysis, the short-term construction impacts and long-term operational impacts were assessed at the intersection level following the same process as the No Action Alternative. Projected traffic delays and LOS at the key intersections were then compared against those of the No Action Alternative to identify the impacts and potential mitigation measures for each Build Alternative.

The proposed construction staging and proposed permanent roadway improvements would be required to comply with the NJDOT State Highway Access Management Code (NJAC 16:47) and NJDOT Traffic Mitigation Guidelines (NJDOT 2014). Furthermore, any proposed construction-related maintenance of traffic devices would be required to comply with the FHWA's MUTCD.

4.7.4 Impact Analysis

4.7.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be built and no changes attributable to the Proposed Project would occur to existing or planned transportation or circulation services within the Project Area. As such, there would be no direct impacts on transportation from the Proposed Project.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse*** impacts on transportation and circulation within the study area. Depending on the magnitude, severity, and frequency of future flooding events and SLR, these effects could reasonably increase to ***indirect, potentially significant adverse*** impacts by resulting in longer term, more permanent effects to transportation and circulation within the study area. Per the significance criteria, the No Action Alternative:

- *Could induce a substantial, short- or long-term change to a transportation or circulation condition in the region.*
- *Could induce other changes that could result in a short- or long-term substantial increase in traffic congestion, decrease in safety, decrease in on-street parking supply, adversely alter pedestrian and bicycle facilities, change demand for transit services and facilities, or adversely affect the movement patterns of freight goods.*

Continued and increased flooding within the study area could lead to more frequent roadway and sidewalk inundation that reduces the capacity and safety of the affected roadway for vehicular, bicycle, and pedestrian modes of transportation. Long-term inundation of particular transportation routes could result in the closure or inaccessibility of roadways, railroads, mass transit routes/services, sidewalks, bicycle paths, and on-street parking. This in turn could lead to the need for short-term or long-term detours, resulting in increased traffic and the deterioration of LOS within the study area and overall region. Ultimately, this could lead to unreliable access for local communities to major arterial roadways and interruptions or delays in mass transit and freight services within the study area.

Traffic projections were forecasted from 2016 to 2022 at the intersection level using information based on annual growth rates and major future development projects to estimate traffic volumes under the No Action Alternative for the purpose of comparing them to the estimated Build Alternative traffic volumes in the following sections. Capacity analysis for key intersections was performed according to the process described in **Section 4.7.3**. **Table 4.7-2** summarizes the average delay and LOS at the intersection level for the AM, MD, and PM peak hours for the No Action Alternative. **Figure 3.7-2** illustrates the study survey locations. The detailed Synchro intersection analysis assumptions and results are included in

Appendix F; the results include V/C ratios (as a measure of theoretical roadway capacity), average delay in seconds per vehicle, and LOS for both signalized and unsignalized intersections.

Several of the intersections shown in **Table 4.7-2** were too complex to be analyzed as a single intersection in the Synchro model. Therefore, they were analyzed as two separate intersections. In order to provide an overall descriptive LOS for the entire intersection, the total vehicular delay was calculated for each of the analysis segments and summed. The total intersection delay for the overall intersection was then divided by the total vehicles passing through the intersection to determine an average delay per vehicle. This technique was used at Intersection 4-5 (State Route 17 and Moonachie Avenue), Intersection 13 (US Route 46 and Hollister Road), Intersection 19 (Route 17 and Franklin Avenue\Malcolm Avenue), and Intersection 22 (Huyler Street and North Street).

Compared to the existing delay and LOS shown in **Table 3.7-4**, a moderate increase in average intersection delay is anticipated at almost all study intersections due to the increase in volumes between 2016 and 2022. A majority of the intersections are anticipated to operate at LOS D or better, with the exception of the intersection at State Route 17 and Moonachie Avenue. The intersection at State Route 17 and Moonachie Avenue is currently operating at LOS E during the existing AM and PM peak hours, and would continue operating at LOS E during the AM peak hour, but deteriorate to LOS F during the PM peak hour in 2022. In general, the greatest increases in delay are seen during the PM peak hour, most notably at the US Route 46 and Huyler Street intersection, where the delay increases from 39.2 seconds (LOS D) to 54.6 seconds (LOS D).

Table 4.7-2: Synchro Model Results for AM, MD, and PM Peak Hours Under the No Action Alternative

Intersection ID	Intersection Name	AM Peak Hour		MD Peak Hour		PM Peak Hour	
		Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS
1	Route 120 (Paterson Plank Road) and Route 17 NB Exit Ramp	12.6	B	15.4	B	19.1	B
2	Route 120 (Paterson Plank Road) and Murray Hill Parkway	12.5	B	13.6	B	17.8	B
3	Route 120 (Paterson Plank Road) and Gotham Parkway	7.5	A	10.5	B	51.3	D
4-5	Route 17 & Moonachie Ave	61.3	E	54.3	D	87.3	F
6	Moonachie Avenue and Redneck Avenue/Private Driveway	15.7	B	9.0	A	12.5	B
7	Washington Avenue and Commerce Road	16.7	B	20.8	C	24.4	C

Intersection ID	Intersection Name	AM Peak Hour		MD Peak Hour		PM Peak Hour	
		Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS
8	Washington Avenue and Moonachie Road	30.8	C	19.2	B	19.9	B
9*	Empire Boulevard and Terminal Boulevard	4.5	A	3.9	A	5.1	A
10*	Empire Boulevard and State Street	0.1	A	0.1	A	0.1	A
11	Moonachie Road and E Joseph Street	12.1	B	10.5	B	21.7	C
12	Washington Avenue and Liberty Street	16.0	B	13.5	B	17.9	B
13	US Route 46 and Hollister Road	23.0	C	30.0	C	34.5	C
14	US Route 46 and Huyler Street	39.1	D	29.4	C	54.6	D
15	Main Street and Liberty Street	26.0	C	21.7	C	27.4	C
16	US Route 46 and Liberty Street	49.7	D	41.4	D	49.0	D
17*	Main Street and Washington Avenue	17.2	C	11.5	B	31.4	D
18	US Route 46 and Bergen Turnpike	43.8	D	35.5	D	34.0	C
19	Route 17 and Franklin Avenue/Malcolm Avenue	37.4	D	36.3	D	41.9	D
20	North Street and Green Street	10.1	B	8.8	A	10.8	B
21*	North Street and I-80 EB Exit 65 on & off ramps	25.0	D	11.4	B	18.3	C
22	Huyler Street and North Street	30.7	C	22.5	C	29.9	C

*Intersection is unsignalized

4.7.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation during construction activities due to increased construction vehicle and worker trips in the Project Area and proposed road/lane closures, realignments, and/or raisings.
- ***Short-term, less-than-significant, adverse*** impacts to the on-street parking supply on Main Street, Riverside Avenue, Dietrich Street, and Commerce Boulevard within the proposed Alternative 1 footprint due to construction staging and access.
- ***Short-term, less-than-significant, adverse*** impacts to transit and freight services in the Project Area from the increase in construction vehicles and worker trips and the construction of a closure gate on the NJ Transit railroad track during the construction phase of Alternative 1.
- ***Long-term, less-than-significant, adverse*** impacts to roadway traffic and circulation during operational activities due to increased vehicle trips associated with the maintenance of the proposed LOP and the use of the proposed parks and boat dock/kayak launch.
- ***Long-term, less-than-significant, adverse*** impacts to the NJ Transit railroad track during flood events due to the proposed closure gate.
- ***Long-term, beneficial*** effects to pedestrian transportation and circulation within the Project Area due to the proposed paths, walkways, and boat dock/kayak launch along the Hackensack River.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects to the sustainability of existing transportation and circulation within the Project Area from increased flood protection against coastal storm surges.

The following subsections provide greater detail.

Direct Impacts

<u>Construction Activities</u>

Short-term transportation impacts associated with construction activities under Alternative 1 were estimated based on the total number of construction vehicle trips and work days over the 3-year construction phase within the LOP work areas (Northern, Central, Southern, and Berry’s Creek). The number of construction vehicle and worker trips was determined based on total construction vehicle and equipment estimates for Alternative 1 along with the estimated truck trips by construction material type, and the anticipated number of construction work days. Over the construction phase, approximately 61.3 percent of the construction vehicles and equipment would occur within the Central Segment during construction, followed by approximately 25.4 percent within the Berry’s Creek area, 7.2 percent in the Southern Segment, and 6.1 percent in the Northern Segment.

Based on the proposed construction schedule, the construction peak month was determined to be March 2021. The construction peak month represents the month with the greatest overall percentage of construction vehicles and workers within all work areas. During this peak month, the Central Segment and Berry’s Creek work area would have 5.2 percent of construction work completed, while the Northern and Southern Segments would have 8.3 and 8.2 percent of construction work completed during this month, respectively. Using a temporal distribution for workers and trucks based on a construction work shift from 7:00 AM to 4:00 PM during this peak month, the number of construction vehicle and worker trips were determined for the AM peak hour. The peak hour for construction traffic was determined to be 7AM-8AM for workers, and 8AM to 9AM for trucks.

The number of AM peak hour construction trips for Alternative 1 is projected to be 87 vehicles per hour, which is below the 100 new half-trip threshold as per NJAC 16:47-4.36 (State of New Jersey 2017). Further, these trips would be spread out through the roadway network. Based on the traffic analysis discussed above and the trip distribution process described in **Appendix F**, the intersection of US Route 46 and Bergen Turnpike (also referred to as Intersection 18) is anticipated to experience the highest number of new construction trips. This intersection is comprised of the two largest arterial roadways in the study area; it would provide access to and from the proposed construction work zones. However, total new construction trips at this intersection are estimated to be approximately 30 vehicles during the AM peak hour, which is below the 100 new half-trip threshold. Because Alternative 1 would generate less than 100 new half-trips from construction activities, a LOS analysis is not required. Therefore, ***short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would be anticipated during construction activities due to increased construction vehicle and worker trips. A detailed summary of the analysis described above is provided in **Appendix F**.

As described under **Section 2.5.2.2**, the construction of Alternative 1 would require some road-raising and road/lane closures and/or realignment activities within the LOP. Road realignments and/or lane closures could be required for portions of Main Street (east of Bergen Turnpike; Central Segment), Riverside Avenue (south of Washington Avenue; Central Segment), Dietrich Street (east of Maiden Lane; Central Segment), and Commerce Boulevard (between Washington Ave and Central Boulevard; Southern Segment). The construction requires the temporary closure of a parking lane along eastbound Commerce Boulevard. Commerce Boulevard would still have enough width to accommodate two-way traffic. The remaining three roads are dead end roads and their closure would not be anticipated to affect traffic circulation within the Project Area. Within the Berry's Creek work area, road-raising activities would occur to portions of Paterson Plank Road and Murray Hill Parkway. Temporary lane realignments would be required on these roads during construction. Because the proposed road-raising and potential road/lane closures and/or realignment activities are relatively isolated and temporary in duration, ***short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would occur.

Temporary impacts to on-street parking supply would be expected on Main Street, Riverside Avenue, Dietrich Street, and Commerce Boulevard due to construction staging and access. Because on-street parking impacts would be localized and temporary in nature, and have only a limited effect on the overall on-street parking supply in the Project Area, ***short-term, less-than-significant, adverse*** impacts to on-street parking supply would be anticipated.

Temporary disruptions or delays in transit or freight service could occur during the construction of Alternative 1. No impact to Teterboro Airport would occur. The construction of the flood closure gate could temporarily interrupt the service of NJ Transit Rail Main Line, Bergen County Line, Port Jervis Line, Pascack Valley Line, and Meadowland Line. However, NJDEP would coordinate the construction of the closure gate with NJ Transit to minimize impacts to less-than-significant levels. Bus routes, truck routes, and freight railroads would remain open during construction. Therefore, ***short-term, less-than-significant, adverse*** impacts to transit and freight services would occur as a result of construction activities.

Operation and Maintenance Activities

Operation of Alternative 1 would not close or restrict public roadways, as the LOP (including closure gates) would not be located on any public roads. Operational activities include activities associated with flood events (pre-event, during, and post-event), routine maintenance, and emergency maintenance and repair, as discussed in **Section 2.5.2.3**. These activities would generate only minimal, periodic vehicle trips.

In addition, under Alternative 1, four new parks and one boat launch are proposed that would generate future vehicle trips; they include:

1. Fluvial Park, 3.8 acres
2. K-Town Park, 1.4 acres
3. Riverside Park, 2.2 acres
4. DePeyster Creek Park, 0.6 acre
5. Boat dock/kayak launch near K-Town Park

Per the Institute of Traffic Engineers (ITE) Trip Generation Manual, 9th Edition (ITE 2012), the four proposed parks would be classified as County Parks and the boat dock/kayak launch would be classified as a 6-berth marina. Trip generation factors and splits from the ITE Trip Generation Manual were used to calculate the trip generation for Alternative 1, as shown in **Table 4.7-3**.

Table 4.7-3: Trip Generation for Proposed Recreational Facilities Under Alternative 1

Land Uses	Size	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
County Parks	8.0 Acres	3	1	4	1	3	4
Marina	6 Berths	1	1	2	1	1	2
	Total Trips	4	2	6	2	4	6

These trip generation rates were based on the peak hour of the adjacent streets; no credit was taken for drive-by trips. Vehicle trips associated with the operation of the LOP and the proposed land use changes (i.e., proposed recreational facilities) would generate far less than the 100 new half-trips threshold, per NJAC 16:47-4.36 (State of New Jersey 2017), within the Project Area. Therefore, a LOS analysis is not required. Because operational vehicle trips are projected to be less than 100 new half-trips and a LOS analysis is not required, ***long-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would occur during operational activities due to increased vehicle trips.

No impact to bus routes or freight routes would occur under this alternative. However, the proposed closure gate on the NJ Transit railroad line would be closed during flood events. The closure of this gate would interrupt the service of NJ Transit Rail Main Line, Bergen County Line, Port Jervis Line, Pascack Valley Line, and Meadowland Line. However, it is likely that all NJ Transit rail operations would be suspended during major flood events. O&M personnel would coordinate the operation of this closure gate with NJ Transit, and follow NJ Transit closure procedures, prior to and during flooding events to reduce impacts. Therefore, ***long-term, less-than-significant, adverse*** impacts to transit services would occur due to the proposed closure gate on the NJ Transit railroad line.

Under Alternative 1, a total of approximately 9,270 LF of new public paths and walkways, 0.2 acre of parking areas, and a new boat dock/kayak launch would be added along the Hackensack River. Currently, public access to the waterfront is limited for both pedestrians and boaters. The proposed paths and walkways would provide connectivity to the existing Riverwalk in the City of Hackensack (far northern end of the LOP) and the proposed Fluvial Park, K-Town Park, and Riverside Park. Given the current lack of public access to the waterfront, ***long-term beneficial*** effects to transportation and circulation would occur within the Project Area due to the proposed paths, walkways, and boat dock/kayak launch along the Hackensack River.

Indirect Impacts

No adverse indirect impacts to transportation and circulation are anticipated to occur as a result of the construction and operation of Alternative 1. Alternative 1 would not be anticipated to induce a change to existing transportation and circulation conditions within the Project Area or the region.

Alternative 1 would provide increased flood protection against coastal storm surges and future SLR to transportation facilities and services within the Project Area. Vehicle, bicycle, and pedestrian routes would be inundated by water less frequently, thereby reducing potential traffic congestion caused by detours and increasing the safety of these routes. Freight services would experience fewer delays or disruptions during the movement of freight goods in and out of the Project Area. Therefore, a ***long-term beneficial*** impact to transportation and circulation within the Project Area would be anticipated from reduced flooding in the Project Area.

Mitigation Measures and BMPs

No potentially significant adverse impacts to transportation or circulation have been identified from the proposed construction or operation of Alternative 1. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase for Alternative 1, coordination with local municipalities and service providers (e.g., NJ Transit) on potential monitoring needs, road/lane closures and realignments, and the proposed closure gate on the railroad track would occur.
- During the construction phase of Alternative 1, TMPs would be implemented in conjunction with the local municipalities and service providers to minimize impacts to these entities and provide the public with information on road closures and detours. This would allow pedestrians, bicyclists, freight facilities, transit facilities, and ancillary transportation facilities to plan their travel routes, minimize delays and disruptions, and ensure the safety of these routes.
- During the operation of Alternative 1, maintenance activities would be performed during non-peak traffic hours to the extent practicable.
- During the operation of Alternative 1, operation of the NJ Transit railroad line closure gate would be coordinated with NJ Transit prior to and during flooding events to minimize delays and disruptions to transit services. Gate closure would be conducted in accordance with NJ Transit procedures.

4.7.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding from heavy precipitation events, but continued and increased coastal flooding from storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation during construction activities due to increased construction vehicle and worker trips in the Project Area and proposed road/lane closures.
- ***Short-term, less-than-significant, adverse*** impacts to the on-street parking supply within the proposed Alternative 2 footprint due to construction staging and access, and parking of personal vehicles by construction workers.
- ***Short-term, less-than-significant, adverse*** impacts to transit and freight services in the Project Area from the increase in construction vehicles and worker trips during the construction phase of Alternative 2, and the temporary closure of the railroad bridge over East Riser Ditch during its removal and replacement.
- ***Short-term, less-than-significant, adverse*** impacts to pedestrian circulation in portions of the Project Area due to sidewalk closures during construction of some of the green infrastructure systems.
- ***Long-term, less-than-significant, adverse*** impacts to roadway traffic and circulation during operational activities due to increased vehicle trips associated with the maintenance of the proposed green infrastructure and the use of the proposed parks.
- ***Long-term, beneficial*** effects to pedestrian and boat transportation and circulation within the Project Area due to the proposed park improvements including the creation of pedestrian paths, a new public boat launch and dock, and a kayak launch.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects to the sustainability of existing transportation and circulation within the Project Area from increased protection against inland flooding.

The following subsections provide greater detail.

Direct Impacts

Construction Activities

Short-term transportation impacts associated with construction activities under Alternative 2 were estimated based on the total number of construction vehicle trips and work days during the three temporal phases over the 3-year construction period within the Project Area. The number of construction vehicle and worker trips was determined based on total construction vehicle and equipment estimates for the Alternative 2 along with the estimated truck trips by construction material type, and the anticipated number of construction work days. Over the approximately 3-year construction period, an estimated 8,329 construction truck trips would occur with approximately 66 percent of the construction vehicles and workers occurring in Phase 1 (November 2019 – February 2021), followed by approximately 15 percent in Phase 2 (March 2021 – December 2021), and 19 percent in Phase 3 (January 2022 – August 2022). Based on the proposed construction schedule, the construction peak month was determined to be June 2020 for Alternative 2, as compared to March 2021 for Alternative 1. The peak hour for construction traffic under Alternative 2, based on a temporal distribution for workers and trucks during a 7:00 AM to 4:00 PM work shift, was determined to be 7:00 AM to 8:00 AM for workers, and 8:00 AM to 9:00 AM for trucks. These are the same peak hours that would be anticipated during the construction of Alternative 1.

The number of AM peak hour construction trips for Alternative 2 is projected to be 59 vehicles per hour, which is below the 100 new half-trip threshold as per NJAC 16:47-4.36. Based on the traffic analysis discussed above and the trip distribution process described in **Appendix F**, the intersection of US Route 46 and Bergen Turnpike would be anticipated to experience the highest number of new construction trips, similar to Alternative 1. However, total new construction trips at this intersection are estimated to be approximately 34 vehicles during the AM peak hour, which is below the 100 new half-trip threshold. Because Alternative 2 would generate fewer than 100 new half-trips from construction activities, a LOS analysis is not required. Therefore, ***short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would be anticipated during construction activities due to increased construction vehicle and worker trips. A detailed summary of the analysis described above is provided in **Appendix F**.

Compared to Alternative 1, Alternative 2 would create fewer overall peak hour construction trips, but would lead to a slightly greater number of construction trips at the most utilized intersection. Further, peak hour construction trips under Alternative 2 would be spread throughout the roadway network in the Project Area to a greater extent in comparison to Alternative 1 where construction trips would be concentrated along the Hackensack River and Berry's Creek. As a result, more roads would be impacted by construction trips, but the overall impact would be more dispersed.

As described in **Section 2.5.3**, construction would occur within public road rights-of-way for numerous components of Alternative 2. Green infrastructure systems would generally be constructed from public roads due to the limited space available for construction. A full list of the green infrastructure systems, as well as the streets on which they're proposed, is provided in **Table 2.5-3**. Additionally, the following streets would be used for staging during construction of nearby green infrastructure systems:

- Monroe Street (near intersection with Bertolotto Avenue)
- Commercial Avenue (near intersection with Moonachie Avenue)
- Concord Street (near intersection with Moonachie Avenue)
- Charles Street (near intersection with Main Street)
- Marshall Avenue (near intersection with Main Street)
- Frederick Avenue (near intersection with Main Street)
- Garden Street (near intersection with Moonachie Road)
- Park Street (near intersection with Bruno Street)
- Oxford Drive (near intersection with Redneck Avenue)

Generally, construction and staging within public rights-of-way would be contained within parking or shoulder lanes, and thus would not impact circulation within the Project Area. However, in some circumstances, parking lanes or shoulders are not available (e.g., along Moonachie Avenue and Empire Boulevard), so partial lane closures would be necessary to accommodate construction. The impacted roads are typically wide enough that full lane closures would not be necessary. Construction of green infrastructure systems would also require trenching along streets in residential and commercial areas. This would result in some driveways being inaccessible from the road during both the initial trenching process and the repaving process, but each driveway would not be impacted for longer than one day during each of these processes.

Construction of new parks and open space improvements could require occasional, temporary lane closures while certain materials are being delivered to, or removed from, the construction sites.

However, all construction activities and staging associated with these components would be contained within the park/open space properties.

Transportation impacts would also be caused by the grey infrastructure components. Losen Slote force mains A and C would be constructed within public rights-of-way. Single lane closures would be expected while these force mains are being installed, but these lane closures would likely only impact 200-foot sections of road at a time. Overall, each force main would likely require 10 weeks or fewer for installation. Force main installation would also require trenching along commercial and residential streets; thus, driveway access would be temporarily inhibited. Construction of the East Riser Ditch channel improvements would result in temporary closures of Amor Avenue and West Commercial Avenue while the culverts beneath them are being removed and replaced. These road closures would have durations of approximately 5 weeks or fewer. Because the potential road/lane closures under Alternative 2 are limited in scope and duration, ***short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would be expected.

Temporary impacts to on-street parking supply would be expected within the Project Area under Alternative 2 from both the use of some parking lanes for construction staging and access, as well as the use of other parking spots by construction workers for their personal vehicles. Because on-street parking impacts would be localized and temporary in nature, and have only a limited effect on the overall on-street parking supply, ***short-term, less-than-significant, adverse*** impacts to on-street parking supply would be anticipated.

Temporary disruptions or delays in transit or freight service could occur during the construction of Alternative 2. During the East Riser Ditch channel improvements, a railroad bridge would be removed and replaced. This bridge would be closed for approximately 5 weeks or fewer, which would disconnect approximately 0.4 mile of the Seaman Lead in the industrial portion of Carlstadt from the NJ Transit Pascack Valley Line along State Route 17. Currently, the Seaman Lead is used by approximately one or two trains per year; therefore, freight disruptions would be unlikely. However, prior to construction, coordination would occur with NJ Transit and the local users of this rail spur in order to minimize potential impacts during construction. No impact to Teterboro Airport would occur. Bus routes and truck routes would remain open during construction. Therefore, ***short-term, less-than-significant, adverse*** impacts to transit and freight services would be expected as a result of construction activities.

Sidewalks would be temporarily closed during construction of some of the green infrastructure systems, which could restrict pedestrian circulation in some portions of the Project Area. However, construction for each green infrastructure system would be completed within approximately 3 weeks or less. Due to the short duration of any sidewalk closures, and the presence of ample alternative sidewalks in the Project Area, Alternative 2 would lead to ***short-term, less-than-significant, adverse*** impacts to pedestrian circulation.

<u>Operation and Maintenance Activities</u>

Operation of Alternative 2 would not close or restrict public roadways. Operational activities include activities associated with flood events (pre-event, during, and post-event), routine maintenance, and emergency maintenance and repair, as discussed in **Section 2.5.3**. These activities would generate only minimal, periodic vehicle trips.

In addition, under Alternative 2, five new parks are proposed that would generate future vehicle trips; they include:

1. Fluvial Park, 4.4 acres
2. Riverside Park, 2.6 acres
3. DePeyster Creek Park, 8.0 acres

4. Caesar Place Park, 4.0 acres
5. Avanti Park, 1.0 acre

Per the ITE Trip Generation Manual, 9th Edition (ITE 2012), the five proposed new parks would be classified as County Parks, land use code #412. Trip generation factors and splits from the ITE Trip Generation Manual were used to calculate the trip generation for Alternative 2, as shown in **Table 4.7-4**.

Table 4.7-4: Trip Generation for Proposed Recreational Facilities under Alternative 2

Land Uses	Size	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
County Parks	20.0 acres	3	2	5	3	2	5
	Total Trips	3	2	5	3	2	5

These trip generation rates were based on the peak hour of the adjacent streets; no credit was taken for drive-by trips. A minimum of one trip was assigned to each park. Vehicle trips associated with the operation of Alternative 2 and the proposed land use changes (i.e., proposed recreational facilities) would generate far less than the 100 new half-trips threshold , per NJAC 16:47-4.36, within the Project Area. Therefore, a LOS analysis is not required. Because operational vehicle trips are projected to be fewer than 100 new half-trips and a LOS analysis is not required, ***long-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would be expected during operational activities due to increased vehicle trips.

No impact to transit services, including bus routes and freight routes, would occur during the operational phase of Alternative 2.

Under Alternative 2, there would be creation or improvement of several recreational facilities in the Project Area. A total of approximately 9,900 LF of new public paths and walkways and 0.3 acre of parking areas would be created at the proposed new parks and improved open spaces. A new public boat launch (capable of supporting trailered vessels) and dock would be available at the proposed Riverside Park, and a kayak launch would be installed at the proposed Fluvial Park. These features would provide ***long-term beneficial*** effects on pedestrian and boat circulation in the Project Area. Additionally, as described under Alternative 1, public access to the waterfront is currently limited for both pedestrians and boaters, so the creation of three new waterfront parks with pedestrian and boating opportunities would be an improvement over existing conditions. However, the trails proposed under Alternative 2 would be contained within the park footprints, and would not be interconnected throughout the Project Area as under Alternative 1 (i.e., the continuous trail from the Hackensack Riverwalk to Riverside Park).

Indirect Impacts

No adverse indirect impacts to transportation and circulation would be anticipated to occur as a result of the construction and operation of Alternative 2. Alternative 2 would not be anticipated to induce changes to existing transportation and circulation conditions within the Project Area or the region.

Alternative 2 would provide increased flood protection against stormwater and fluvial flooding to transportation facilities and services within the Project Area. Vehicle, bicycle, and pedestrian routes would be inundated by water less frequently, thereby reducing potential traffic congestion caused by detours and increasing the safety of these routes. Freight services would experience fewer delays or disruptions during the movement of freight goods in and out of the Project Area. Therefore, a ***long-term beneficial*** impact to transportation and circulation within the Project Area would be anticipated from reduced flooding in the Project Area.

Mitigation Measures and BMPs

No potentially significant adverse impacts to transportation or circulation have been identified from the proposed construction or operation of Alternative 2. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase for Alternative 2, coordination with local municipalities and service providers (e.g., NJ Transit) on potential monitoring needs and road, lane, and sidewalk closures would occur.

- During the construction phase of Alternative 2, TMPs would be implemented in conjunction with the local municipalities and service providers to minimize impacts to these entities and provide the public with information on road closures and detours. Additionally, coordination with NJ Transit and local businesses in the Borough of Carlstadt regarding the closure of the railroad bridge over East Riser Ditch would occur prior to its removal and replacement.

- During the operation of Alternative 2, maintenance activities would be performed during non-peak traffic hours to the extent practicable.

4.7.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint and fewer stormwater improvement projects. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences between Alternatives 2 and 3.

Direct Impacts

Construction Activities

Short-term transportation impacts associated with construction activities under Alternative 3 were estimated using the same methodology described under Alternative 2. The construction peak month (June 2020) and peak hour of construction traffic for workers (7:00 AM-8:00 AM) and trucks (8:00 AM to 9:00 AM) would be the same. However, an estimated 7,240 construction truck trips would occur over the approximately 3-year construction period, or approximately 13.1 percent less than Alternative 2. The reduction in truck trips would be anticipated to occur primarily during Phase 2 (March 2021 – December 2021).

The number of AM peak hour construction trips for Alternative 3 is projected to be 54 vehicles per hour, in comparison to 59 vehicles per hour under Alternative 2. Based on the traffic analysis discussed above and the trip generation process described in **Appendix F**, the intersection of US Route 46 and Bergen Turnpike would be anticipated to experience the highest number of new construction trips, similar to Alternatives 1 and 2. However, total new construction trips at this intersection are estimated to be approximately 31 vehicles during the AM peak hour, in comparison to 34 vehicles under Alternative 2. Similar to Alternative 2, ***short-term, less-than-significant, adverse*** impacts to roadway traffic and circulation would be anticipated during construction activities under Alternative 3 due to a slight increase in construction vehicle and worker trips. However, these impacts would be expected to be slightly less than those anticipated for Alternative 2. A detailed summary of the transportation analysis described above is provided in **Appendix F**.

Potential impacts under Alternative 3 due to road/lane closures would be similar to those described for Alternative 2. However, Fluvial Park and DePeyster Creek Park would not be constructed, thus temporary lane closures would not occur during delivery or removal of materials at those locations. Additionally, Losen Slote force main C would not be constructed; therefore, no lane closures or driveway inaccessibility associated with that construction work (i.e., in the West Park Street and East Park Street rights-of-way) would occur under Alternative 3. As such, ***short-term, less-than-significant, adverse*** impacts to transportation and circulation in the Project Area would be slightly less under Alternative 3 due to temporary travel lane closures.

Impacts to on-street parking under Alternative 3 would be similar to, but less than, those that would be expected under Alternative 2, due to Losen Slote force main C not being constructed in streets with parking lanes, and an overall reduction in the amount of construction work to be conducted (see **Section 2.5.4.2**). Therefore, ***short-term, less-than-significant, adverse*** impacts to on-street parking supply in the Project Area would be slightly less under Alternative 3.

Short-term, less-than-significant, adverse impacts to transit and freight services and pedestrian circulation associated with construction activities under Alternative 3 would be expected to be the same as Alternative 2.

<u>Operation and Maintenance Activities</u>

Operation of Alternative 3 would not close or restrict public roadways. Operational activities would be the same as described for Alternative 2, and would generate only minimal, periodic vehicle trips.

In addition, under Alternative 3, three new parks are proposed that would generate future vehicle trips; they include:

1. Riverside Park, 2.6 acres
2. Caesar Place Park, 4.0 acres
3. Avanti Park, 1.0 acre

Per the ITE Trip Generation Manual, 9th Edition (ITE 2012), the three proposed new parks would be classified as County Parks, land use code #412. Trip generation factors and splits from the ITE Trip Generation Manual were used to calculate the trip generation for Alternative 3, as shown in **Table 4.7-5**.

Table 4.7-5: Trip Generation for Proposed Recreational Facilities under Alternative 3

Land Uses	Size	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
County Parks	7.6 Acres	2	1	3	2	1	3
	Total Trips	2	1	3	2	1	3

These trip generation rates were based on the peak hour of the adjacent streets; no credit was taken for drive-by trips. Vehicle trips associated with the operation of Alternative 3 and the proposed land use changes (i.e., proposed recreational facilities) would be slightly lower than Alternative 2. Therefore, ***long-term, less-than-significant, adverse*** impacts to roadway traffic and circulation under Alternative 3 would be expected to be slightly lower during operational activities due to increased vehicle trips.

Similar to Alternative 2, Alternative 3 would have ***long-term beneficial*** effects on pedestrian and boat circulation in the Project Area. However, these beneficial effects would be less than those expected under Alternative 2 because only approximately 6,400 LF of public pathways would be constructed under Alternative 3, which represents 35.4 percent less than Alternative 2. Access to the public boat dock at Riverside Park would be the same between Alternative 2 and Alternative 3, but Alternative 3 would not include the kayak launch since Fluvial Park would not be constructed.

Indirect Impacts

Similar to Alternative 2, the Alternative 3 Build Plan would reduce inland flooding from heavy precipitation events. A ***long-term beneficial*** impact to transportation and circulation within the Project Area is anticipated from reduced flooding in the Project Area. Reduced flooding would lead to less frequent inundation of railroads and vehicle, bicycle, and pedestrian routes, thereby reducing disruption to freight services, reducing potential traffic congestion caused by detours, and increasing the safety of these routes. However, flood protection provided under Alternative 3 would be slightly less than that provided under Alternative 2, as Losen Slote pump station C would not be constructed. Additionally, Fluvial Park and DePeyster Creek Park would not be constructed, so localized stormwater retention and treatment benefits at those locations would not be realized.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.7.4.3**).

4.8 Noise and Vibration

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on the noise and vibration environment in and around the Project Area. Noise impacts can be either direct or indirect. A direct impact would occur if the Proposed Project directly changes the existing noise environment of the study area, which could occur by introducing new noise-generating sources in the environment. An indirect impact would occur if the Proposed Project induces other changes that could affect the local noise environment. For example, should the Proposed Project contribute to future increased development of the study area that could produce noise (e.g., through traffic increases), an indirect impact would occur. Similarly, should the Proposed Project result in the need to re-route traffic; an indirect impact to the local noise environment could occur along the re-routed path.

4.8.1 Definition of Study Area

As described in **Section 3.8**, the study area for noise and vibration includes the areas around Proposed Project activities and components, as well as areas that could be affected indirectly within the Project Area. Overall, the noise study area is contained within the boundaries of the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to the noise environment in accordance with 40 CFR 1508.27.

4.8.2 Thresholds of Significance

The significance criteria used to evaluate the potential direct and indirect effects of the alternatives to the noise environment are shown in **Table 4.8-1**. In determining significance, local regulations (summarized in **Section 3.8.2**) and generally accepted perception thresholds were used. An increase of 3 dBA would be considered a just noticeable difference, an increase of 5 dBA would be considered a noticeable change, and an increase of 10 dBA would be a doubling of loudness. The magnitude, duration, and affected area are all considered when evaluating significance.

4.8.1 Analysis Methodology

The Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to the existing noise environment in the defined study area; the existing noise environment is described in **Section 3.8**. This subsection describes the noise analysis methodology used to determine potential effects associated with both short-term construction activities and long-term operational activities (i.e., operations of pump stations and emergency generators) associated with each of the considered alternatives. Based on the components and activities associated with each considered alternative, this analysis determines potential short- and long-term, direct and indirect effects to the noise environment and recommends mitigation measures for adverse effects, as appropriate.

4.8.1.1 Short-Term Construction

The Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to the existing noise environment in the defined study area; the existing noise environment is described in **Section 3.8**. This subsection describes the noise analysis methodology used to determine potential effects associated with both short-term construction activities and long-term operational activities (i.e., operations of pump stations and emergency generators) associated with each of the considered alternatives. Based on the components and activities associated with each considered alternative, this analysis determines potential short- and long-term, direct and indirect effects to the noise environment and recommends mitigation measures for adverse effects, as appropriate.

4.8.1.2 Long-Term Operations

Each Build Alternative would install equipment that would emit noise during long-term operational activities. The primary source of long-term operational noise would be proposed pump stations, which include pumps, emergency generators, and other equipment. Occasional maintenance vehicles could also operate within the Project Area during long-term operational activities.

Long-term mobile noise sources during operations would be limited to occasional vehicle trips for maintenance. A mobile noise screening assessment of long-term vehicle operations was performed using the same methods as used for short-term construction activities. Project-generated traffic volumes, including both long-term vehicle operations and re-routed, non-Project related traffic volumes indirectly altered by the Proposed Project, were compared to the existing traffic volumes, based on data and analyses presented in **Section 3.7** and **Section 4.7**. Where operations would triple existing traffic volumes, a screening model was prepared using FHWA's traffic noise model (TNM).

Table 4.8-1: Noise and Vibration Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Noise and Vibration Change	• Would not result in a discernible change in noise or vibration levels during construction or operational activities • Increased noise or vibration levels would occur, but would comply with applicable regulations or no applicable regulations exist
	Indirect Noise and Vibration Change	• Would not result in a discernible change in noise or vibration levels due to re-routed traffic • Would not induce other activities that would alter the local noise or vibration environment
	Applies to All Effect Types	• Would not result in discernable changes to the noise or vibration conditions in the region or locality • Would only alter noise or vibration conditions for an indiscernible or negligible period of time
Less-than-Significant	Direct Noise and Vibration Change	• Would result in vibration levels between the perceptible and annoyance thresholds • Would result in a change in broadband noise levels that exceed applicable regulations by < 10 dBA L_{eq}, or a change in octave band noise levels that exceed applicable regulations by < 5 dBL L_{eq}
	Indirect Noise and Vibration Change	• Would result in vibration levels between the perceptible and annoyance thresholds due to re-routed traffic or other activities • Would result in a change in noise levels that exceeds applicable regulations by < 10 dBA L_{eq} due to re-routed traffic or other activities
	Applies to All Effect Types	• Impacts would be localized in specific areas • Noise or vibration conditions would only be altered for a short, finite period
Potentially Significant	Direct Noise and Vibration Change	• Would result in vibration levels above the annoyance threshold • Would result in a change in broadband noise levels that exceeds applicable regulations by ≥ 10 dBA L_{eq}, or a change in octave band noise levels that exceeds applicable regulations by ≥ 5 dBL L_{eq}
	Indirect Noise and Vibration Change	• Would result in vibration levels above the annoyance threshold due to re-routed traffic or other activities • Would result in a change in noise levels that exceeds applicable regulations by ≥ 10 dBA L_{eq} due to re-routed traffic or other activities
	Applies to All Effect Types	• Would result in adverse noise or vibration impacts observed throughout affected municipalities • Would permanently adversely alter noise or vibration conditions in the study area
Beneficial	Direct Noise and Vibration Change	• Would result in a decrease in noise or vibration levels during construction or operational activities
	Indirect Noise and Vibration Change	• Would result in a reduction in noise or vibration levels due to re-routed traffic • Would induce other activities that would decrease noise or vibration in the study area
	Applies to All Effect Types	• Would result in noise or vibration reductions in the study area

Long-term noise impacts from stationary sources are not expected for most of the proposed equipment within the pump stations because the equipment will be enclosed in buildings, which would attenuate noise impacts. However, proposed emergency generators can be loud, so an assessment of potential generator noise was performed. Stationary noise levels from operation of the proposed emergency generators were modeled using spreadsheet models based on International Organization for Standardization (ISO) 9613-2, *Attenuation of Sound During Propagation Outdoors*. Manufacturers' sound data were obtained for the basis of design emergency generators and exhaust mufflers. Additionally, for indoor generators, noise reduction from the building was included for mechanical and radiated noise; the generator exhaust would be ducted out of the building, and therefore no building attenuation was applied for exhaust noise.

4.8.1.3 Underwater Noise Assessment Methodology

Each Build Alternative would result in construction activities along the shoreline of the Hackensack River and Berry's Creek, and may be subject to NMFS underwater noise exposure guidelines, which are outlined in *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS 2016b) and *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish* (Caltrans 2015). Endangered species such as sturgeon may be present in the Hackensack River, and therefore the potential for underwater noise impacts were evaluated. This assessment was based on current NMFS criteria to assess the potential physiological effects on fish exposure to impulsive noise and cumulative sound exposure level for the onset of physical injury and for behavioral modification. These values vary by species; however, the current general consensus injury threshold sound pressure level limits are 206 dB peak and 187 dB accumulated sound exposure level (the sound pressure level representing the total sound energy of an event compressed into a single second of time) for fish larger than or equal to 2 grams and an accumulated sound exposure level of 183 dB for fish less than 2 grams. The general consensus behavioral effects threshold is 150 root mean square decibels (dB_{rms}).

Pile driving is the only project-related activity that has the potential to generate sound pressure levels exceeding the consensus limits, and as such, was the only activity evaluated in this analysis. In the event that underwater noise levels would exceed the acoustic thresholds, mitigation measures, such as bubble curtains, were evaluated. Pile driving locations were assumed to be along the LOP and on land only. The specific pile types and sizes have not yet been determined. Average values for pile types and sizes were assumed for this analysis. The in-water sound transmission loss constant will need further evaluation for this specific setting.

4.8.1.4 Vibration Analysis Methodology

Each Build Alternative would result in construction activities with the potential to cause vibration impacts on buildings and residents. The construction vibration assessment was conducted using the methods outlined in the latest version of the FTA's *Transit Noise and Vibration Impact Assessment* guidance manual (FTA 2006). These methods include evaluations of the potential for damage to buildings and human annoyance. Impacts are based on calculated distances between specific types of equipment and vibration-sensitive buildings and occupants. In the event buildings are located within the calculated impact distances for construction equipment, mitigation measures were evaluated.

As discussed in **Section 3.8.2,** the State of New Jersey has vibration criteria in NJAC 19:4-7:4. Within the Project Area, the only municipality with vibration criteria is the Borough of Teterboro, which are identical to those set forth in NJAC 19:4-7:4. Therefore, the vibration limits set in NJAC 19:4-7.4 were used as the regulatory criteria for the entire Project Area.

4.8.2 Impact Analysis

The following subsections assess potential direct and indirect impacts to the noise and vibration environment associated with the implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.8.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented and noise and vibration environment would not be altered by construction or operation activities associated with the Proposed Project. Accordingly, there would be no direct impacts to the noise and vibration environment.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse*** impacts on the noise or vibration environment in the study area due to traffic congestion and diversion of vehicles in flooded areas, which would be anticipated to occur on a more frequent basis. Per the significance criteria, the No Action Alternative:

- *Could result in vibration levels between the perceptible and annoyance thresholds due to re-routed traffic or other activities*
- *Could result in a change in noise levels that exceeds applicable regulations by < 10 dBA L_{eq} due to re-routed traffic or other activities*

4.8.2.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding of the Project Area from high tides and coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, potentially significant, adverse*** noise and vibration impacts to properties and buildings in the Project Area from stationary activities during the construction phase of Alternative 1.
- ***Short-term, potentially significant, adverse*** vibration impacts from pile driving in the Project Area.
- ***Short-term, less-than-significant, adverse*** noise impacts to marine life during the construction phase of Alternative 1.
- ***Long-term, less-than-significant, adverse*** noise impacts to properties in the Project Area due to the testing of pump station generators during operation of Alternative 1.

Alternative 1 would result in no **indirect** noise or vibration impacts.

The following subsections provide greater detail.

Direct Impacts

<u>Noise during Construction Activities</u>

Under Alternative 1, the Proposed Project would construct a LOP within the Boroughs of Little Ferry, Carlstadt, and East Rutherford; the Township of South Hackensack; and the City of Hackensack. Construction of Alternative 1 would occur between the year 2019 and 2022, with peak activity occurring in the year 2021. The construction schedule is unknown at this time; therefore, this assessment assumed construction would occur Monday through Saturday between the hours of 7:00 AM and 4:00 PM. Construction would cause a short-term increase in traffic volumes in the Project Area. Construction would also require the temporary use of heavy equipment near noise- and vibration-sensitive receptors. Following construction, Alternative 1 would include the operation of one pump station and minimal maintenance vehicle trips around the LOP.

Construction would cause a short-term increase in traffic volumes due to worker vehicle trips and heavy truck trips for deliveries and equipment. The majority of inbound worker trips would be expected at the beginning of the shift, while most outbound worker trips would be expected at the end of the shift. The heavy truck trips would be distributed throughout the shift. As presented in **Section 3.7**, the AM peak hour of 7:00 to 8:00 AM during the peak construction period of 2021, which is also the overall peak hour, conservatively includes the worker vehicles from 7:00 to 8:00 AM and the trucks from 8:00 to 9:00 AM for assessment purposes. During this conservative peak hour, 57 worker vehicles would arrive to the Project Area and 15 heavy trucks would arrive and depart. These vehicles would be distributed across the Northern, Central, Southern, and Berry's Creek LOP work areas. Based on a review of the AM peak hour, the volume of construction vehicles would increase (over existing conditions) the traffic volumes by up to 27 percent for trucks and 3 percent for cars, with a total traffic volume increase of up to 5 percent. During the remaining hours of the construction shift and during non-peak construction periods, the overall trend for the area (as shown in **Figure 3.7-3**) is for traffic volumes to decrease by as much as 40% below the AM peak hour levels. With the same level of construction-related truck traffic, but reduced overall traffic volumes during midday periods, truck traffic volumes would increase by up to 38 percent, with a total traffic volume increase of up to 8 percent. These increases would translate to hourly L_{eq} increases of 1 dBA or less in any area.

Construction would only occur during daytime hours between 2019 and 2022. There are no local regulations that would apply to construction vehicles on local roads and a substantial change in noise level is not anticipated due to construction vehicles; therefore, no direct noise impacts are anticipated from short-term mobile construction noise sources associated with Alternative 1.

Numerous stationary construction activities would occur during the construction phase of Alternative 1, including demolition, clearing and grubbing, excavation, pile driving, sheet piling installation, repaving, and wetland restoration. Based on the expected types and quantities of equipment associated with each activity, pile driving/sheet piling installation ("pile driving") and clearing and grubbing were identified as the two loudest stationary construction activities for Alternative 1. **Table 4.8-2** summarizes the equipment and levels associated with these two activities.

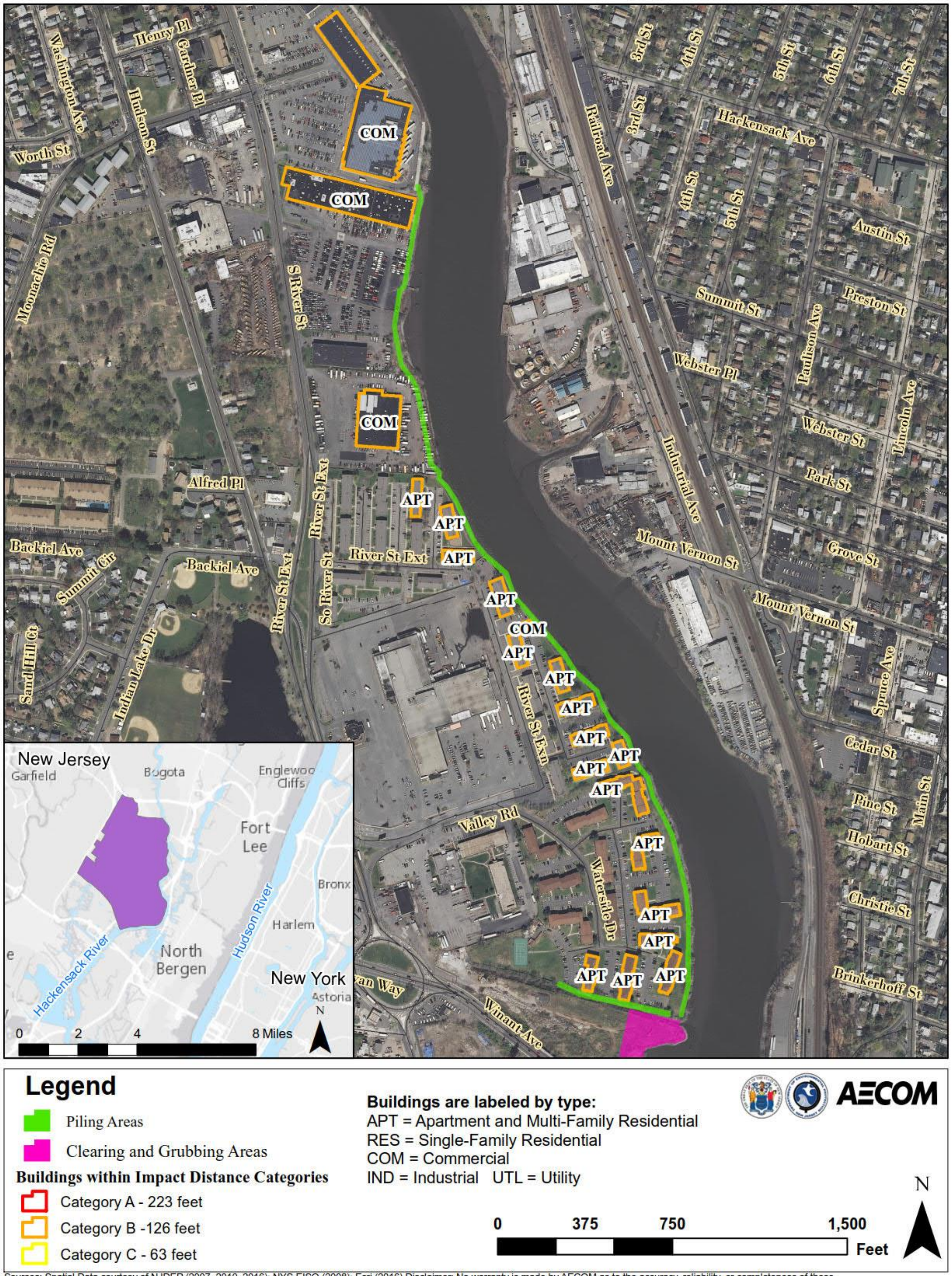
Table 4.8-2: Loudest Stationary Construction Activities

Activity	Equipment	Usage Factor	L_{max} at 50 feet (dBA)	Hourly L_{eq} at 50 feet (dBA)	Quantity	Activity Total Hourly L_{eq} at 50 feet (dBA)
Pile Driving / Sheet Piling	Impact Pile Driver / Vibratory Pile Driver	20	95	88	1	88
	Crane	16	85	77	1	
Clearing and Grubbing	Excavator	40	85	81	1	88
	Loader, Crawler	40	80	76	1	
	Brush Chipper	50	85	82	1	
	Chain Saw	20	85	78	2	
	Dump Truck	40	84	80	2	

Usage factor = the percentage of time that the equipment is in use
dBA = A-weighted decibel scale
L_{eq} = equivalent sound pressure level
L_{max} = maximum sound pressure level
Source: FHWA Highway Construction Noise Handbook (2006)

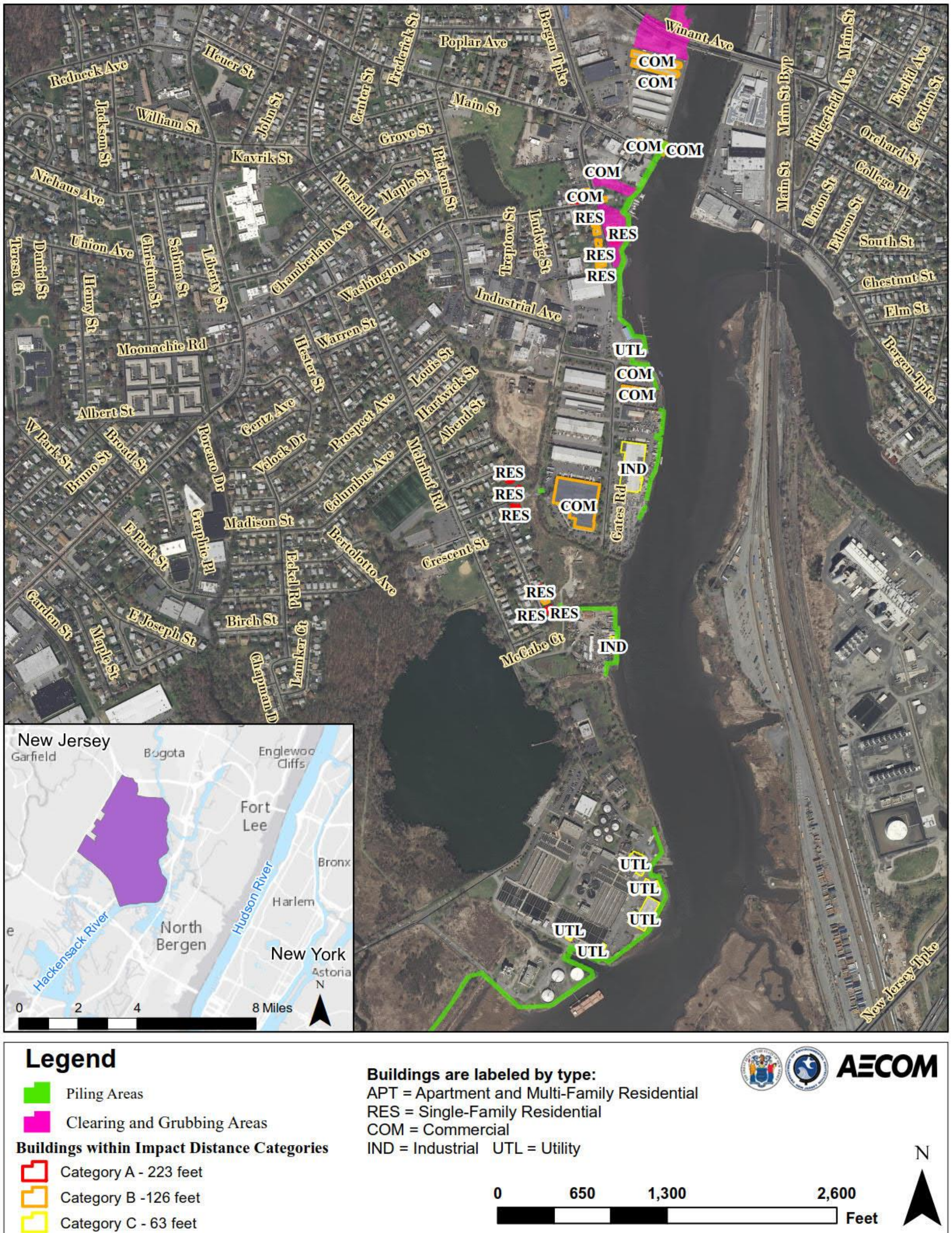
The activity total hourly L_{eq} is the logarithmic sum of the noise levels for each piece of equipment expected to be used during each activity. While impact pile drivers and vibratory pile drivers are the loudest pieces of equipment, they do not produce their maximum noise emissions continuously. Individually, the clearing and grubbing equipment is quieter than a pile driver, but the activity would operate more pieces of equipment for a higher percentage of each hour. As a result, the total hourly L_{eq} for both pile driving and clearing and grubbing is modeled to be 88 dBA at 50 feet.

Pile driving would occur where floodwalls are built, which would occur along the majority of the LOP. Clearing and grubbing would occur in areas where there is existing vegetation in the Alternative 1 easement. Pile driving and clearing and grubbing have equal hourly L_{eq}, but because pile driving would occur more consistently across the LOP than clearing and grubbing, pile driving was used as the focus for the LOP. Clearing and grubbing was considered in cases where these activities would occur away from the LOP, such as in construction of Fluvial Park and Riverside Park. **Figure 4.8-1**, **Figure 4.8-2**, **Figure 4.8-3**, and **Figure 4.8-4** illustrate the modeled pile driving locations and clearing and grubbing locations that are away from the LOP and receivers. The edge of each clearing and grubbing area was used to determine the closest distance to nearby receivers. Maximum distances between the activities and the regulatory limits were calculated to determine the buffer zones within which noise impacts may occur. The number of noise-sensitive receptors within these buffer zones was then determined using a GIS database for the Project Area.



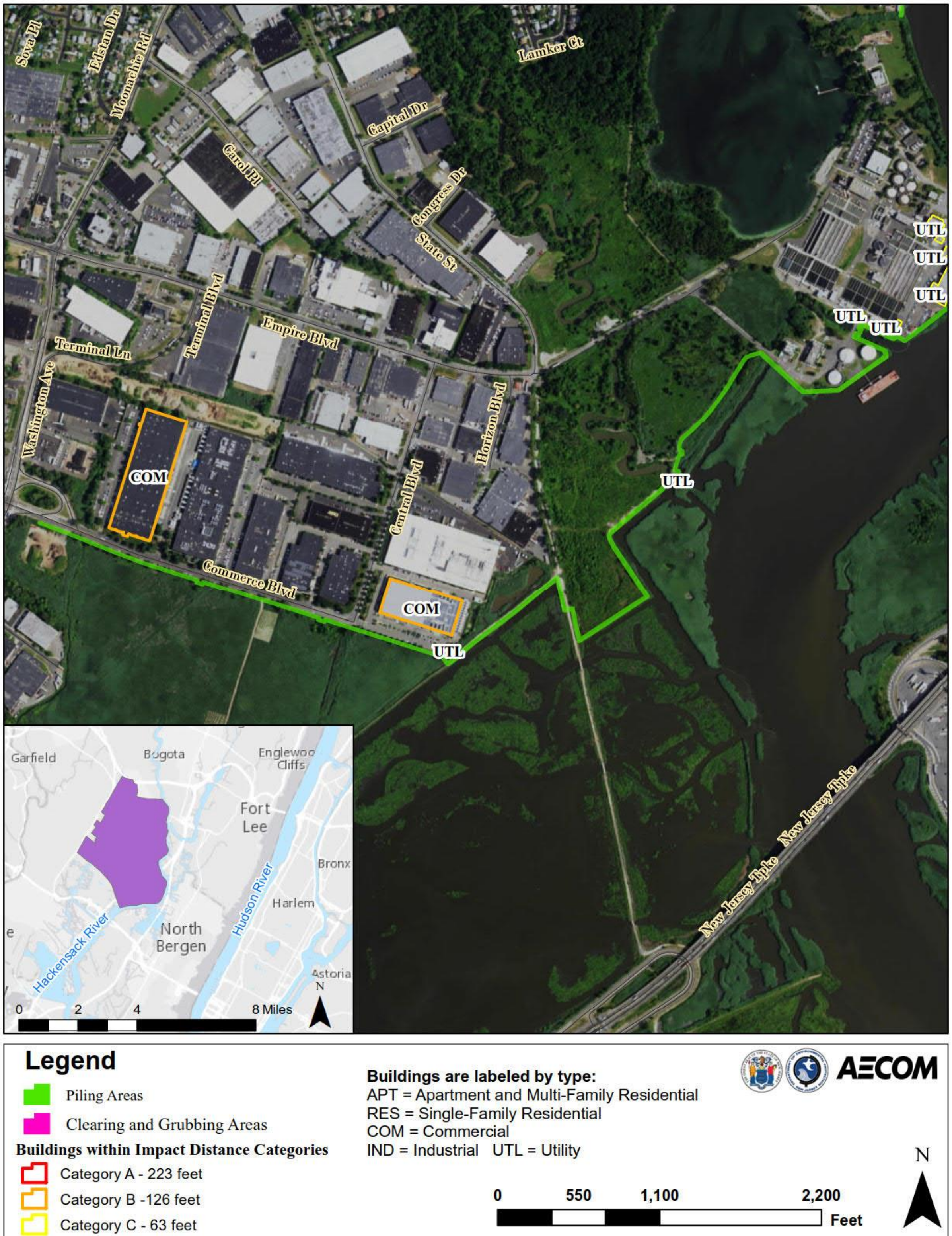
Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.8-1: Alternative 1 Modeled Stationary Construction Noise Impacts in the Northeast Region of the Project Area



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.8-2: Alternative 1 Modeled Stationary Construction Noise Impacts in the Central Hackensack Region of the Project Area



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.8-3: Alternative 1 Modeled Stationary Construction Noise Impacts in the Southeast Region of the Project Area

Legend

Piling Areas

Clearing and Grubbing Areas

Buildings within Impact Distance Categories

Category A - 223 feet

Category B -126 feet

Category C - 63 feet

Buildings are labeled by type:
APT = Apartment and Multi-Family Residential
RES = Single-Family Residential
COM = Commercial
IND = Industrial UTL = Utility

AECOM

0 320 640 1,280 Feet

N

Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.8-4: Alternative 1 Modeled Stationary Construction Noise Impacts in the Berry's Creek Region of the Project Area

The Alternative 1 stationary construction activities would occur in the City of Hackensack; the Boroughs of Little Ferry, Carlstadt, and East Rutherford; and the Township of South Hackensack. None of these municipalities have quantitative noise limits applicable to construction activities; however, most do have construction schedule restrictions. **Table 4.8-3** summarizes the potential for impacts due to construction schedule restrictions.

Table 4.8-3: Alternative 1 Construction Schedule Restrictions

Municipality *	Weekday Allowable Hours for Construction	Saturday Allowable Hours for Construction	Potential for Impact to Construction Schedule
City of Hackensack	7:00 AM to 6:00 PM	9:00 AM to 6:00 PM	Less-than-Significant
Borough of Little Ferry	8:00 AM to 8:00 PM	8:00 AM to 8:00 PM	Less-than-Significant
Borough of Carlstadt	7:00 AM to 6:00 PM	7:00 AM to 6:00 PM	No Impact
Borough of East Rutherford	7:00 AM to 6:00 PM	Not permitted	Potentially Significant
Township of South Hackensack	No mention of construction noise	No mention of construction noise	No Impact

* The Boroughs of Moonachie and Teterboro are not included in this table, as they would not be affected by the construction of Alternative 1.

The construction schedule is assumed to occur Monday through Saturday between the hours of 7:00 AM and 4:00 PM. Based on this construction schedule, no impacts related to scheduling were identified for the Borough of Carlstadt or the Township of South Hackensack. However, construction could occur outside of the allowable hours for the City of Hackensack, the Borough of Little Ferry, and the Borough of East Rutherford. The potential schedule-related impacts in the City of Hackensack are considered to be a ***short-term, less-than-significant adverse*** effect because only a two-hour period on Saturdays is outside of the permitted construction times. This potential impact is also expected to be less-than-significant in the Borough of Little Ferry because the construction schedule is out of permitted times for only one hour each day. Within the Borough of East Rutherford, schedule-related impacts are ***potentially significant***, as any construction on Saturdays would violate local regulations.

With the exception of the northern end of the LOP, construction would occur within the Meadowlands District. Therefore, noise limits implemented by NJSEA through NJAC 19:4 apply to construction activities unless a noise mitigation plan is approved by the NJSEA. **Table 4.8-4** summarizes the results of the stationary construction noise assessment based on the predicted noise levels and the noise and vibration impact significance criteria provided in **Table 4.8-1**, with potentially significant impacts defined by predicted levels being greater than or equal to 10 dBA above the regulatory limits. Note that the sound levels associated with potentially significant impacts are all above the background levels monitored throughout the study area, listed in **Section 3.8**. **Figure 4.8-1** through **Figure 4.8-4** show the properties that could experience ***short-term, potentially significant adverse*** noise impacts from Alternative 1.

Stationary construction activities have a high potential to disturb nearby residents. However, construction would be localized to a rather linear work area and would not occur throughout the municipalities. Each construction activity, such as pile driving, would move along the LOP in a generally linear fashion. Peak noise levels would occur when the activity is nearest to noise-sensitive receptors; noise levels would taper off as the equipment progresses along the LOP. Other construction activities, aside from pile driving and clearing and grubbing, would be expected to produce lower noise levels. The modeled receptors were generally placed on the receiving property line or the edge of the easement if the easement overlapped a noise-sensitive parcel; therefore, expected noise levels at the homes or buildings themselves could be lower. Interior noise levels would be further reduced, especially if windows are closed. All residential buildings having ***potentially significant adverse*** noise impacts have air conditioning units, so windows in these buildings do not need to be open during the construction activities. To reduce the potential for disturbance, mitigation measures will be evaluated and implemented where feasible. Where no local regulations apply, no impact is anticipated from stationary construction noise.

Table 4.8-4: Alternative 1 Stationary Construction Noise Model Results

NJ Performance Standard Category	Sound Limit (dBA)	Buffer Distance to Potentially Significant Impact (feet)	# of Properties with Potentially Significant Impacts
A	65	223	11
B	70	126	41
C	76	63	12

dBA = A-weighted decibel scale of sound pressure level

Changes to Noise during Operational Activities

During long-term operations of Alternative 1, fewer than 10 maintenance vehicles would operate within the Project Area during peak hours (see **Section 4.7**). The addition of maintenance vehicle trips to existing local roadways is not expected to produce a noticeable change in noise levels. Additionally, there are no local regulations that would apply to operational mobile noise sources. Therefore, no impacts would be expected from mobile sources associated with long-term operations of Alternative 1.

Alternative 1 would construct and operate a new pump station at the Berry's Creek Surge Barrier, which would be located in the Borough of East Rutherford. Two 1,500-kilowatt (kW) diesel generators would be located within the pump station building. One generator may operate during emergency situations; however, emergency operation would be exempt from the applicable noise regulations. The generators would be tested on a monthly basis during daytime hours, and each generator would operate individually for up to 1 hour. Generator testing would be subject to the broadband and spectral State limits (NJAC 7:29) and the broadband NJSEA limits (NJAC 19:4), so generator noise levels were predicted at the nearest receptors. **Table 4.8-5** lists the generator noise levels assumed in the assessment.

Table 4.8-5: Modeled Generator Noise Levels

Component	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Generator Exhaust SPL at 50 feet, dB	105*	105*	105	99	90	89	89	89	86
Generator Mechanical SPL at 50 feet, dB	81*	81*	81	82	80	81	83	80	84
Exhaust Muffler Noise Attenuation, dB	9	17	37	33	20	20	20	19	19

*The generator noise levels at 31.5 and 63 Hz were assumed to be equal to the noise level at 125 Hz
dB = unweighted decibel
Hz = Hertz
SPL = sound pressure level
Basis-of-design generator: CAT 3512
Basis-of-design exhaust muffler: Maxim M42

The exhaust muffler noise attenuation was subtracted from the generator exhaust noise levels. No further attenuation was applied to the exhaust noise because the exhaust path would be ducted out of the building. Building noise attenuation attributable to a standard metal building was subtracted from the generator mechanical noise. The louvers in the exterior walls of the building were assumed to be standard louvers with 5 to 10 dB of noise attenuation, depending on frequency.

Figure 4.8-5 shows the distances between the pump station building and the closest NJSEA performance standard Category A, B, and C land use zone properties. Also shown in this figure are buffer distances within which the associated noise level limits were calculated to be exceeded by 10 dBA or more. Depending on the background sound levels at each location near the pump station building during generator tests, the noise from the generators may be audible at many locations in the area. Since no properties are within the impact limit buffer zones, generator testing would result in ***long-term, less-than-significant adverse*** noise impacts.

With regard to the octave band frequency limits, noise levels from generator testing were calculated to exceed the New Jersey State Noise Control Code by 5 dB or more within 290 feet of the pump station building, mainly from the sides of the building with louvers. There are no noise-sensitive receptors within this buffer zone and generator testing would last up to 2 hours per month during daytime hours. Additionally, the generator noise would be localized in an area with commercial and industrial receptors. Acoustical louvers and other treatments, which were conservatively excluded from this assessment, will be evaluated during final design of the pump station. Based on this information, the potential for impact from stationary operations noise is considered less than significant.

Figure 4.8-5: Alternative 1 Modeled Stationary Operations Noise Impact Potential

Underwater Noise

During the construction of Alternative 1, the only project-related source of underwater noise impacts in the Project Area would be pile driving activities near the banks of the Hackensack River and Berry's Creek. No pile driving is expected to take place within either of these bodies of water, thereby minimizing the potential impact to marine life. However, there is a wide range of sound pressure levels that can be generated from pile driving, depending on the pile size and type, for both impact and vibratory driving. The variation in sound pressure levels can be more than 30 dB (Caltrans 2015), but typical land-based pile driving for the planned 9-hour per day schedule would only generate in-water sound pressure levels over the injury and behavioral limits for organisms within 30 feet of any pile driving activities. Although this is considered to be a ***short-term, less-than-significant adverse*** impact on marine life in these bodies of water, this would need to be reevaluated after the pile driving components are clearly defined.

Vibration

During the construction of Alternative 1, the only project-related activity capable of producing potentially damaging levels of vibration to buildings more than 50 feet away is pile driving. Assuming typical maximum vibration levels (FTA 2006), the structural damage thresholds may be exceeded between 30 and 75 feet from impact pile drivers, with the specific distance depending on the soils between the activities and each building, the type of building construction, and the type and size of piles and drivers. **Figures G-29** through **G-38** in **Appendix G** shows the buildings where vibrations from pile driving may cause ***potentially significant adverse*** impacts. These vibration levels would also exceed the New Jersey District Zoning Regulations referenced in **Section 3.8.2** of this document.

Figures G-29 through **G-38** in **Appendix G** also shows the buildings that are within the threshold distances for vibration-related annoyance. These distances vary between 125 feet for vibratory pile driving and 290 feet for impact pile driving. **Table 4.8-6** lists the number of buildings that have the potential for vibration impacts as a result of Alternative 1 construction activities. These are preliminary estimates based on average conditions since the type and size of piles and drivers are not known at this time and vibration levels vary substantially with type and size of piles and drivers. Soil types can also affect results and limited soil type data are available at this time. This analysis should be updated when more details are available.

Table 4.8-6: Summary of Potential Alternative 1 Vibration Impacts

Activity	Type of Limit Exceeded	Distance Limit from Activity to Building (feet)	Number of Affected Buildings
Impact pile driving (Central and Berry's Creek LOP areas only)	NJAC Category A	160	4
	NJAC Category B	87	7
	NJAC Category C	55	10
	FTA standard construction damage limit	55	15
	FTA fragile building damage limit	77	0
	FTA annoyance limit (residential only)	290	26

Activity	Type of Limit Exceeded	Distance Limit from Activity to Building (feet)	Number of Affected Buildings
Vibratory pile driving (all LOP areas)	NJAC Category A	66	2
	NJAC Category B	36	16
	NJAC Category C	22	6
	FTA standard construction damage limit	22	18
	FTA fragile building damage limit	32	0
	FTA annoyance limit (residential only)	125	22

Indirect Impacts

Under Alternative 1, no indirect noise or vibration impacts would occur from the construction or operation of Alternative 1 because activities with the potential to generate noise or vibration, such as re-routed trucks, are not anticipated to generate any perceptible change in the Project Area if they occur.

Mitigation Measures and BMPs

The following mitigation measures and/or BMPs would be implemented to reduce identified potentially significant adverse impacts to less-than-significant levels.

- During the final design process, potential impacts from vibration would be reevaluated, as needed, based on the final pile driving locations to ensure they do not substantially differ from the anticipated impacts determined in this EIS.
- If necessary during the permitting process, potential impacts from underwater noise would be reevaluated based on the final pile driving locations to ensure they do not substantially differ from the anticipated impacts determined in this EIS.
- During construction, noise reducing and/or the quietest practicable construction methods and equipment, such as the use of noise shrouds around pile driving rigs and equipment equipped with mufflers and noise attenuation devices would be used. All equipment would be properly maintained.
- During construction, contractors would place noise barriers between work areas and noise-sensitive receptors. Noise barriers must block the line of sight between the noise source and receiver to be effective. Noise barriers are most effective when located close to the noise source or receiver.
- Stationary equipment, such as generators and compressors, would be enclosed and would use acoustical louvers and/or sound attenuators in the exterior walls of these enclosures to reduce noise emissions through the air inlet and outlet louvers of the pump station building.

- Contractors would utilize specific vibration control measures that can be implemented for pile driving activities, including predrilling or augering and maximizing the use of vibratory rather than impact pile driving. Additionally, contractors should consider the use of drilled piles instead of impact or vibratory pile driving.
- Construction vehicles would be routed away from residential streets, to the extent possible.
- Vehicle idling would be limited in accordance with NJAC 7:27-14 and NJAC 7:27-15.
- Contractors and subcontractors would be trained to raise awareness of noise-specific issues and noise-sensitive areas. Noise complaint and response procedures would be established.
- The construction schedule would be communicated to the public, including days of the week and hours of the day when work would occur. Furthermore, during construction, contractors would work with the local municipalities to address any scheduling concerns. Contractors should plan construction activities to occur during daytime hours to eliminate impacts during more sensitive nighttime hours.
- A construction schedule that is adjusted to comply with local regulations would be developed.
- An approved noise mitigation plan would be developed with the NJSEA. During construction, contractors would describe and commit to a mitigation plan that would be implemented during the final design and construction phases of the project. The plan should provide a procedure for establishing thresholds and limiting vibration levels for potentially affected structures based on an assessment of each structure’s ability to withstand the loads and displacements due to construction vibrations. Additionally, a vibration monitoring plan and compliance monitoring program would be implemented.

4.8.2.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would provide stormwater drainage improvements to the Project Area, but coastal flooding from storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, potentially significant, adverse*** noise and vibration impacts to properties and buildings in the Project Area from stationary activities during the construction phase of Alternative 2.
- ***Short-term, potentially significant, adverse*** vibration impacts from pile driving in the Project Area.
- ***Short-term, less-than-significant, adverse*** noise impacts to marine life during the construction phase of Alternative 2.
- ***Long-term, less-than-significant, adverse*** noise impacts to properties in the Project Area due to the testing of pump station generators during operation of Alternative 2.

Alternative 2 would result in no **indirect** noise or vibration impacts.

The following subsections provide greater detail.

Direct Impacts

Noise during Construction Activities

Under Alternative 2, the Proposed Project would construct stormwater drainage improvements in the Boroughs of Little Ferry, Moonachie, and Carlstadt. Construction of Alternative 2 would occur between the year 2019 and 2022, with peak activity occurring in the year 2020. Following construction, Alternative 2 would include the operation of three pump stations and minimal maintenance vehicle trips around the stormwater management improvement areas.

The construction schedule is unknown at this time; therefore, this assessment was conducted using the same methodology and general assumptions as Alternative 1 (see **Section 4.8.2.2**) with a few minor differences. As presented in **Section 3.7**, the AM peak hour of 7:00 to 8:00 AM, which is also the overall peak hour, conservatively includes the worker vehicles from 7:00 to 8:00 AM and the trucks from 8:00 to 9:00 AM for assessment purposes. During this conservative peak hour, 39 worker vehicles would arrive to the Project Area and 10 heavy trucks would arrive and depart, in comparison to 57 worker vehicles and 15 heavy trucks under Alternative 1. These vehicles would be distributed across the grey infrastructure, green infrastructure, and park improvement work areas. Based on a review of the AM peak hour, the volume of construction vehicles would increase (over existing conditions) the traffic volumes by up to 16 percent for trucks and 3 percent for cars, with a total traffic volume increase of up to 4 percent (in comparison to a total traffic volume of 5 percent under Alternative 2). During the remaining hours of the construction shift and during non-peak construction periods, the overall trend for the area (as shown in **Figure 3.7-3**) is for traffic volumes to decrease by as much as 40 percent below the AM peak hour levels. With the same level of construction-related truck traffic, but reduced overall traffic volumes during midday periods, truck traffic volumes would increase by up to 24 percent, with a total traffic volume increase of up to 6 percent. Under Alternative 2, these increases would also translate to hourly L_{eq} increases of 1 dBA or less in any area, but would be slightly less than Alternative 1. Similar to Alternative 1, no direct noise impacts are anticipated from short-term mobile construction noise sources associated with Alternative 2.

Numerous stationary construction activities would occur during the construction phase of Alternative 2, including demolition, clearing and grubbing, excavation, pile driving, sheet piling installation, repaving, and wetland restoration. Based on the expected types and quantities of equipment associated with each activity, pile driving/sheet piling installation (“pile driving”) and excavation were identified as the two loudest stationary construction activities for Alternative 2. **Table 4.8-2** summarizes the equipment and sound pressure levels associated with these two activities.

Figure 4.8-6 through **Figure 4.8-10** show the modeled pile driving and excavation locations that are away from the stormwater management improvement areas and receivers. The edge of each excavation area was used to determine the closest distance to nearby receivers. Maximum distances between the activities and the regulatory limits were calculated to determine the buffer zones within which noise impacts may occur. The number of noise-sensitive receptors within these buffer zones was then determined using a GIS database for the Project Area.

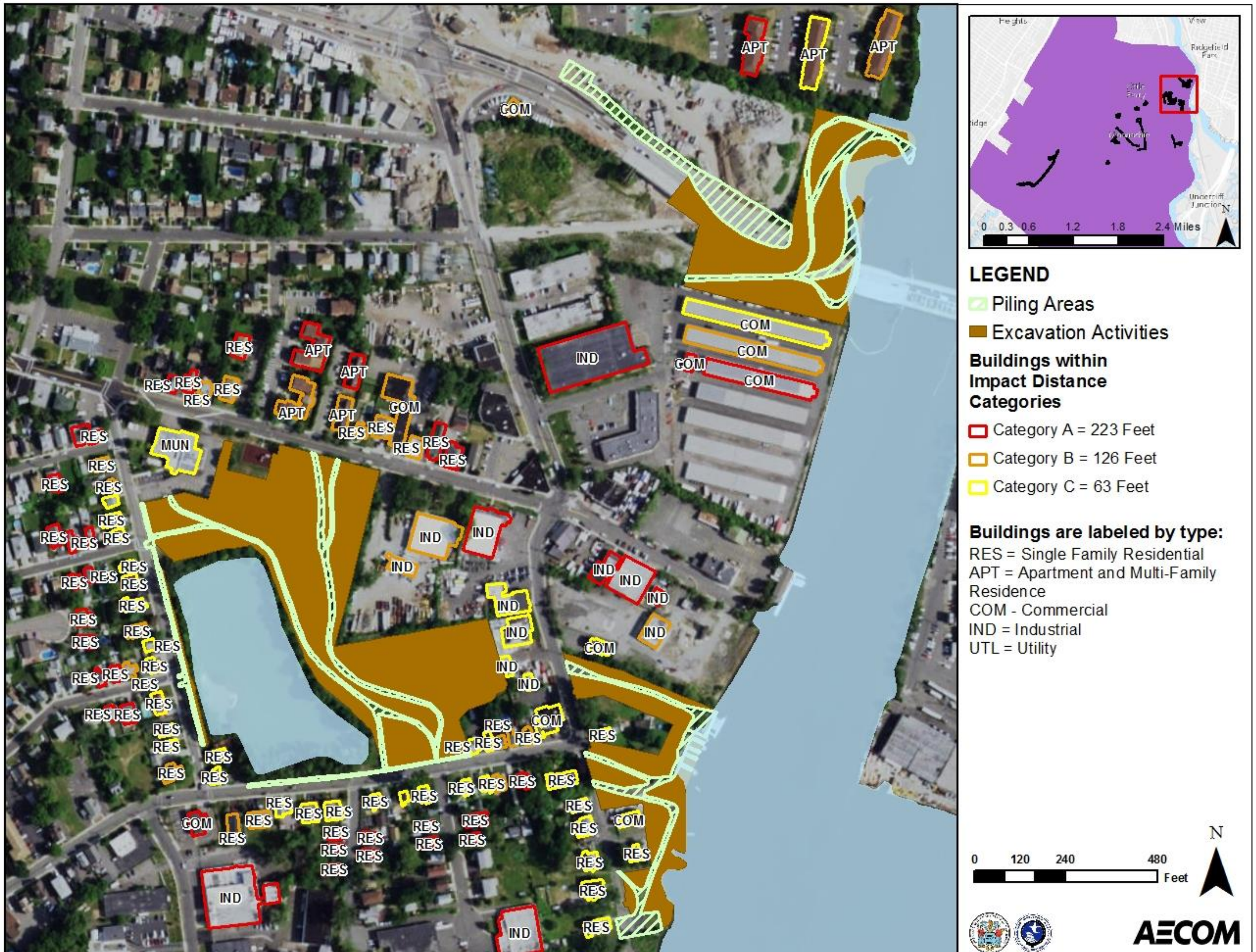


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Figure 4.8-6: Alternative 2 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

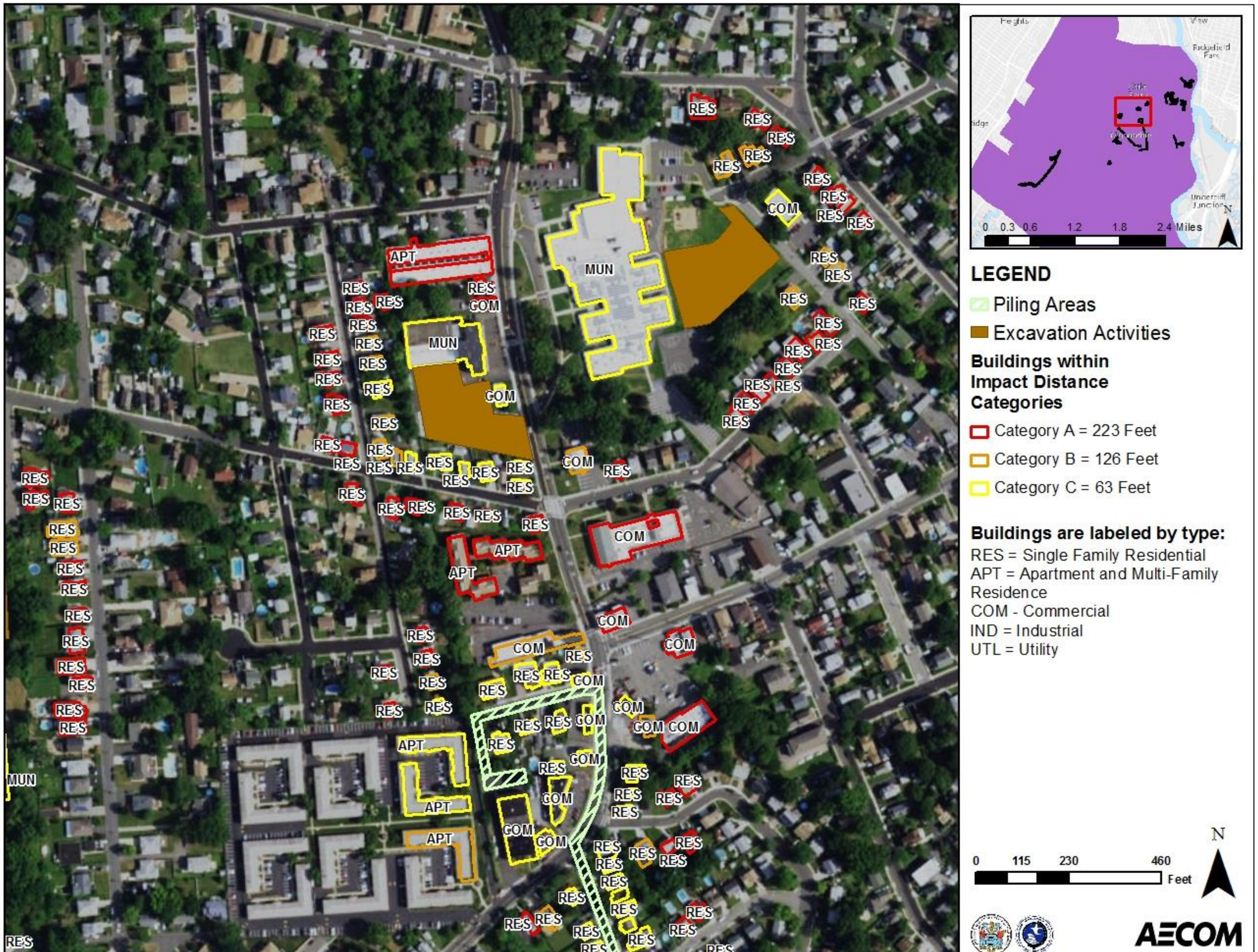

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Figure 4.8-7: Alternative 2 and 3 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

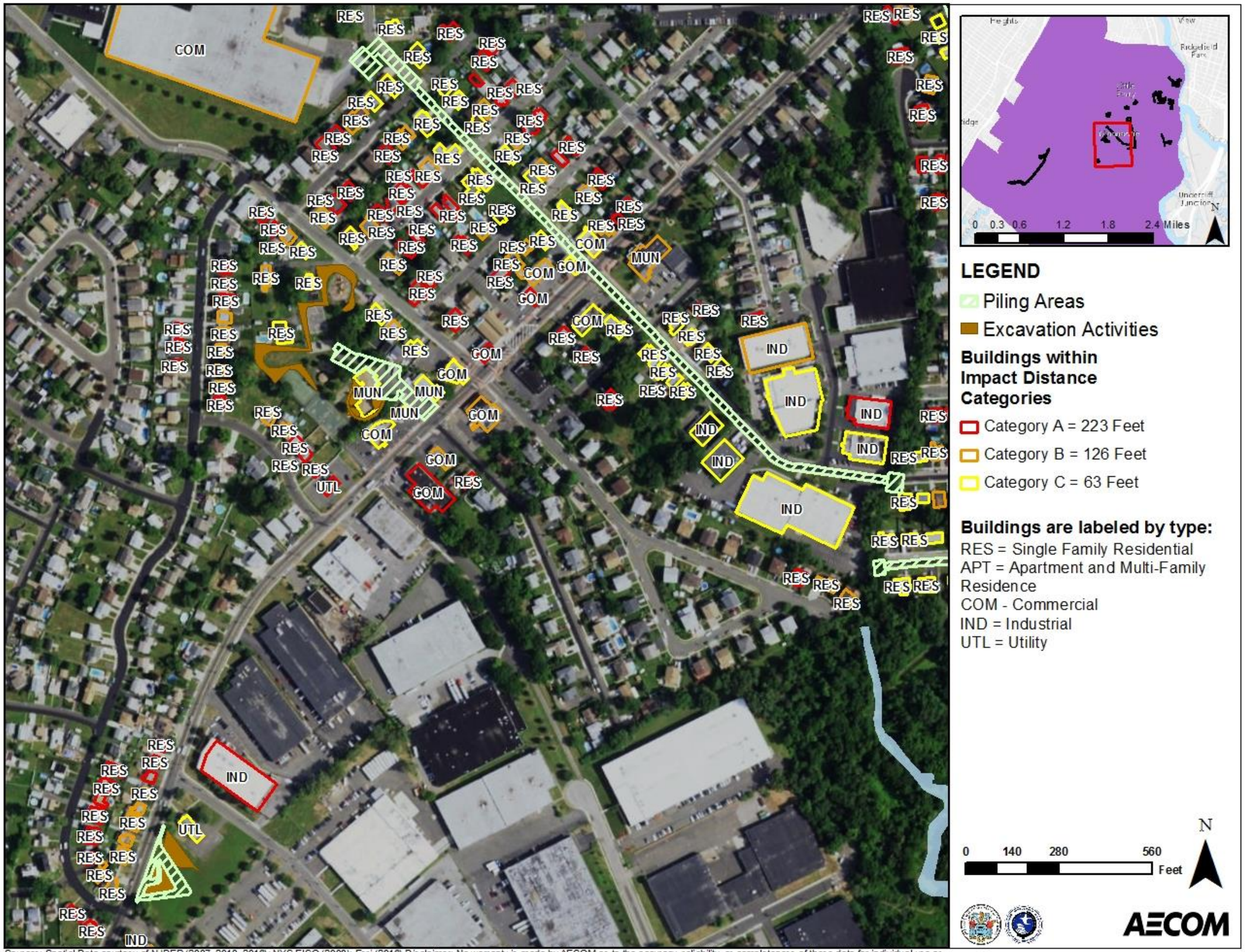

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Figure 4.8-8: Alternative 2 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

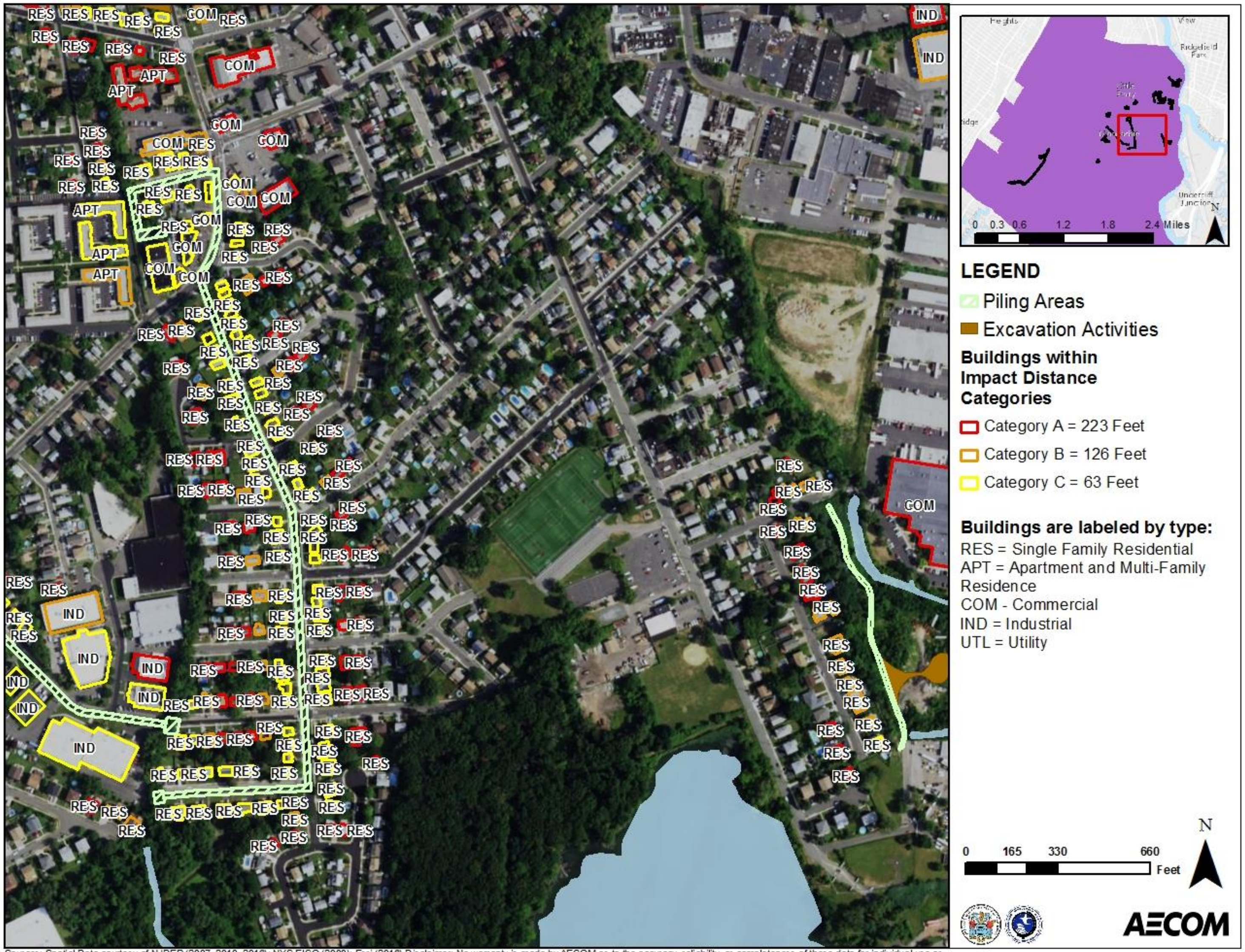

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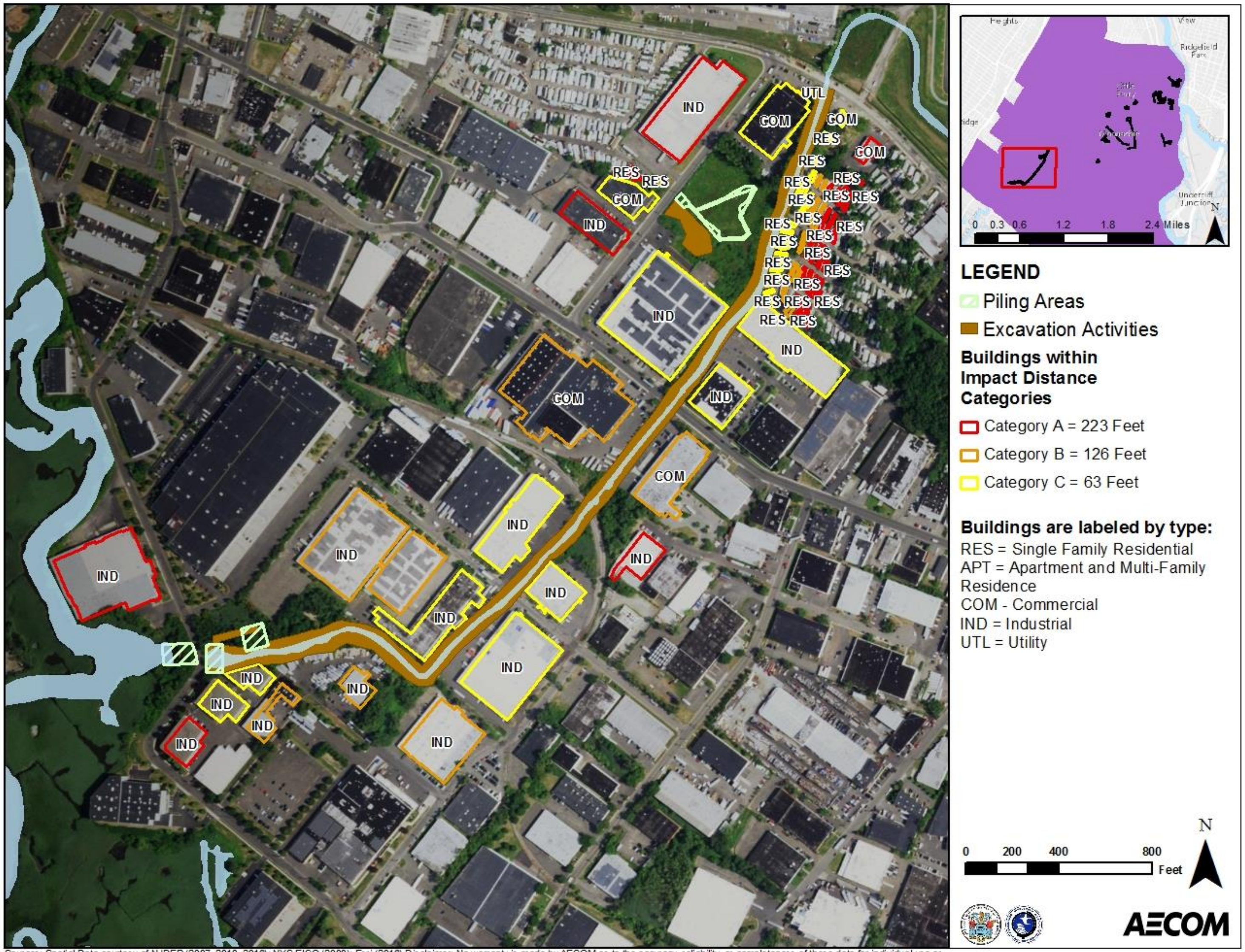
Figure 4.8-9: Alternative 2 Modeled Stationary Construction Noise Impacts (see subject area in legend map)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.8-10: Alternative 2 and 3 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

Under Alternative 2, the Proposed Project would construct stormwater drainage improvements in the Boroughs of Little Ferry, Moonachie, and Carlstadt. None of these municipalities have quantitative noise limits applicable to construction activities; however, they all have construction schedule restrictions. **Table 4.8-7** summarizes the potential for impacts due to construction schedule restrictions.

Table 4.8-7: Alternative 2 Constrcution Schedule Restrictions

Municipality	Weekday Allowable Hours for Construction	Saturday Allowable Hours for Construction	Potential for Impact to Construction Schedule
Borough of Little Ferry	8:00 AM to 8:00 PM	8:00 AM to 8:00 PM	Less-than-Significant
Borough of Carlstadt	7:00 AM to 6:00 PM	7:00 AM to 6:00 PM	No Impact
Borough of Moonachie	7:00 AM to 8:00 PM	7:00 AM to 8:00 PM	No Impact

The construction schedule is assumed to occur Monday through Saturday between the hours of 7:00 AM and 4:00 PM. Based on this construction schedule, no impacts related to scheduling were identified for the Boroughs of Carlstadt or Moonachie. However, construction could occur outside of the allowable hours for the Borough of Little Ferry. The potential schedule-related impacts in the Borough of Little Ferry are considered to be a ***short-term, less-than-significant, adverse*** effect because only a one-hour period on weekdays and Saturdays is outside of the permitted construction times.

Similar to Alternative 1, construction would occur within the Meadowlands District with the exception of the northern end of the stormwater management improvement areas. Therefore, noise limits implemented by NJSEA through NJAC 19:4 apply to construction activities unless a noise mitigation plan is approved by the NJSEA. **Table 4.8-8** summarizes the results of the stationary construction noise assessment based on the predicted noise levels and the noise impact significance criteria provided in **Table 4.8-1**, with potentially significant impacts defined by predicted levels being greater than or equal to 10 dBA above the regulatory limits. Note that the sound pressure levels associated with potentially significant impacts are all above the background levels monitored throughout the study area, listed in **Section 3.8**. **Figure 4.8-6** through **Figure 4.8-10** show the properties that could experience ***short-term, potentially significant, adverse*** noise impacts from Alternative 2.

Stationary construction activities have a high potential to disturb nearby residents. However, construction would be localized to specific work areas and would not occur throughout the municipalities. Peak noise levels would occur when the activity is nearest to noise-sensitive receptors; noise levels would taper off as the equipment progresses around the Project Area. Other construction activities, aside from pile driving and excavating, would be expected to produce lower noise levels. The modeled receptors were generally placed on the receiving property line or the edge of the easement if the easement overlapped a noise-sensitive parcel; therefore, expected noise levels at the homes or buildings themselves could be lower. Interior noise levels would be further reduced, especially if windows are closed. All residential buildings having ***potentially significant*** noise impacts have air conditioning units, so windows in these buildings do not need to be open during the construction activities. To reduce the potential for disturbance, mitigation measures will be evaluated and implemented where feasible. Where no local regulations apply, no impact is anticipated from stationary construction noise.

Table 4.8-8: Alternative 2 Stationary Construction Noise Model Results

NJ Performance Standard Category	Sound Limit (dBA)	Buffer Distance to PotentiallySignificant Impact (feet)	Number of Properties with Potentially Significant Impacts
A	65	223	633
B	70	126	278
C	76	63	56

dBA = A-weighted decibel scale of sound pressure level

Changes to Noise during Operational Activities

Similar to Alternative 1, fewer than 10 maintenance vehicles would operate within the Project Area during peak hours and no local regulations would apply to operational mobile noise sources. Therefore, no impacts would be expected from mobile sources associated with long-term operations of Alternative 2.

Alternative 2 would construct and operate three new pump stations – one at East Riser Ditch and two near Losen Slote, which would be located in the Boroughs of Little Ferry, Moonachie, and Carlstadt. One 1,500-kW diesel generator would be located within each of the East Riser Ditch and Losen Slote pump station C buildings. One 350-kW diesel generator would be located in the Losen Slote pump station A building. The same methodology and assumptions described under Alternative 1 were used for this analysis (see **Section 4.8.2.2**). **Table 4.8-5** lists the generator levels assumed for the 1,500-kW generators and **Table 4.8-9** lists the levels assumed for the 350-kW generator.

Table 4.8-9: Losen Slote Pump Station A Modeled 350-kW Generator Noise Levels

Component	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Generator Exhaust SPL at 50 feet, dB	84*	84	88	92	97	98	99	95	83
Generator Mechanical SPL at 50 feet, dB	96*	96	88	92	92	94	93	88	82
Exhaust Muffler Noise Attenuation, dB	9	17	37	33	20	20	20	19	19

*The generator noise levels at 31.5 Hz were assumed to be equal to the noise level at 63 Hz
dB = unweighted decibel
Hz = Hertz
SPL = sound pressure level
Basis-of-design generator: CAT C13/15
Basis-of-design exhaust muffler: Maxim M42

Figure 4.8-11 through **Figure 4.8-13** show the distances between the pump station buildings and the closest NJSEA performance standard Category A, B, and C land use zone properties. Also shown in these figures are buffer distances within which the associated noise level limits were calculated to be exceeded by 10 dBA or more. Depending on the background sound levels at each location near the pump station building during generator tests, the noise from the generators may be audible at many locations in the area. There are no properties within the impact limit buffer zones for the East Riser Ditch pump station. For Losen Slote pump station A, there is a Category A property at the buffer distance limit and a Category B property within 2 feet of the buffer distance limit. For Losen Slote pump station C, there are two Category A properties within the buffer distance limit. These calculations assumed the worst case of louvers on the pump stations facing the closest properties. If the pump station buildings are oriented such that louvers or exhaust pipes do not face these properties, the buffer distances decrease enough to eliminate these potential impacts. Other aspects of the pump buildings can also be included to control noise from the generators as part of their final designs, so generator testing would result in ***long-term, less-than-significant, adverse*** noise impacts.

With regard to the octave band frequency limits, noise levels from generator testing were calculated to exceed the New Jersey State Noise Control Code by 5 dB or more within 115 feet of the Losen Slote pump station A building and within 290 feet of the East Riser Ditch pump station and Losen Slote pump station C buildings, mainly from the sides of the buildings with louvers. Losen Slote pump station C is in the Borough of Moonachie and that municipality has noise limits that are less than those listed in the New Jersey State Noise Control Code for nighttime (8:00 PM to 8:00 AM) operations but no limits for daytime operations. Since testing will take place during daytime hours only, these stricter nighttime limits are not applicable to this project.

There are noise-sensitive receptors within these buffer zones for Losen Slote pump stations A and C, but these exceedances are assuming the worst case pump station building design of having the building louvers and generator exhaust pipes facing the noise-sensitive properties. Orienting the buildings such that the louvers and exhaust pipes do not face these properties lowers the impact buffer distances to 37 feet for pump station A and 46 feet for pump station C. This would eliminate the potential impacts associated with pump station A but extra building insulation design would be required for pump station C to avoid any associated noise impacts. In addition, generator testing would only last up to 2 hours per month during daytime hours. Based on this information, the potential for impact from stationary operations noise is considered ***less-than-significant***.

<u>Underwater Noise</u>

During the construction of Alternative 2, the only project-related source of underwater noise impacts in the Project Area would be pile driving activities near the banks of the Hackensack River and interior streams in the proposed Fluvial Park, Riverside Park, and DePeyster Creek Park, and at the coffer dam upstream of Starke Road and downstream of the East Riser Ditch tide gate. No pile driving is expected to take place within any of these bodies of water, thereby minimizing the potential impact to marine life. However, there is a wide range of sound pressure levels that can be generated from pile driving, depending on the pile size and type, for both impact and vibratory driving. The variation in sound pressure levels can be more than 30 dB (Caltrans 2015), but typical land-based pile driving for the planned 9-hour per day schedule would only generate in-water sound pressure levels over the injury and behavioral limits for organisms within 30 feet of any pile driving activities. Although this is considered to be a ***short-term, less-than-significant, adverse*** impact on marine life in these waterbodies, this would need to be reevaluated after the pile driving components are clearly defined.

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Figure 4.8-11: Alternative 2 and 3 Modeled Stationary Operations Noise Impact Potential for ERD Pump Station

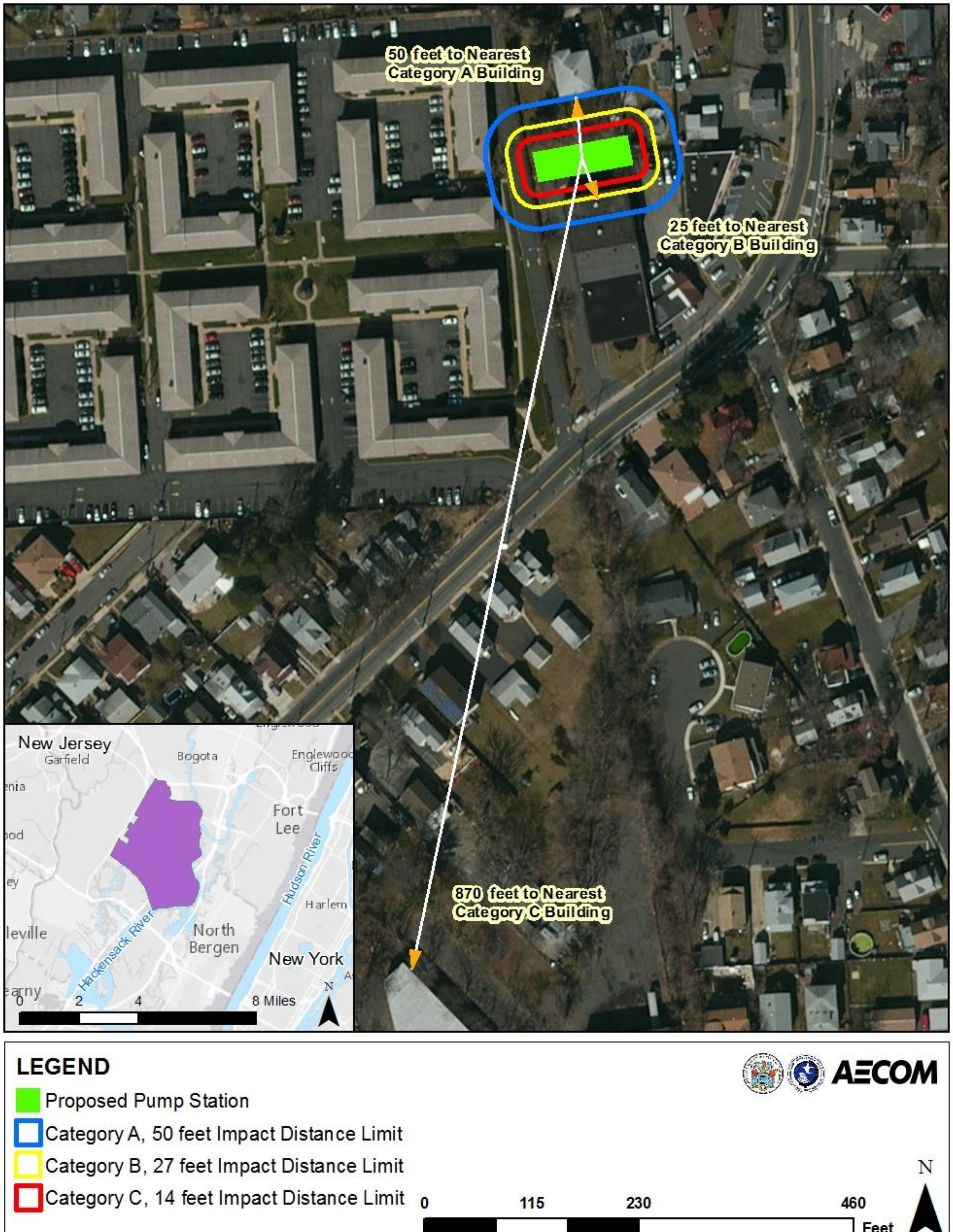

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Figure 4.8-12: Alternative 2 and 3 Modeled Stationary Operations Noise Impact Potential for Losen Slote Pump Station A

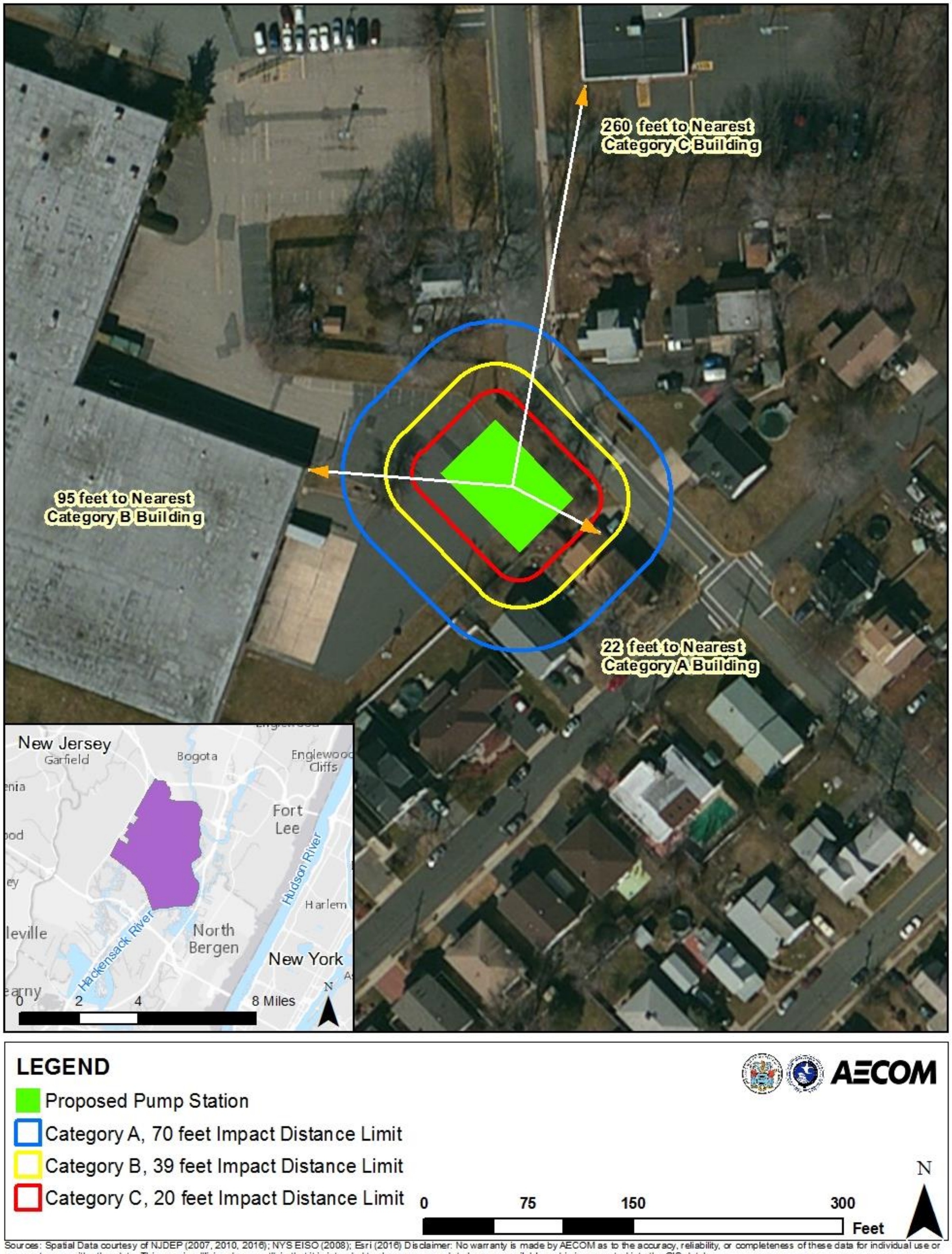

Figure 4.8-13: Alternative 2 Modeled Stationary Operations Noise Impact Potential for Losen Slote Pump Station C

Vibration

During the construction of Alternative 2, the only project-related activity capable of producing potentially damaging levels of vibration to buildings more than 50 feet away is pile driving. Assuming typical maximum vibration levels (FTA 2006), the structural damage thresholds may be exceeded between 30 and 75 feet from impact pile drivers, with the specific distance depending on the soils between the activities and each building, the type of building construction, and the type and size of piles and drivers. **Figure G-39** through **Figure G-43** in **Appendix G** shows the buildings where vibrations from pile driving may cause ***potentially significant*** impacts. These vibration levels would also exceed the New Jersey District Zoning Regulations referenced in **Section 3.8.2** of this document.

Figure G-39 through **Figure G-43** in **Appendix G** also shows the buildings that are within the threshold distances for vibration-related annoyance. These distances vary between 125 feet for vibratory pile driving and 290 feet for impact pile driving. **Table 4.8-10** lists the number of buildings that have the potential for vibration impacts as a result of Alternative 2 construction activities. These are preliminary estimates based on average conditions since the type and size of piles and drivers are not known at this time and vibration levels vary substantially with type and size of piles and drivers. Soil types can also affect results and limited soil type data are available at this time. This analysis should be updated when more details are available.

Table 4.8-10: Summary of Potential Alternative 2 Vibration Impacts

Activity	Type of Limit Exceeded	Distance Limit from Activity to Building (feet)	Number of Affected Buildings
Impact pile driving (Pump Stations and Force Mains)	NJAC Category A	160	260
	NJAC Category B	87	168
	NJAC Category C	55	9
	FTA standard construction damage limit	55	143
	FTA fragile building damage limit	77	0
	FTA annoyance limit (residential only)	290	507
Vibratory pile driving (Green Infrastructure and Parks)	NJAC Category A	66	144
	NJAC Category B	36	72
	NJAC Category C	22	4
	FTA standard construction damage limit	22	34
	FTA fragile building damage limit	32	0
	FTA annoyance limit (residential only)	125	207

Indirect Impacts

Similar to Alternative 1, no indirect noise or vibration impacts would occur from the construction or operation of Alternative 2 because activities with the potential to generate noise or vibration, such as re-routed trucks, are not anticipated to generate any perceptible change in the Project Area if they occur.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 1 would be implemented to reduce the identified ***potentially significant, adverse*** impacts under Alternative 2 (see **Section 4.8.2.2**).

4.8.2.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint and fewer stormwater improvement projects. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences between Alternatives 2 and 3.

Direct Impacts

<u>Noise during Construction Activities</u>

Construction activities would be similar to Alternative 2 (Section 4.8.4.3); however, overall impacts would be slightly less because Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C would not be constructed under Alternative 3. As presented in **Section 3.7**, the AM peak hour of 7:00 to 8:00 AM during the peak construction period of 2020, which is also the overall peak hour, conservatively includes the worker vehicles from 7:00 to 8:00 AM and the trucks from 8:00 to 9:00 AM for assessment purposes. During this conservative peak hour, 36 worker vehicles would arrive to the Project Area and 9 heavy trucks would arrive and depart, in comparison to 39 worker vehicles and 10 heavy trucks under Alternative 2. However, overall traffic volume increases during the AM peak hour would be the same. During the remaining hours of the construction shift and during non-peak construction periods, the overall trend for the area (as shown in **Figure 3.7-3**) is for traffic volumes to decrease by as much as 40 percent below the AM peak hour levels. With the same level of construction-related truck traffic, but reduced overall traffic volumes during midday periods, truck traffic volumes would increase by up to 24 percent, with a total traffic volume increase of up to 5 percent. These increases would also translate to hourly L_{eq} increases of 1 dBA or less in any area. Similar to Alternative 1 and 2, no direct noise impacts are anticipated from short-term mobile construction noise sources associated with Alternative 3.

Stationary construction activities and locations would be similar to Alternative 2. In some instances, the pile driving and excavation locations, noise buffer zones, and affected noise-sensitive receptors within these buffer zones are the same between Alternatives 2 and 3 (see **Figure 4.8-7** and **Figure 4.8-10**). However, in some portions of the Project Area, the number of affected noise-sensitive receptors would be less under Alternative 3. These areas are depicted in **Figure 4.8-14** through **Figure 4.8-16** below.

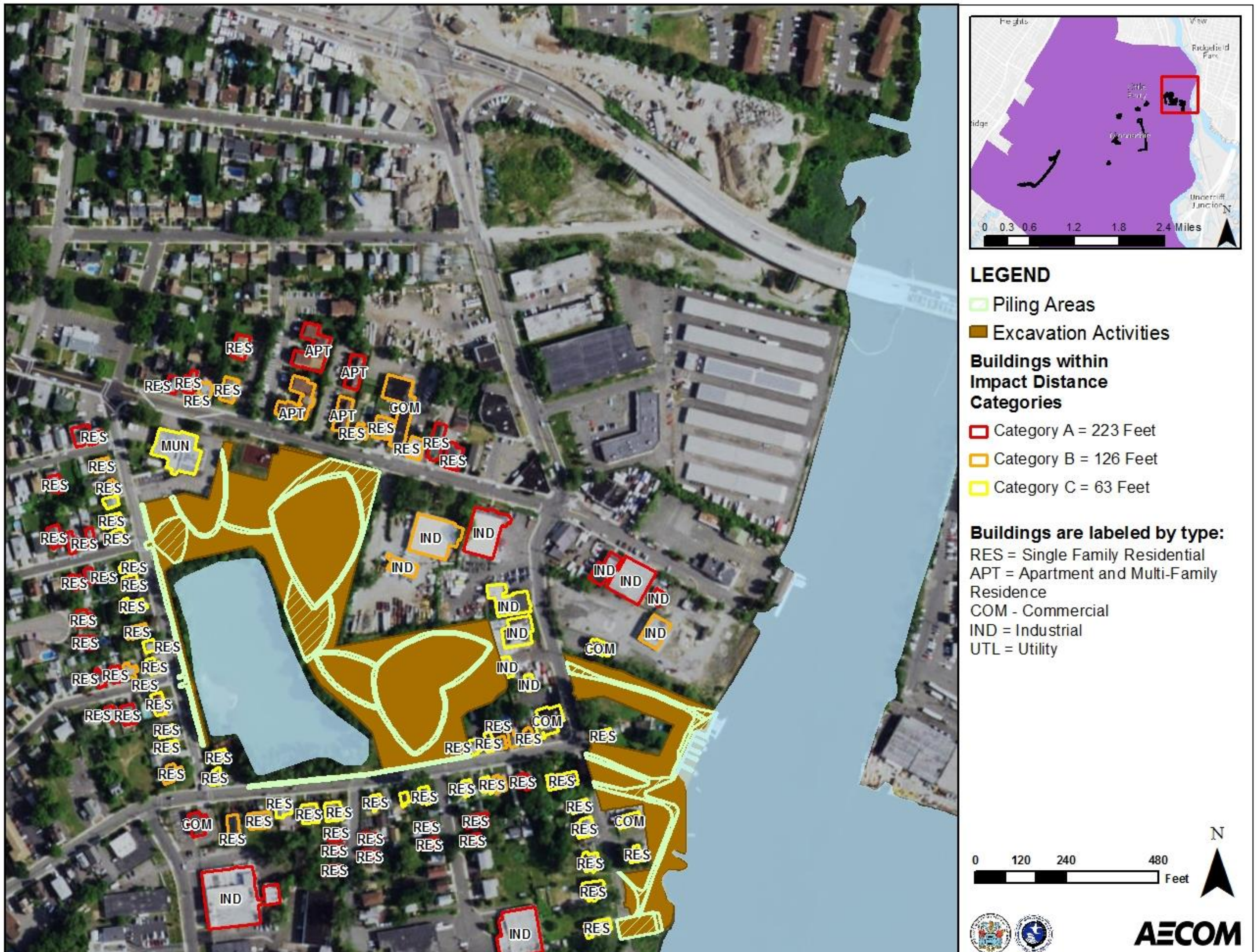

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Figure 4.8-14: Alternative 3 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

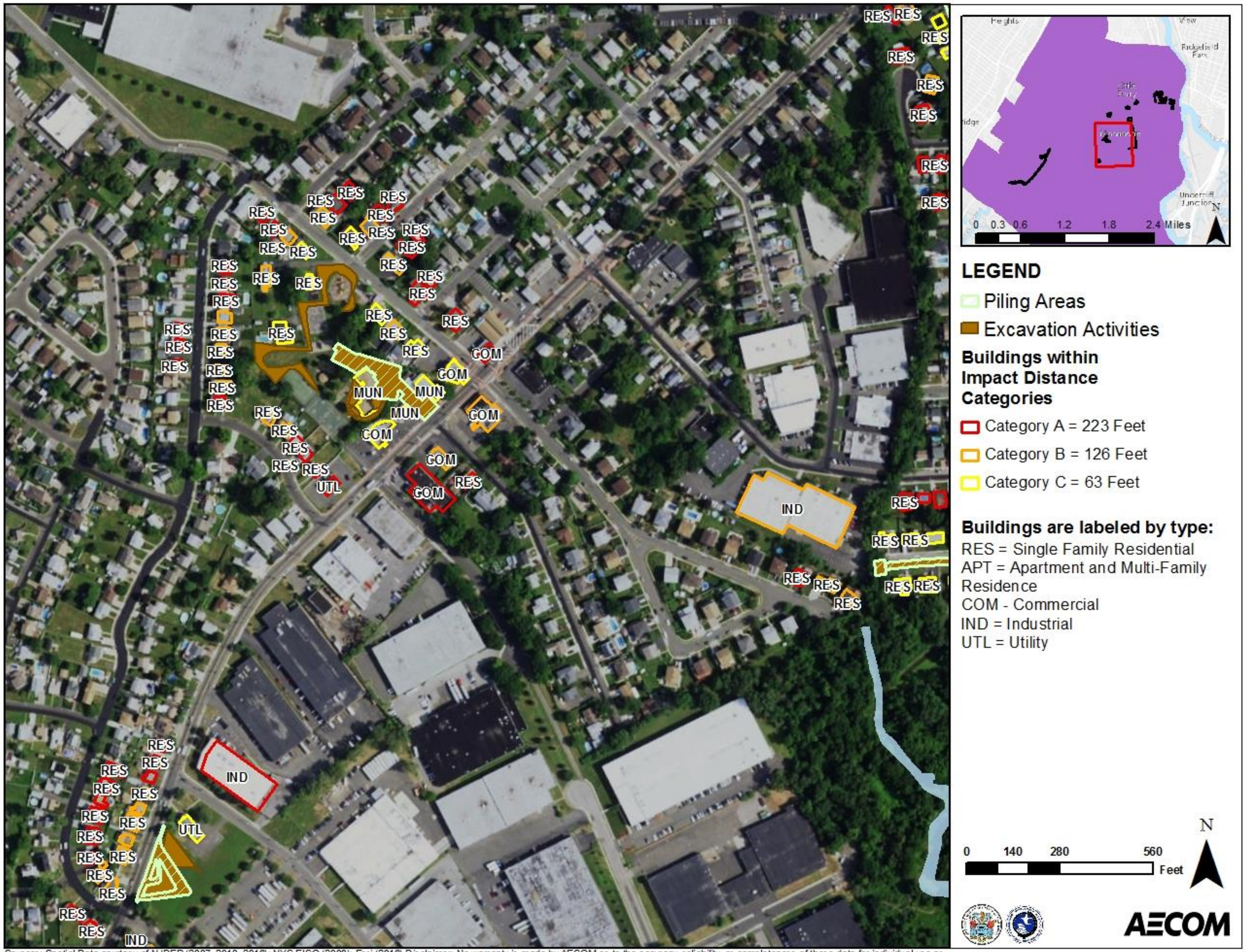

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Figure 4.8-15: Alternative 3 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

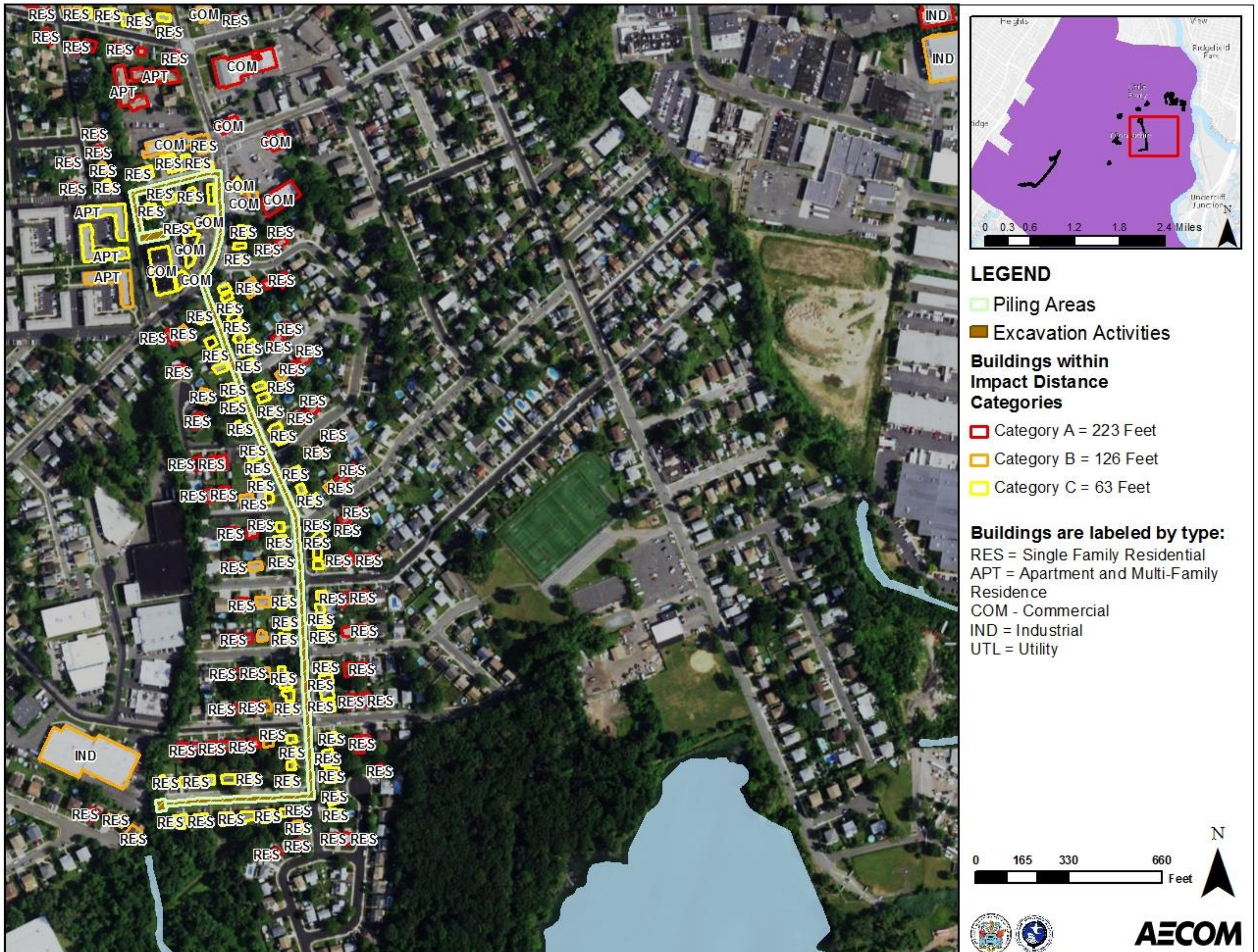

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Figure 4.8-16: Alternative 3 Modeled Stationary Construction Noise Impacts (see subject area in legend map)

Construction schedules and restrictions would be the same as Alternative 2. **Table 4.8-7** summarizes the potential for impacts due to construction schedule restrictions. As such, the potential schedule-related impacts in the Borough of Little Ferry would be anticipated to result in a ***short-term, less-than-significant, adverse*** effect because only a one-hour period on weekdays and Saturdays is outside of the permitted construction times.

Similar to Alternatives 1 and 2, construction would occur within the Meadowlands District with the exception of the northern end and noise limits implemented by NJSEA would apply to construction activities unless a noise mitigation plan is approved by the NJSEA. **Table 4.8-11** summarizes the results of the stationary construction noise assessment based on the predicted noise levels and the noise impact significance criteria provided in **Table 4.8-1**, with potentially significant impacts defined by predicted levels being greater than or equal to 10 dBA above the regulatory limits. Note that the sound pressure levels associated with potentially significant impacts are all above the background levels monitored throughout the study area, listed in **Section 3.8**. **Figure 4.8-7**, **Figure 4.8-10**, **Figure 4.8-14**, **Figure 4.8-15**, and **Figure 4.8-16** show the properties that could experience ***short-term, adverse, potentially significant*** noise impacts from Alternative 3. For more information on stationary construction activities and impacts, refer to **Section 4.8.2.3**.

Table 4.8-11: Alternative 3 Stationary Construction Noise Model Results

NJ Performance Standard Category	Sound Limit (dBA)	Buffer Distance to PotentiallySignificant Impact (feet)	Number of Properties with Potentially Significant Impacts
A	65	223	520
B	70	126	234
C	76	63	52

dBA = A-weighted decibel scale of sound pressure level

<u>Noise during Operational Activities</u>

Similar to Alternatives 1 and 2, no impacts would be expected from mobile sources associated with long-term operations of Alternative 3.

Under Alternative 3, only Losen Slote pump station A and the East Riser Ditch pump station would be constructed and operated. One1,500-kW diesel generator would be located within the East Riser Ditch building and one 350-kW diesel generator would be located in the Losen Slote pump station A building. **Table 4.8-5** lists the generator levels assumed for the 1,500-kW generator and **Table 4.8-9** lists the levels assumed for the 350-kW generator. **Figure 4.8-11** and **Figure 4.8-12** (from Alternative 2) show the distances between the pump station buildings and the closest NJSEA performance standard Category A, B, and C land use zone properties. The potential for impact from stationary operations noise would be anticipated to result in ***long-term, less-than-significant, adverse*** noise impacts. Impacts associated with the two proposed pump stations would be the same as Alternative 2 (see **Section 4.8.2.3**). However, overall impacts would be slightly less under Alternative 3 because the Losen Slote pump station C would not be constructed.

Underwater Noise

During the construction of Alternative 3, the only project-related source of underwater noise impacts in the Project Area would be pile driving activities near the banks of the Hackensack River and interior streams in the proposed Riverside Park, and at the coffer dam upstream of Starke Road and downstream of the East Riser Ditch tide gate. Similar to Alternative 2, ***short-term, adverse less-than-significant*** impacts on marine life in these waterbodies would be expected; however, this would need to be reevaluated after the pile driving components are clearly defined (see **Section 4.8.2.3**). However, these impacts would be slightly less because the waterbodies in the proposed Fluvial Park and DePeyster Creek Park would not be impacted under Alternative 3.

Vibration

During the construction of Alternative 3, the only project-related activity capable of producing potentially damaging levels of vibration to buildings more than 50 feet away is pile driving. Assuming typical maximum vibration levels (FTA 2006), the structural damage thresholds may be exceeded between 30 and 75 feet from impact pile drivers, with the specific distance depending on the soils between the activities and each building, the type of building construction, and the type and size of piles and drivers. **Figures G-40**, **G-43**, **G-44**, **G-45**, and **G-46** in **Appendix G** show the buildings where vibrations from pile driving may cause ***potentially significant*** impacts under Alternative 3. These vibration levels would also exceed the New Jersey District Zoning Regulations referenced in **Section 3.8.2** of this document.

Figures G-40 and **G-43** through **G-46** in **Appendix G** also show the buildings that are within the threshold distances for vibration-related annoyance. These distances vary between 125 feet for vibratory pile driving and 290 feet for impact pile driving. **Table 4.8-12** lists the number of buildings that have the potential for vibration impacts as a result of Alternative 3 construction activities. These are preliminary estimates based on average conditions since the type and size of piles and drivers are not known at this time and vibration levels vary substantially with type and size of piles and drivers. Soil types can also affect results and limited soil type data are available at this time. This analysis should be updated when more details are available. In comparison to Alternative 2, the number of impacted buildings would be less due to the decreased footprint under Alternative 3.

Table 4.8-12: Summary of Potential Alternative 3 Vibration Impacts

Activity	Type of Limit Exceeded	Distance Limit from Activity to Building (feet)	Number of Affected Buildings
Impact pile driving (Pump Stations and Force Mains)	NJAC Category A	160	197
	NJAC Category B	87	17
	NJAC Category C	55	9
	FTA standard construction damage limit	55	113
	FTA fragile building damage limit	77	0
	FTA annoyance limit (residential only)	290	388

Activity	Type of Limit Exceeded	Distance Limit from Activity to Building (feet)	Number of Affected Buildings
Vibratory pile driving (Green Infrastructure and Parks)	NJAC Category A	66	114
	NJAC Category B	36	8
	NJAC Category C	22	4
	FTA standard construction damage limit	22	21
	FTA fragile building damage limit	32	0
	FTA annoyance limit (residential only)	125	158

Indirect Impacts

Similar to Alternative 2, no indirect noise or vibration impacts would occur from the construction or operation of Alternative 3.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 1 would be implemented to reduce the identified ***potentially significant, adverse*** impacts under Alternative 2 (see **Section 4.8.2.2**).

4.9 Air Quality and Greenhouse Gas Emissions

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on ambient air quality, including GHG emissions, in and around the Project Area. Ambient air quality may be affected by air pollutant emissions generated from proposed fossil fuel-fired stationary and mobile sources associated with the Proposed Project. Air quality impacts may be direct, consisting of emissions generated by stationary sources installed in the Project Area, or indirect, consisting of emissions from existing stationary sources (e.g., power plant generating emissions for electrical sources). Air quality impacts may be short-term, consisting of emissions generated during the construction phase, or long-term, consisting of emissions generated from emission sources during the operational phase.

4.9.1 Definition of Study Area

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to affect ambient air quality in the study area; existing conditions are described in **Section 3.9**. As described in **Section 3.9**, the study area for air quality includes Bergen County, although GHGs are considered on a regional level. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to local and regional air quality.

4.9.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives to local and regional air quality are shown in **Table 4.9-2**. Estimated GHG emissions are identified, but are not assigned a significance impact level due to the regional nature of their impact.

Based on the attainment status designations for Bergen County, and in accordance with the anti-backsliding provisions of 40 CFR § 51.905, NJDEP must quantify the emissions of $PM_{2.5}$, NO_x, VOCs (i.e., the precursors for O_3 and $PM_{2.5}$), SO_2 (i.e., the precursor for $PM_{2.5}$), and CO to determine the applicability of the General Conformity regulations. Although a $PM_{2.5}$ precursor, emissions of NH_3 do not have to be quantified because none of the Proposed Project activities would result in emissions of NH_3. **Table 4.9-1** identifies the *de minimis* levels for consideration in the General Conformity Applicability Analysis.

Table 4.9-1: Applicable General Conformity De Minimis Levels[1]

Pollutants of Concern (tons per year)				
$PM_{2.5}$	NOx[2]	VOC[2]	SO_2	CO
100	100	50	100	100

1. 40 CFR § 93.153(b)(1)
2. Other ozone NAAQS inside an ozone transport region

MACT standards (see **Section 3.9.2.1**) and Generally Available Control Technology (GACT) standards apply to both major and area sources. USEPA's major source thresholds for HAPs include emissions greater than 10 tons per year of a single HAP or greater than 25 tons per year of combined HAPs (USEPA 2016o). Area sources, or those sources that emit less than the major source thresholds, may also have specific MACT or GACT standards (USEPA 2016p). As described in **Section 3.9.3**, NJDEP also compares modeled HAP air concentrations to health benchmarks that are established by the USEPA and other government agencies. Relevant health benchmark calculations are outlined in **Appendix H** for comparison. There are also State reporting thresholds for sources that have the potential to emit HAPs (NJAC 7:27-22) that were also used to analyze the impact of HAPs from the Proposed Project.

GHG emissions, calculated in CO_{2e} units, were compared to the annual State-wide GHG emissions (i.e., 104,600,000 metric tons of CO_{2e}, as described in **Section 3.9.3**) to determine the Proposed Project's level of contribution to State-wide GHG emissions.

Air quality permits would be obtained for the Proposed Project as necessary in compliance with Federal, State, and local standards. NJDEP requires a permit to be obtained for any fuel-burning equipment, regardless of size (NJAC 7:27-8.2).

Beyond the thresholds and criteria described above, HUD does not have separate air quality thresholds or criteria against which potential impacts should be analyzed to determine their significance. HUD recommends adherence to the thresholds and criteria outlined in Federal, State, and local regulations and guidelines (HUD 2016c).

Table 4.9-2: Air Quality Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Air Quality Emissions Change	• Would not result in emissions that exceed *de minimis* levels or conflict with applicable air quality plans • Would not result in potential direct human health risks for sensitive populations, such as children and the elderly • Would not generate fugitive emissions
	Indirect Air Quality Emissions Change	• Would not induce emissions outside of the study area that would exceed *de minimis* levels or conflict with applicable air quality plans • Would not produce indirect human health risks for sensitive populations
	Applies to All Effect Types	• Would not result in discernable changes to air quality in the region or locality • Would only alter air quality for an indiscernible or negligible period of time
Less-than-Significant	Direct Air Quality Emissions Change	• Would result in negligible emissions of criteria pollutants within an attainment area, and would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans • Would result in negligible emissions of HAPs, and would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans • Would result in minimal amounts of fugitive emissions • Would result in minimal direct human health risks for sensitive populations
	Indirect Air Quality Emissions Change	• Would induce negligible emissions indirectly outside of the study area that would not exceed *de minimis* levels, change the category of non-attainment status, or conflict with applicable air quality plans • Would induce negligible emissions of HAPs indirectly outside the study area, but would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans • Would not produce indirect human health risks for sensitive populations
	Applies to All Effect Types	• Air quality conditions would only be altered for a short, finite period • Impacts would be temporary and localized in specific areas, and would not substantially affect regional conditions

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Air Quality Emissions Change	• Would result in emission levels that could exceed *de minimis* levels, change attainment status of the study area, or conflict with applicable air quality plans • Would result in emissions of HAPs that exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans • Would result in fugitive emissions that would cause visibility issues • Would result in direct human health risks for sensitive populations
	Indirect Air Quality Emissions Change	• Would induce emission levels outside the study area that could exceed *de minimis* levels, change attainment status, or conflict with applicable air quality plans • Would induce emissions of HAPs indirectly outside the study area that exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans • Would produce indirect human health risks on sensitive populations
	Applies to All Effect Types	• Would result in a substantial, short- or long-term impact on local or regional air quality • Impact would be long-term and adverse, and/or could substantially affect regional air quality
Beneficial	Direct Air Quality Emissions Change	• Would result in improvements to air quality, including reductions of emissions, in the study area
	Indirect Air Quality Emissions Change	• Would induce improvements to air quality, including reductions of emissions, outside of the study area
	Applies to All Effect Types	• Would result in air quality benefits observed throughout affected communities or regions

4.9.3 Analysis Methodology

Each of the Build Alternatives and the No Action Alternative was evaluated to determine its potential to produce changes to ambient air quality in the defined study area; existing air quality conditions have been described in **Section 3.9**.

Methodologies and references used to conduct the review and analysis included Federal and State guidance documents and regulations, such as the CAA's General Conformity Rule (40 CFR §§ 51 and 93). Air quality impact calculations, completed in accordance with the General Conformity Rule and other applicable standards, are provided in **Appendix H**. The calculation methodologies and analysis considerations are further described below. Note that all calculations in **Appendix H** are based on an alternative's potential to emit, and not its actual emissions. Potential to emit is the maximum capacity that a facility or piece of stationary equipment would be expected to emit and assumes that the unit(s) does not have any limitations or restrictions on its operation or capacity (40 CFR § 70.2).

Based on the components and activities associated with each considered alternative, this analysis determines potential short- and long-term, direct and indirect effects to air quality and recommends mitigation measures for adverse effects, as appropriate.

4.9.3.1 Criteria Pollutants

A General Conformity Applicability Analysis was completed to determine the potential levels of non-attainment criteria or maintenance pollutants that may be emitted by each considered alternative. The results from the General Conformity Applicability Analysis are summarized by alternative in **Section 4.9.4**; an explanation of the General Conformity Rule is presented in **Section 3.9.2.1**.

Details on the proposed construction equipment and permanent stationary sources, including the projected hours of operation, used in the General Conformity Applicability Analysis were obtained from NJDEP's construction and design contractor. Horsepower ratings for the equipment were obtained from NJDEP's construction and design contractor, through a review of various manufacturer specifications, or based on general industry guidance. Loading factors and emission factors for the proposed construction and permanent stationary equipment are from USEPA's AP-42 (and subsequent revisions) (USEPA 1995), the *Air Emissions Guide for Air Force Mobile Sources* (AFCEE 2016a) and the *Air Emissions Guide for Air Force Stationary Sources* (AFCEE 2016b)[59], unless otherwise listed in the calculations.

Potential PM_{10} and $PM_{2.5}$ emissions from fugitive emissions are included in the criteria pollutant calculations. Fugitive emissions are typically temporary (i.e., only generated during a project's construction phase). Potential PM_{10} and $PM_{2.5}$ emissions from fugitive emissions were calculated for each considered alternative based on information provided by NJDEP's construction contractor as related to proposed grading and construction activities.

4.9.3.2 Hazardous Air Pollutants

As described in **Section 3.9.1**, HAP emissions may cause or contribute to health risks in humans or to adverse environmental effects when deposited in soil or water. HAP emissions were calculated for each

[59] The *Air Emissions Guide for Air Force Mobile Sources* (AFCEE 2016a) and the *Air Emissions Guide for Air Force Stationary Sources* (AFCEE 2016b) are used when emission factors are not readily available in USEPA's compilation of emission factors (AP-42) (USEPA 1995) or from the equipment manufacturer. AFCEE guides are user-friendly and are comprehensively used by DoD agencies to prepare emissions inventories for facilities across the United States and worldwide.

piece of permanent, stationary equipment installed as a result of the Proposed Project, NJDEP's construction and design contractor either provided information on the projected hours and days of operation and the maximum heat input of each piece of equipment, or provided manufacturer's information about the equipment from which these details could be reasonably determined. The projected annual fuel consumption and emissions were calculated using emission factors from relevant manufacturer's specifications, USEPA's AP-42 (USEPA 1995), or other reference methodologies, as appropriate.

4.9.3.3 Greenhouse Gas Emissions

As described in **Section 3.9.1**, the impact of GHGs is typically a function of regional emissions and not a specific source location. Therefore, potential GHG emissions from each considered alternative were compared against State-wide 2012 GHG emissions of 104,600,000 metric tons of CO_{2e} (NJDEP 2015a). CO_{2e} emissions were calculated by using emission factors provided by the *Air Emissions Guide for Air Force Mobile Sources* (AFCEE 2016a), unless otherwise specified in the calculations. Detailed calculations are presented in **Appendix H**; a summary of the results is presented by alternative in **Section 4.9.4**.

4.9.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to air quality associated with the implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operation activities.

4.9.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented and the air quality conditions of the study area would not be altered by construction or operation activities associated with the Proposed Project. Accordingly, there would be no project-related impacts to air quality.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse*** impacts on regional air quality due to traffic congestion and diversion of vehicles in flooded areas, which would be anticipated to occur on a more frequent basis. In addition, increased flooding could carry fine sediments into the Project Area which have a potential to become airborne during dry periods (i.e., fugitive dust). Per the significance criteria, the No Action Alternative:

- *Could result in negligible emissions of criteria pollutants within an attainment area, and would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans*
- *Could result in negligible emissions of HAPs, and would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans*
- *Could result in minimal direct human health risks for sensitive populations.*

4.9.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short- and long-term, less-than-significant, adverse*** impacts to air quality in the Project Area due to criteria pollutant emissions. Criteria pollutant emissions would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans.

- ***Short- and long-term, less-than-significant, adverse*** impacts to human health and sensitive populations in the Project Area.
- ***Short- and long-term, less-than-significant, adverse*** impacts to air quality in the Project Area due to HAP emissions. HAP emissions would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans.

Alternative 1 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to air quality outside the Project Area due to criteria pollutant emissions. Criteria pollutant emissions would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans.
- ***Short-term, less-than-significant, adverse*** impacts to air quality outside the Project Area due to HAP emissions. HAP emissions would not would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans.

The following subsections provide greater detail on the specific analyses undertaken. Because direct and indirect effects are similar for each of these analyses, they are not discussed separately below. Direct effects to air quality are confined to the study area, and indirect effects occur outside the study area (see **Table 4.9-2**).

Criteria Pollutant Emissions Impact Analysis

As shown in **Table 4.9-3** the *de minimis* threshold levels for General Conformity are 100 tons per year for NO_x, $PM_{2.5}$, SO_2, and CO and 50 tons per year for VOCs. As part of the General Conformity Applicability Analysis (see **Appendix H**), NJDEP considered Alternative 1 activities subject to the General Conformity requirements. Activities under Alternative 1 that would generate criteria pollutant emissions include, but are not limited to, the following:

- Handling and transport of excavated and imported materials (i.e., soil, concrete, asphalt, etc.) during construction
- Operations of heavy-duty, diesel-powered trucks and equipment at the site during construction
- Operations of heavy-duty, diesel-powered trucks traveling to and from the site to dispose of or deliver materials during construction
- Operations of permanent, stationary emergency generators at the proposed Berry's Creek Surge Barrier
- Storage of excavated and imported materials in stockpiles
- Traveling of construction equipment on unpaved roads
- Site preparation activities during construction (i.e., clearing, grubbing, grading, etc.).

Further details on the sources, such as the types and sizes of construction equipment, assumed to be used under Alternative 1 are provided in **Appendix H**.

For the General Conformity Applicability Analysis, potential emissions were estimated for each source type for each proposed year of construction, and for proposed future years of operation. The General Conformity Applicability Analysis includes both direct and indirect emissions associated with Alternative 1. **Table 4.9-3** below shows the criteria pollutant emissions estimations for each year of Alternative 1 and compares them to the applicable *de minimis* levels. The PM_{10} and $PM_{2.5}$ values in **Table 4.9-3** include fugitive emission values as part of the criteria pollutant total summary[60]. The detailed calculations can be found in **Appendix H**.

Table 4.9-3: Projected Annual Criteria Pollutant Emissions for Alternative 1 Compared with Conformity De Minimis Levels[1]

Pollutant	2020 Construction Emissions (tons per year)	2021 Construction Emissions (tons per year)	2022 Construction Emissions (tons per year)	Annual Operations Emissions (tons per year)	General Conformity *De Minimis* Levels (tons per year)[2,3]
CO	15.90	22.86	15.91	0.63	100
NO_x	16.63	20.22	16.67	4.36	100
VOC	2.71	2.92	3.52	0.17	50
PM_{10}	3.40	2.20	2.57	0.05	100
$PM_{2.5}$	2.63	1.94	2.29	0.05	100
SO_2	1.14	1.39	1.12	0.002	100

1. This table provides the undivided potential annual emissions for the entirety of Alternative 1. For an itemization of the potential annual emissions for divided specific work-areas (i.e., the Northern Segment of the LOP, the Central Segment of the LOP, the Southern Segment of the LOP, and the Berry's Creek Surge Barrier), please refer to **Appendix H**.
2. 40 CFR § 93.153(b)(1).
3. NO_x and VOC - other ozone NAAQS inside an ozone transport region.

Based on the projected annual estimated emissions for the study area, it was determined that temporary construction and permanent stationary emissions under Alternative 1 would not exceed the annual *de minimis* levels for criteria pollutants under General Conformity. Therefore, a General Conformity Determination is not required. Based on the emission levels for indirect sources and emission limitations and resulting low emissions from the direct emission sources (i.e. emergency generators), both direct and indirect criteria pollutant emissions from the proposed Alternative 1 would have a ***short- and long-term, less-than-significant, adverse*** impact on air quality.

The proposed diesel-fired emergency generators would be subject to NSPS, specifically, 40 CFR Part 60, Subpart IIII requirements. Subpart IIII standards establish emission limitations for emergency generators based on the year of manufacture and the size of the unit. This CFR subpart also requires use of ultra-low sulfur diesel (ULSD) to minimize oxides of sulfur emissions. A certificate of conformity would be required from the manufacturer to establish that the engine meets the emission limitations of Subpart IIII and no additional control requirements would apply unless the unit is subject to non-attainment new source review and exceeds emission thresholds. Additionally, State regulations (NJAC 7:27-8.2(c)1) require that any fuel-burning equipment with a maximum heat input rating of 1 million British thermal units (Btu) per hour or greater to obtain the preconstruction permit and operational certificate.

[60] The fugitive emission values assume 90 percent control efficiency from water sprayed on unpaved roads and stockpiles. Limited driving is expected on unpaved roads as the proposed staging areas and transport routes are paved.

Details on how the criteria pollutants could potentially affect public health and sensitive populations (i.e., children, the elderly, and the infirmed) are presented in **Section 3.9.1**. Long-term (i.e., generally more than two years) construction activities that are adjacent to sensitive receptors may have the potential to impact air quality and, subsequently, sensitive populations. A review of the Project Area identified that no concentrated sensitive populations (i.e., schools, senior centers, and hospitals) are located within or adjacent to the Alternative 1 footprint. Locations of schools, senior centers, and hospitals in the Project Area are shown on **Figure 3.13-2** and **Figure 3.13-3** in **Section 3.13.3**. Additionally, predicted emission levels from Alternative 1 are well below General Conformity *de minimis* levels (**Table 4.9-3**); therefore, impacts to human health and sensitive populations from criteria pollutant emissions under Alternative 1 would be expected to be ***short- and long-term, less-than-significant, adverse***.

Hazardous Air Pollutant Emissions Impact Analysis

HAP emissions were calculated for each of the permanent, stationary equipment installed as a result of Alternative 1. Under Alternative 1, the only permanent, stationary equipment that would be installed are two emergency diesel generators. These generators were determined to need a capacity of 1,500 kW each to accommodate anticipated pump station power needs during emergencies. **Table 4.9-4** shows the potential annual HAP emissions that would be emitted under Alternative 1. Detailed HAP calculations for these generators are presented in **Appendix H**. Please note that the calculations assumed that generators would use ULSD (less than 15 parts per million [ppm] by weight) and that both of the generators would run for a projected 100 hours per year.

Table 4.9-4: Projected Annual Operational HAP Emissions for Alternative 1

HAP	Emissions (tons per year)	Major Source Threshold (tons per year)[1]
Acetaldehyde	3.55E-05	10
Acrolein	1.11E-05	
Benzene	1.09E-03	
Formaldehyde	1.11E-04	
Naphthalene	1.83E-04	
Polycyclic Aromatic Hydrocarbons (PAHs)[2]	1.15E-04	
Toluene	3.96E-04	
Xylenes	2.72E-04	
Total HAP Emissions	**2.22E-03**	**25**

1.(USEPA 2016o).
2.For inventory purposes, assume PAH is the same as Polycyclic Organic Matter.

Table 4.9-4 shows that emission levels of individual and combined HAPs from the operation of the proposed emergency generators would be significantly less than the major source thresholds. Therefore, the units would not be subject to MACT standards under a major source category. However, all existing and new emergency generators are subject to area source MACT under NESHAP (40 CFR Part 63, Subpart ZZZZ) requirements. Since the proposed emergency backup generators are subject to NSPS Subpart IIII requirements, compliance with these requirements would also satisfy compliance with NESHAP Subpart ZZZZ requirements, and no additional requirements would apply.

Details on how HAPs could potentially affect public health and sensitive populations are presented in **Section 3.9.3**. However, similar to the description presented in the criteria pollutant impact analysis, direct and indirect impacts to sensitive populations from HAP emissions under Alternative 1 would be expected to be ***less than significant***. Additionally, sources subject to permitting under NJAC 7:27-8.2 (c)1 are required to perform a risk assessment, which includes the risk to human health, if they meet the criteria under NJAC 7:27-8.5. Since the proposed emergency generators would be well below the applicability standards under NJAC 7:27-8.5, no further risk assessment would be required.

Based on the emission levels, compliance with applicable emission and work practice standards, and NJAC risk performance levels, it is expected that impacts of HAPs and toxic air emissions would be ***less than significant***.

Greenhouse Gas Emissions Impact Analysis

Potential GHG emissions from Alternative 1 were calculated for each year of construction and for the permanent operations. Activities under Alternative 1 that would generate GHG emissions include, but are not limited to, the following:

- Operations of heavy-duty, diesel-powered equipment during construction
- Operations of permanent, stationary emergency generators at the proposed Berry's Creek Surge Barrier.

Table 4.9-5 shows the potential GHG emissions projected to be emitted under Alternative 1 and are compared to 2012 State-wide GHG emissions. Detailed GHG calculations are presented in **Appendix H**.

Table 4.9-5: Potential Annual GHG Emissions for Alternative 1 Compared with the 2012 State-wide GHG Emissions

GHG	Year				
	2020 Construction Emissions (metric tons per year)	2021 Construction Emissions (metric tons per year)	2022 Construction Emissions (metric tons per year)	Annual Operations Emissions (metric tons per year)	2012 State-wide GHG Emissions (metric tons per year)
CO_{2e}	1,665.18	1,996.32	1,624.59	211.68	104,600,000
Percentage of State-wide Emissions	**0.0016%**	**0.0019%**	**0.0016%**	**0.0002%**	**---**

As **Table 4.9-5** shows, the relative annual contribution of GHG emissions from Alternative 1 compared to annual GHG emissions in New Jersey State would be negligible.

Mitigation Measures and BMPs

No potentially significant adverse effects to air quality have been identified. The following mitigation measures and/or BMPs would be implemented to further reduce identified ***less-than-significant adverse*** effects:

- Truck beds would be covered while in transit to limit fugitive emissions.
- Water would be sprayed on any unpaved roads or stockpiles to limit fugitive emissions.[61]
- Construction staging areas and transport routes would be isolated from sensitive populations.
- ULSD would be used in permanent, stationary sources to minimize oxides of sulfur emissions.
- Clean diesel would be used in construction equipment and vehicles through the implementation of add-on control technologies such as diesel particulate filters and diesel oxidation catalysts, repowers, and/or newer and cleaner equipment. When feasible, auxiliary power units or electric-powered equipment would be used in lieu of diesel-powered equipment.
- Control measures on heavy construction equipment and vehicles, such as minimizing operating and idling time, would be implemented to limit criteria pollutant emissions.

4.9.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Short- and long-term, less-than-significant, adverse*** impacts to air quality in the Project Area due to criteria pollutant emissions. Criteria pollutant emissions would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans.
- ***Short- and long-term, less-than-significant, adverse*** impacts to human health and sensitive populations in the Project Area.
- ***Short- and long-term, less-than-significant, adverse*** impacts to air quality in the Project Area due to HAP emissions. HAP emissions would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans.

Alternative 2 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to air quality outside the Project Area due to criteria pollutant emissions. Criteria pollutant emissions would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans.
- ***Short-term, less-than-significant, adverse*** impacts to air quality outside the Project Area due to HAP emissions. HAP emissions would not would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans.

The General Conformity Applicability Analysis for Alternative 2 found that predicted emissions were lower than those for Alternative 1. Specifically, lower emissions under Alternative 2 would be expected from:

- a decrease in overall equipment use,
- a decrease in the footprint area expected for site preparation activities,
- a reduction in the amount of materials being transported and the number of truck trips needed for exports and imports, and
- proposed emergency generators that are smaller in size.

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[61] The calculations presented in **Appendix H**, as well as the results presented in **Tables 4.9-4**, **4.9-5**, and **4.9-6**, assume a 90 percent control efficiency from water sprayed on unpaved roads and stockpiles. Limited driving is expected on unpaved roads as the proposed staging areas and transport routes are paved.

The following subsections provide greater detail on the specific analyses undertaken. Because direct and indirect impacts are similar for each of these analyses, they are not discussed separately below. Direct effects to air quality are confined to the study area, and indirect effects occur outside the study area (see **Table 4.9-2**).

Criteria Pollutant Emissions Impact Analysis

As shown in **Table 4.9-1**, the *de minimis* threshold levels for General Conformity are 100 tons per year for NO_x, $PM_{2.5}$, SO_2, and CO and 50 tons per year for VOCs. As part of the General Conformity Applicability Analysis, NJDEP considered Alternative 2 activities subject to the General Conformity requirements. Activities under Alternative 2 that would generate criteria pollutant emissions would be the same as those listed under the Alternative 1 analysis for criteria pollutants, except the permanent, stationary generators would be located at the proposed East Riser Ditch and Losen Slote A and C pump stations. Further details on the sources, such as the types and sizes of construction equipment, assumed to be used under Alternative 2 are provided in **Appendix H**.

For the General Conformity Applicability Analysis, potential emissions were estimated for each source type for each proposed year of construction, and for proposed future years of operation. The General Conformity Applicability Analysis includes both direct and indirect emissions associated with Alternative 2. **Table 4.9-6** below shows the criteria pollutant emissions estimations for each year of Alternative 2 and compares them to the applicable *de minimis* levels. The PM_{10} and $PM_{2.5}$ values in **Table 4.9-6** include fugitive emission values as part of the criteria pollutant total summary. The detailed calculations can be found in **Appendix H**.

Table 4.9-6: Projected Annual Criteria Pollutant Emissions for Alternative 2[1]

Pollutant	2019 Construction Emissions (tons per year)	2020 Construction Emissions (tons per year)	2021 Construction Emissions (tons per year)	2022 Construction Emissions (tons per year)	Annual Operations Emissions (tons per year)	General Conformity *De Minimis* Levels (tons per year)[2,3]
CO	0.66	6.51	3.00	4.06	0.27	100
NO_x	0.90	10.75	5.14	7.42	2.04	100
VOC	0.16	1.51	0.70	0.92	0.05	50
PM_{10}	0.30	1.30	0.58	0.86	0.02	100
$PM_{2.5}$	0.27	1.13	0.50	0.77	0.02	100
SO_2	0.06	0.75	0.36	0.53	0.003	100

1. This table provides the undivided potential annual emissions for the entirety of Alternative 2.
2. 40 CFR § 93.153(b)(1).
3. NO_x and VOC - other ozone NAAQS inside an ozone transport region.

Similar to Alternative 1, both direct and indirect criteria pollutant emissions from the proposed Alternative 2 would have a ***short- and long-term, less-than-significant, adverse*** impact on air quality. The proposed diesel-fired emergency generators under Alternative 2 would be subject the same requirements as described for Alternative 1 (**Section 4.9.4.2**).

Concentrated sensitive populations were identified to be located within or adjacent to the Alternative 2 footprint, such as where construction is proposed on elementary school properties. Proposed construction activities that are adjacent to sensitive receptors would be short-term. For example, construction at Robert Craig Elementary School and Memorial/Washington Schools is proposed to have a duration of 20 and 60 days, respectively. Long-term impacts could be anticipated from the proposed emergency generators at the Losen Slote A and C pump stations as they are adjacent to residential areas. Mitigation measures and BMPs (as identified below) would be implemented to further reduce impacts to sensitive populations. Additionally, predicted emission levels from Alternative 2 are well below General Conformity *de minimis* levels (**Table 4.9-6**). Therefore, impacts to human health and sensitive populations from criteria pollutant emissions under Alternative 2 would be expected to be ***short-and long-term, less-than-significant, adverse***. Schools, senior centers, and hospitals in the Project Area that are within or adjacent to the Alternative 2 footprint are further discussed in **Section 4.13.4.3**.

Hazardous Air Pollutant Emissions Impact Analysis

HAP emissions were calculated for each of the permanent, stationary equipment installed as a result of Alternative 2. Under Alternative 2, the only permanent, stationary equipment that would be installed are three emergency diesel generators, one at each of the proposed pump stations. To accommodate anticipated pump station power needs during emergencies, the generators were assumed to have these capacities:

- East Riser Ditch Pump Station – one 1,500 kW emergency generator,
- Losen Slote Pump Station A – one 350 kW emergency generator, and
- Losen Slote Pump Station C – one 1,500 kW emergency generator.

Table 4.9-7 shows the potential annual HAP emissions that would be emitted under Alternative 2. Detailed HAP calculations for these generators are presented in **Appendix H**. Please note that the calculations assumed that generators would use ULSD (less than 15 ppm by weight) and that each generator would run for a projected 100 hours per year.

Table 4.9-7: Projected Annual Operational HAP Emissions for Alternative 2

HAP	Emissions (tons per year)	Major Source Threshold (tons per year)[1]
Acetaldehyde	1.62E-04	10
Acrolein	2.63E-05	
Benzene	1.25E-03	
Formaldehyde	3.05E-04	
Naphthalene	1.97E-04	
Polycyclic Aromatic Hydrocarbons (PAHs)[2]	1.43E-04	
Toluene	4.63E-04	
Xylenes	3.19E-04	
Total HAP Emissions	**2.86E-03**	**25**

1.(USEPA 2016o).
2.For inventory purposes, assume PAH is the same as Polycyclic Organic Matter.

Table 4.9-7 shows that emission levels of individual and combined HAPs from the operation of the proposed emergency generators would be significantly less than the major source thresholds. The proposed diesel-fired emergency generators under Alternative 2 would be subject the same requirements as described for Alternative 1 (**Section 4.9.4.2**).

Concentrated sensitive populations were identified to be located within or adjacent to the Alternative 2 footprint; however, similar to the description presented in the criteria pollutant impact analysis, direct and indirect impacts to sensitive populations from HAP emissions under Alternative 2 would be expected to be ***less than significant***. Additionally, similar to the emergency generators proposed under Alternative 1, the proposed emergency generators for Alternative 2 would be well below the applicability standards under NJAC 7:27-8.5 and no further risk assessment would be required.

Based on the emission levels, compliance with applicable emission and work practice standards, and NJAC risk performance levels, it is expected that impacts of HAPs and toxic air emissions would be ***lessthan significant***.

Greenhouse Gas Emissions Impact Analysis

Potential GHG emissions from Alternative 2 were calculated for each year of construction and for the permanent operations. Activities under Alternative 2 that would generate GHG emissions would be the same as those listed under Alternative 1 analysis for GHG emissions, except the permanent, stationary generators would be located at the proposed East Riser Ditch and Losen Slote pump stations.

Table 4.9-8 shows the potential GHG emissions projected to be emitted under Alternative 2 and are compared to 2012 State-wide GHG emissions. Detailed GHG calculations are presented in **Appendix H**.

Table 4.9-8: Projected Annual GHG Emissions for Alternative 2

GHG	Year					
	2019 Construction Emissions (metric tons per year)	2020 Construction Emissions (metric tons per year)	2021 Construction Emissions (metric tons per year)	2022 Construction Emissions (metric tons per year)	Annual Operations Emissions (metric tons per year)	2012 State-wide GHG Emissions (metric tons per year)
CO_{2e}	81.40	988.68	476.19	694.39	236.37	104,600,000
Percentage of State-wide Emissions	**0.0000007%**	**0.000009%**	**0.000005%**	**0.000007%**	**0.000002%**	**---**

As **Table 4.9-8** shows, the relative annual contribution of GHG emissions from Alternative 2 compared to annual GHG emissions in New Jersey State would be negligible.

Mitigation Measures and BMPs

No potentially significant adverse effects to air quality have been identified. The same mitigation measures as identified for Alterative 1 (**Section 4.9.4.2**) would be considered for Alternative 2. In addition, because concentrated sensitive populations were identified to be located within or adjacent to the Alternative 2 footprint, the following additional mitigation measures and/or BMPs would be implemented to further reduce identified ***less-than-significant adverse*** effects:

- Proposed construction at or near schools would be scheduled to occur when school is not in session.
- Windows would be closed and indoor air would be circulated (i.e., air conditioning) in buildings where sensitive receptors are located to limit exposure to outdoor air quality.

4.9.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2; it has the same footprint as Alternative 2, except the proposed Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and associated force main would not be constructed. As such, under Alternative 3, the methodology, analysis, and the overarching conclusions are the same as Alternative 2. The General Conformity Applicability Analysis for Alternative 3 found that predicted emissions were lower than those for Alternative 2, which accounts for the loss of Fluvial Park, DePeyster Creek Park, and the Losen Slote C pump station and associated force main. Specifically, lower emissions under Alternative 3 would be expected from:

- a decrease in overall construction duration,
- a decrease in overall equipment use,
- a decrease in the footprint area expected for site preparation activities,
- a reduction in the amount of materials being transported and the number of truck trips needed for exports and imports, and
- elimination of the proposed emergency generator at Losen Slote pump station C.

Since the analysis and conclusions for Alternative 3 can be assumed to be the same as Alternative 2 (**Section 4.9.4.3**), summary tables that show the emission values identified in the General Conformity Applicability Analysis for Alternative 3 are provided below.

Criteria Pollutant Emissions Impact Analysis

Table 4.9-9 below shows the criteria pollutant emissions estimations for each year of Alternative 3 and compares them to the applicable *de minimis* levels. The PM_{10} and $PM_{2.5}$ values in **Table 4.9-9** include fugitive emission values as part of the criteria pollutant total summary. The detailed calculations can be found in **Appendix H**.

Table 4.9-9: Projected Annual Criteria Pollutant Emissions for Alternative 3[1]

Pollutant	2019 Construction Emissions (tons per year)	2020 Construction Emissions (tons per year)	2021 Construction Emissions (tons per year)	2022 Construction Emissions (tons per year)	Annual Operations Emissions (tons per year)	General Conformity *De Minimis* Levels (tons per year)[2,3]
CO	0.66	6.25	1.38	2.90	0.17	100
NO_x	0.90	10.13	2.31	5.03	1.14	100

Pollutant	2019 Construction Emissions (tons per year)	2020 Construction Emissions (tons per year)	2021 Construction Emissions (tons per year)	2022 Construction Emissions (tons per year)	Annual Operations Emissions (tons per year)	General Conformity *De Minimis* Levels (tons per year)[2,3]
VOC	0.16	1.46	0.32	0.67	0.02	50
PM_{10}	0.26	1.17	0.27	0.58	0.01	100
$PM_{2.5}$	0.23	1.00	0.23	0.51	0.01	100
SO_2	0.06	0.71	0.16	0.36	0.002	100

1. This table provides the undivided potential annual emissions for the entirety of Alternative 2.
2. 40 CFR § 93.153(b)(1).
3. NO_x and VOC - other ozone NAAQS inside an ozone transport region.

Similar to Alternative 2, both direct and indirect criteria pollutant emissions from the proposed Alternative 3 would have a ***short- and long-term, less-than-significant, adverse*** impact on air quality and sensitive populations.

Hazardous Air Pollutant Emissions Impact Analysis

Table 4.9-10 shows the potential annual HAP emissions that would be emitted under Alternative 3. Detailed HAP calculations for these generators are presented in **Appendix H**. Please note that the calculations assumed that generators would use ULSD (less than 15 ppm by weight) and that each generator would run for a projected 100 hours per year.

Table 4.9-10: Projected Annual Operational HAP Emissions for Alternative 3

HAP	Annual Operational Emissions (tons per year)	Major Source Threshold (tons per year)[1]
Acetaldehyde	1.44E-04	10
Acrolein	2.08E-05	
Benzene	7.00E-04	
Formaldehyde	2.49E-04	
Naphthalene	1.05E-04	
Polycyclic Aromatic Hydrocarbons (PAHs)[2]	8.54E-05	
Toluene	2.65E-04	
Xylenes	1.83E-04	
Total HAP Emissions	**1.75E-03**	**25**

1.(USEPA 2016o).
2.For inventory purposes, assume PAH is the same as Polycyclic Organic Matter.

Based on the emission levels, compliance with applicable emission and work practice standards, and NJAC risk performance levels, it is expected that impacts of HAPs and toxic air emissions would be ***less than significant***.

Greenhouse Gas Emissions Impact Analysis

Table 4.9-11 shows the potential GHG emissions projected to be emitted under Alternative 3 and are compared to 2012 State-wide GHG emissions. Detailed GHG calculations are presented in **Appendix H**.

Table 4.9-11: Projected Annual GHG Emissions for Alternative 3

GHG	Year					
	2019 Construction Emissions (metric tons per year)	2020 Construction Emissions (metric tons per year)	2021 Construction Emissions (metric tons per year)	2022 Construction Emissions (metric tons per year)	Annual Operations Emissions (metric tons per year)	2012 State-wide GHG Emissions (metric tons per year)
CO_{2e}	81.46	929.31	213.56	466.90	130.53	104,600,000
Percentage of State-wide Emissions	**0.0000008%**	**0.000009%**	**0.000002%**	**0.000004%**	**0.000001%**	**---**

As **Table 4.9-11** shows, the relative annual contribution of GHG emissions from Alternative 3 compared to annual GHG emissions in New Jersey State would be negligible.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 (**Section 4.9.4.3**) would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3.

4.10 Global Climate Change and Sea Level Change

Given the global nature of climate change and sea level change, this impact analysis is framed differently than the other Technical Resource Area analyses presented in this EIS. This analysis describes how each of the Proposed Project's considered alternatives would respond to and address global climate change and sea level change.

As discussed in **Section 3.10**, the NJDEP considered climate change from the following two perspectives: (1) the potential effects of a proposed action on climate change as indicated by assessing GHG emissions; and (2) the effects of climate change on a proposed action and its environmental impacts. Within this EIS, the potential effects of the considered alternatives on climate change, in the form of a GHG emissions analysis, is presented in **Section 4.9**. Further, the potential effects of climate change, in the form of SLR, on the three Build Alternatives and the No Action Alternative alternatives and their ability to satisfy the purpose of and need for the Proposed Project, are discussed in **Section**

4.17. This section provides a summary of how each considered alternative would address or respond to changing climate and sea level conditions.

4.10.1 Definition of Study Area

As described in **Section 3.10**, this analysis includes the Project Area, as well as areas adjacent to the Project Area along the Hackensack River. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of climate change and sea level change in accordance with 40 CFR 1508.27.

4.10.2 Thresholds of Significance

The significance criteria used to evaluate the potential effects from climate change on each of the alternatives are shown in **Table 4.10-1**. The less-than-significant impact level is not applicable to this technical resource area.

Table 4.10-1: Global Climate Change and Sea Level Change Impact Significance Criteria

Impact Level	Impact Description
No Impact	• Would not reduce flooding due to storm surge or stormwater flooding • Would not address the potential effects of ongoing climate change and sea level change
Potentially Significant	• Would increase flooding due to storm surge or stormwater flooding in the study area • Would not address the potential effects of ongoing climate change and sea level change
Beneficial	• Would reduce flooding due to storm surge or stormwater flooding in the study area • Would not address the potential effects of ongoing climate change and sea level change

4.10.3 Analysis Methodology

This section summarizes the methodology (i.e., modeling) used to incorporate the anticipated impacts of climate change and sea level change into the design of the Proposed Project's Build Alternatives, and how these models were used to assess the capability of each alternative to respond to or address the effects of climate change and sea level change. This is consistent with the framework established in **Section 3.10** for the existing and future projected conditions in the study area. This methodology is described in further detail in **Section 4.17.3**. The anticipated future conditions of the study area due to anticipated climate change effects are described in **Section 3.10**.

Sea Level Change

High resolution MIKE21 hydrodynamic and wave models were developed for the study area, in conjunction with regional ADCIRC model and Simulating Waves Nearshore (SWAN) hydrodynamic and wave models, in order to simulate existing and proposed conditions. Scenarios were run in order to evaluate the No Action Alternative (i.e., baseline condition) and each of the three Build Alternatives under both existing and future conditions (i.e., including climate change effects). NOAA Intermediate High (i.e., 2.4 feet of SLR) or Intermediate Low (i.e., 1.2 feet of SLR) sea level change values for the 2075 horizon, as described in **Section 3.10,** were added to the Atlantic Ocean boundary of the regional model and propagated into the high resolution MIKE21 model for all future conditions runs. The capability of each alternative to address the effects of sea level change was assessed using the quantitative results of the modeling, which included changes to flooded areas.

Temperature

No formal analysis of temperature impacts on the Project Area was performed. Potential increases in temperature would not be expected to impact, or be addressed by, the Proposed Project's considered alternatives. Discussion of the Proposed Project's impacts on GHGs are discussed in **Section 4.9.4**.

Precipitation

A Hydrologic Engineering Center (HEC) – Hydrologic Modeling System (HMS) model was developed for the study area. This model provided hydrologic inputs for multiple HEC – River Analysis System (RAS) and InfoWorks models that were also developed in parallel to simulate the system hydraulics. Scenarios were run in order to evaluate the No Action Alternative (i.e., baseline condition) and each of the three Build Alternatives under both existing and future conditions (i.e., including climate change effects). Projected percent changes to precipitation depths for the 2075 horizon were applied to the existing return period precipitation depths. The capability of each alternative to address the effects of climate change, as well as the projected increase in precipitation intensity, was assessed using the quantitative results of the modeling, which included changes to flooded areas and peak discharges.

4.10.4 Impact Analysis

The following subsections summarize the potential effects of climate change and sea level change on the implementation of the Build Alternatives and the No Action Alternative.

4.10.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented, and no changes attributable to the Proposed Project would be made to address potential impacts of climate change and sea level change. However, ***potentially significant adverse*** impacts could occur. Per the significance criteria, the No Action Alternative:

- *Would increase flooding in the study area due to storm surge or stormwater flooding* (see **Section 4.1.2.1**).
- *Would not address potential effects of ongoing climate change and sea level change.*

As described in **Section 4.17.4.1**, approximately 17 percent of the Project Area is currently at risk of flooding during the normal tide[62]. Under the 1.2-foot and 2.4-foot SLR scenarios, respectively, approximately 19 to 42 percent of the Project Area would be at risk of flooding during the normal tide (see **Figure 4.17-1**). During the 50-year storm, approximately 36 percent of the Project Area is currently

[62] Please note the "area at risk of flooding" (i.e., area with the potential to flood) described in this EIS was determined based on the total acreage within the Project Area for the No Action Alternative and Alternative 1. As shown in **Figure 4.17-1**, the majority of the area "at risk of flooding" under existing normal tide conditions occurs within the southern and eastern portions of the Project Area that are largely dominated by tidal wetlands/waters (e.g., Hackensack River, MRI Wetland Mitigation Bank, the Richard P. Kane Natural Areas and Wetland Mitigation Bank, and Berry's Creek).

at risk of flooding; under the 1.2-foot and 2.4-foot SLR scenarios, respectively, approximately 47 to 62 percent of the Project Area would be at risk of flooding (see **Figure 4.17-2**). These potential increases in flooding would have ***potentially significant adverse*** impacts on numerous resources in the Project Area.

As further described in **Section 4.17.4.1**, peak discharges of precipitation events (2-year, 5-year, 10-year, 25-year, 50-year, and 100-year) are generally expected to increase over time in the Project Area's inland waterways (i.e., the various creeks and ditches). Further, peak discharge increases are consistently greater for the 2.4-foot SLR scenario than for the 1.2-foot SLR scenario at most locations, as higher normal tides in the Hackensack River or Berry's Creek would slow, and consequently prolong, discharge. The extent of flooding at inland waterways (i.e., East Riser Ditch and Losen Slote) would also increase over time. The East Riser Ditch floodplain currently encompasses between 360 and 871 acres, depending on storm intensity; by 2075, it would increase to between 448 and 1092 acres. The Losen Slote floodplain would also increase, but to a lesser extent. Currently it varies between 302 and 414 acres, depending on storm intensity; by 2075, it would increase to between 320 and 464 acres. Increases in peak discharges and flooding extent of inland waterways in the Project Area would also lead to ***potentially significant adverse*** impacts on various resources in the Project Area due to factors such as increased flooding and erosion.

4.10.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following impacts:

- ***Potentially significant adverse*** impacts from climate change and SLR to the overall capability of the LOP to reduce coastal flooding over time.
- ***Potentially significant adverse*** impacts from climate change due to increased precipitation and stormwater flooding.
- ***Beneficial*** impacts to the Project Area over the life of the Proposed Project (approximately 50 years) through increased flood protection against coastal flooding.

The following discussion provides greater detail.

Under Alternative 1, a structural LOP would be constructed along the Hackensack River and Berry's Creek to reduce the risk of coastal flooding. As the portion of the Project Area at risk of coastal flooding is anticipated to become steadily larger due to projected SLR even during the normal tide (see No Action Alternative discussion above), increased flood protection under Alternative 1 would have ***direct beneficial*** impacts on the Project Area by helping to address (i.e., reduce) the potential impacts of SLR. As discussed in **Section 4.17.4.2**, increased flood protection provided by Alternative 1 during the normal tide would be relatively minor under existing conditions and the 1.2-foot SLR scenario; however, under the 2.4-foot SLR scenario, Alternative 1 would provide increased flood protection to approximately 24 percent of the Project Area (approximately 1,300 acres; see **Figure 4.17-7**).

Additionally, as SLR is expected to exacerbate storm surge elevations, Alternative 1 would further benefit the Project Area by reducing the increases in anticipated storm surge flooding. For example, during a 50-year storm under the 2.4-foot SLR scenario, approximately 62 percent of the Project Area would be at risk of flooding under the No Action Alternative, but only approximately 41 percent of the Project Area would be at risk of flooding under Alternative 1 (see **Figure 4.17-8**). However, as only approximately 24 percent of the Project Area would be at risk of flooding under Alternative 1 with existing conditions, it is also evident that SLR would gradually reduce the level of flood protection provided by Alternative 1 over time as compared to the level of flood protection provided under existing conditions. As discussed in **Section 4.17.4.2**, Alternative 1 would protect against an approximately 50-year storm surge under existing conditions, but only against an approximately 10-year storm surge in 2075 under the 2.4-foot SLR scenario. Sea level change would therefore result in ***potentially significant adverse*** impacts on the relative level of flood protection provided by Alternative 1 over time.

Alternative 1 would not be specifically designed to address precipitation events of increasing intensity and frequency. Implementation of Alternative 1 would likely lead to a minor decrease in impervious surfaces and minor, localized stormwater drainage improvements, but overall stormwater management in the Project Area would remain similar to the No Action Alternative. Further, the infrastructure and performance of Alternative 1 would not be impacted by more frequent or intense precipitation. Therefore, climate change could result in ***potentially significant adverse*** impacts to the Project Area due to increased precipitation and stormwater flooding under Alternative 1.

Mitigation Measures and BMPs

As the Proposed Project is itself intended to reduce the impacts of climate change and SLR, no specific mitigation measures or BMPs would be implemented under Alternative 1.

4.10.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding from heavy precipitation events, but coastal flooding from storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following impacts:

- ***Potentially significant adverse*** impacts from increased coastal flooding in the Project Area due to climate change and SLR.
- ***Potentially significant adverse*** impacts from future increased precipitation intensity on the overall capability of Alternative 2 to reduce inland flooding over time.
- ***Beneficial*** impacts to the Project Area over the life of the Proposed Project (approximately 50 years) through increased flood protection against inland flooding.

The following discussion provides greater detail.

While future SLR[63] and precipitation data were incorporated into the inland flooding models as parameters, the Alternative 2 analysis does not specifically assess coastal flooding. Therefore, the impacts of coastal flooding under Alternative 2, as influenced by climate change and SLR, would be as described under the No Action Alternative; continued and increased coastal flooding would have ***potentially significant adverse*** impacts to numerous resources in the Project Area.

[63] Inland flooding models were constructed using the 1.2-foot SLR scenario, as the stormwater drainage improvements proposed under Alternatives 2 and 3 would likely be of limited value during the substantially increased coastal flooding anticipated during normal tide under the 2.4-foot SLR scenario (see **Figure 4.1-1**).

Increased precipitation intensity over time would increase inland flooding in East Riser Ditch and Losen Slote. As such, Alternative 2 would provide ***direct beneficial*** impacts to the Project Area by reducing the depth and extent of inland flooding from those waterways. As described in **Section 4.17.4.3**, flood reduction would be greatest in East Riser Ditch between the tide gate and Moonachie Avenue, where the improvements would be implemented, but would also be prominent in the Main Reach and Park Street Reach of Losen Slote and in Upper East Riser Ditch north to US Route 46.

However, as precipitation events become more intense over time, the resulting flood levels would also likely increase. As a result, even if Alternative 2 would provide the same or slightly greater flood depth reduction under future conditions, it may not be sufficient to account for the increase in flooding attributable to more intense precipitation events. Therefore, climate change could have ***potentially significant adverse*** impacts on the flood reduction benefits provided by Alternative 2 over time. These impacts would also be evident in projected changes to the extent of flooding in the East Riser Ditch and Losen Slote floodplains, as the difference between floodplain reductions for Alternative 2 under future and existing conditions would not fully account for the increase in flood extent attributable to climate change. For example, while the East Riser Ditch floodplain would increase between 84 and 221 acres under future conditions, depending on storm intensity, the expected reduction in flood extent would only increase between 23 and 46 acres.

Additionally, Alternative 2 would provide localized increases in stormwater infiltration through the installation of green infrastructure and new and improved parks/open spaces. These components would be most effective during low-intensity rainfall events (i.e., the NJ Water Quality Design Storm; see **Section 4.17.4.3**); more intense precipitation events would likely exceed the capacity of these stormwater infiltration features. As the intensity of precipitation events increases over time, the capacity of these features would likely be exceeded with greater frequency, potentially leading to increased stormwater runoff and flooding, and fewer water quality benefits, than under existing conditions.

Mitigation Measures and BMPs

As the Proposed Project is itself intended to reduce the impacts of climate change and SLR, no specific mitigation measures or BMPs would be implemented.

4.10.4.4 Alternative 3: Hybrid Alternative

Alternative 3 would result in impacts to climate change and sea level change similar to those of Alternative 2. Alternative 3 would not influence, or be influenced by, coastal flooding. As such, coastal flooding in the Project Area would be as described under the No Action Alternative. Continued and increased coastal flooding would have ***potentially significant adverse*** impacts on numerous resources in the Project Area.

As described in **Section 4.17.4.4**, Alternative 3 would have ***beneficial*** impacts on the Project Area by providing increased flood protection, but would provide less flood protection than Alternative 2 due to the installation of only one pump station along Losen Slote instead of two. The general influence of increased future precipitation would be approximately the same as Alternative 2, as future increases in precipitation intensity could increase flood levels over existing conditions even with the flood reductions provided under Alternative 3. Therefore, there could be ***potentially significant adverse*** impacts on the flood reduction benefits provided by Alternative 3 over time. Additionally, the green infrastructure and park/open space components of Alternative 3 would be designed to the same standard as under Alternative 2, so the potential would remain for future precipitation events to exceed the infiltration capacity of these features, and thus reduce their flood reduction utility, with greater frequency.

Mitigation Measures and BMPs

As the Proposed Project is itself intended to reduce the impacts of climate change and SLR, no specific mitigation measures or BMPs would be implemented.

4.11 Recreation

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on recreational resources in the Project Area. These resources include parks, open space, and other recreational facilities. Impacts to recreational resources can be either direct or indirect. A direct impact would occur if the Proposed Project would remove a recreational resource or would result in any acquisition of parkland or loss of parking spaces around a facility. Any conversion of an existing park to non-recreation uses would also be classified as a direct impact. An indirect impact would occur if the Proposed Project would induce other changes, such as changes in visitation timings or patterns or increased noise levels surrounding a particular recreational facility, which would affect the recreational resource.

4.11.1 Definition of Study Area

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to effect recreational resources. The study area for recreation includes the existing (see **Section 3.11**) and planned (see **Section 2.5**) parks, open space, and recreational facilities within the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to recreation resources, in accordance with 40 CFR 1508.27.

4.11.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect recreation effects of the alternatives are shown in **Table 4.11-1**.

4.11.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to recreational resources within the Project Area; these resources are described in **Section 3.11**.

For this analysis, construction and operation plans for each of the three Build Alternatives were spatially compared to the inventory of parkland and recreational facilities within the Project Area. Applicable legal, regulatory, and guidance documents were reviewed and considered to identify any relevant local, State, and Federal compliance requirements related to the use and acquisition of these resources.

This analysis addresses the potential direct and indirect effects to existing recreational facilities during construction and operation of the Proposed Project. Where potential adverse effects identified, mitigation measures were recommended, as appropriate.

Table 4.11-1: Recreation Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Recreation Change	• Would not result in loss, disruption, or decrease in the accessibility of a recreational resource • Would not result in a change in the factors contributing to the value of a recreational resource
	Indirect Recreation Change	• Would not induce any further changes to recreational resources, such as a decrease in enjoyment, access, value, use, or accessibility
	Applies to All Effect Types	• No discernable changes to/decreases in recreational resources in the Project Area • Would only alter recreational resources for an indiscernible or negligible period of time
Less-than-Significant	Direct Recreation Change	• Would result in only a temporary loss, disruption, or decrease in accessibility of a recreational resource • Would result in only a temporary change/decrease in the factors contributing to the value of a recreational resource
	Indirect Recreation Change	• Would induce only temporary, infrequent, and finite-period changes/decreases to recreational resources, such as a minimal decrease in enjoyment, access, value, use, or accessibility • Would minimally reduce visitation to a recreational area or the duration of recreational activity
	Applies to All Effect Types	• Recreational resources would only be altered/diminished for a short, finite period • Short-term impacts would be localized in specific areas and not substantially affect or diminish recreational resources throughout the Project Area • No net loss of recreational resources in the Project Area over the long-term
Potentially Significant	Direct Recreation Change	• Would result in a permanent loss, disruption, or decrease in accessibility of a recreational resource • Would result in a permanent decrease in the factors contributing to the value of a recreational resource
	Indirect Recreation Change	• Would induce permanent, frequent, or long-period changes/decreases to recreational resources, such as a substantial decrease in enjoyment, access, value, use, or accessibility • Would substantially reduce visitation to a recreational area or the duration of recreational activity
	Applies to All Effect Types	• Recreation resources would be altered/diminished for an extended or permanent period • Impacts would substantially affect or diminish recreation resources throughout the Project Area • Net loss of recreation resources in the Project Area over the long-term

Impact Level	Type of Effect	Impact Description
Beneficial	Direct Recreation Change	• Would result in a gain, beautification, or increase in accessibility/utility of a recreational resource • Would result in a positive change in the factors contributing to the value of a recreational resource • Would create new recreational areas and/or facilities
	Indirect Recreation Change	• Would induce positive changes to recreational resources, such as an increase of enjoyment, access, value, use, or accessibility • Would induce creation of additional recreational areas and/or facilities
	Applies to All Effect Types	• Would result in recreational benefits, improvements, and/or increases in the Project Area

4.11.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to recreational resources associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.11.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be constructed and no changes attributable to the Proposed Project would occur to the existing recreational facilities within the Project Area. As such, there would be no direct impacts to recreational areas or services from the Proposed Project.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse impacts*** on recreation over time by decreasing accessibility and reducing visitation to recreational facilities. Depending upon the magnitude, severity, and frequency of future flooding events and SLR, these effects could reasonably be expected to increase to ***indirect, potentially significant adverse*** impacts by resulting in longer term, more permanent adverse effects to recreation resources. Per the significance criteria, the No Action Alternative, at a minimum:

- *Could induce temporary loss or decrease in accessibility of a recreational resource*
- *Could induce temporary reduction in visitation to a recreational area*
- *Recreational services could be adversely altered and/or diminished for an extended or permanent period.*

Under the No Action Alternative, and increased flooding within the Project Area would continue to impact recreational resources; this would be expected to increase in frequency and duration over time. Impacts to recreational facilities, such as parks and marinas, would result primarily from flooding associated with coastal storms and their associated storm surges, as well as fluvial flooding during heavy rainfall events.

At present, 88 percent of the publicly accessible recreational areas within the Project Area occur within the 100-year floodplain, rendering them prone to flooding under present-day conditions. With projected climate change and SLR (see **Section 4.1.2.1**), marinas and the majority of the parks within the Project Area could be subject to regular, if not permanent, flooding. These flood events would be expected to disrupt the operation of recreational facilities in the Project Area by damaging recreational infrastructure (e.g. docks and park facilities) and flooding recreational areas. Flooded roads would also impact the access to/use of these facilities, thereby reducing visitation.

4.11.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant adverse*** impacts to the accessibility of recreational resources due to road closures during the construction of Alternative 1.
- ***Short-term, less-than-significant adverse*** impacts to the accessibility of recreational resources due to access limitations to the Hackensack River.
- ***Long-term beneficial*** effects due to the creation of new recreational areas and facilities, including the conversion of undeveloped, developed, or abandoned/poorly maintained properties, buildings, or parking lots into recreational areas.

- ***Long-term beneficial*** changes to the accessibility of recreational areas due to the creation of new paths and walkways, parking facilities, and boating opportunities.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term beneficial*** effects by increasing flood protection against coastal storms, which would reduce the frequency of road closures and improve access to recreational areas and facilities.
- ***Long-term beneficial*** effects to the supply and capacity of recreational facilities and areas by reducing flood-related closures of parks and marinas.

The following subsections provide greater detail.

Direct Impacts

Recreational Resources Displacements

Under Alternative 1, no existing recreational facilities would be permanently displaced or relocated by the construction or operation of the Proposed Project.

Use, Access, Noise, and Aesthetics of Recreation

During the construction of the proposed floodwall within the Richard P. Kane Mitigation Bank and Richard P. Kane Natural Area, a staging area at the southern curb of Commerce Boulevard, east of Washington Avenue, would be installed for less than 12 months. Although classified as a recreational area, the Richard P. Kane Mitigation Bank and Richard P. Kane Natural Area are not open to the public; therefore, there would be no impacts to the public use or access of these areas.

The construction of Alternative 1 would require the closure of portions of Main Street (east of Bergen Turnpike), Riverside Avenue (south of Washington Avenue), and Dietrich Street (east of Maiden Lane) within the Project Area. Generally, access to recreational facilities and areas would continue unimpeded for the majority of the construction process; however, temporary limitations in accessibility to or from various portions of the Project Area would be necessary. Specifically, during the construction of Riverside Park and its associated features (e.g., public access pathway), closure of portions of Riverside Avenue, a dead-end road, could impede access to the Riverside Boat Works, which would result in a ***short-term, less-than-significant adverse*** effect. Limited access to the Riverside Boat Works would require users of Riverside Boat Works to use detours. Although this temporary road closure could increase travel time and reduce access to the Riverside Boat Works, there would be no long-term impacts as access to this facility would be restored upon completion of the construction phase of Alternative 1.

In addition, during the construction phase of Alternative 1, boat access along the Hackensack River at the Riverside Boat Works Marina and Little Ferry Marina would be temporarily disrupted due to the proposed construction of Riverside Park and the proposed floodwall in these areas, respectively. Because the duration of this disruption would be temporary, impacts are anticipated to be minor. Therefore, the effects of Alternative 1 on boat access at these marinas would be ***short-term, less-than-significant adverse*** effects.

Based on an examination of the Proposed Project components under Alternative 1, the operation of Alternative 1 would not result in permanent, adverse effects to the use, access, noise environment, or aesthetics of existing or planned recreational resources within the Project Area.

Availability of Recreation

The operation of Alternative 1 would result in ***long-term, beneficial*** changes to the amount of publicly accessible recreation land within the Project Area due to creation of new recreational areas and facilities, including the conversion of undeveloped, developed, or abandoned/poorly maintained properties, buildings, or parking lots into recreational areas. Specifically, Alternative 1 would convert 10.1 acres of land in the Project Area to accessible, public recreational land. Approximately 147 acres of parks and other recreational fields/facilities exist currently; Alternative 1 would represent an increase of approximately 6 percent of recreational land within the Project Area. The proposed new parks and open space would be located within 500 feet of approximately 670 households, and within 0.25 mile of approximatley 8,400 residents (NJDEP 2018). **Table 4.11-2** identifies the acreage of each proposed recreational facility, as well as its associated benefits to recreational resources in the Project Area. For figures and descriptions of these facilities, please refer to **Section 2.5.2**.

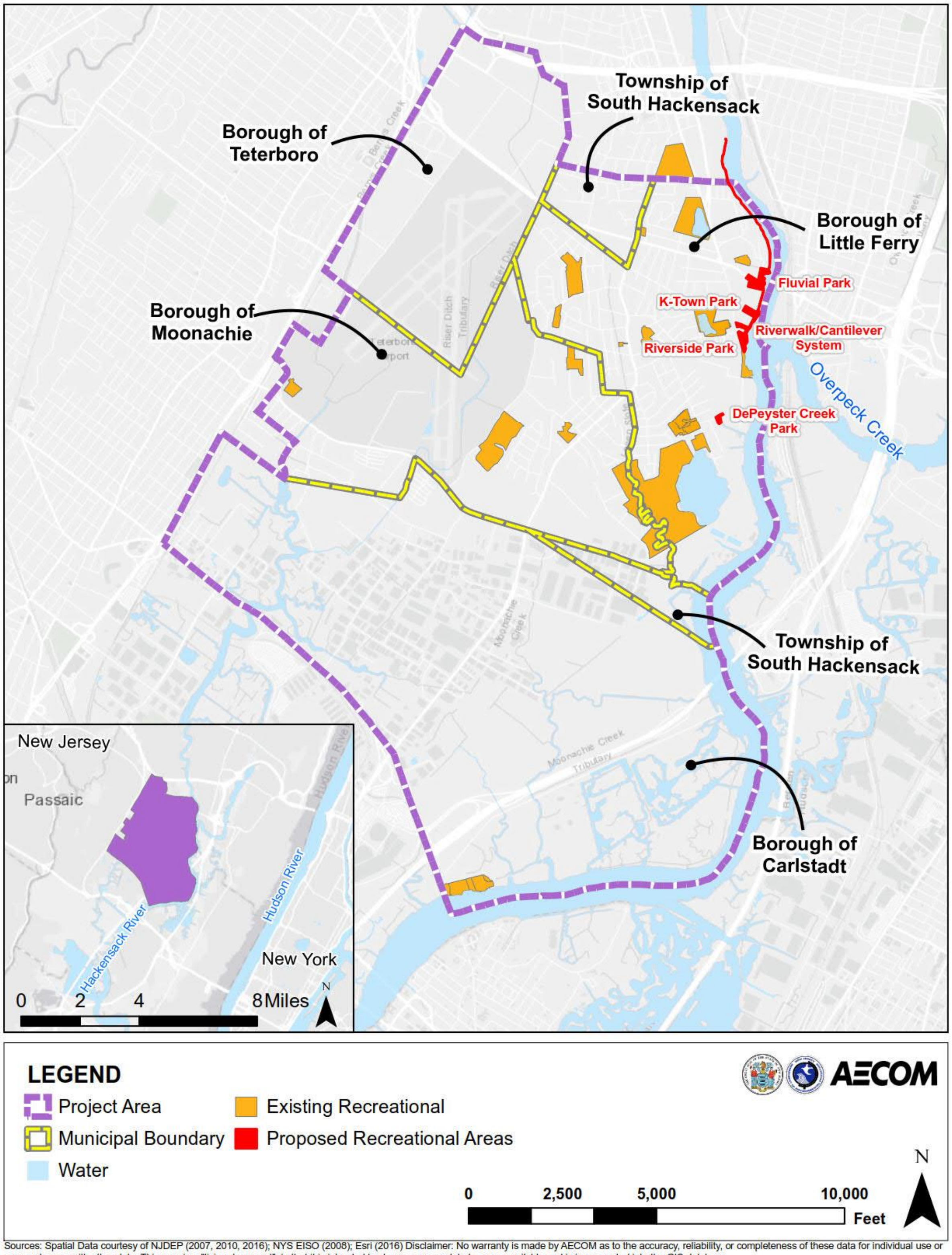
In addition, implementation of Alternative 1 would result in ***long-term, beneficial*** changes to the accessibility of recreational areas through the creation of new paths and walkways, parking facilities, and boating opportunities. Under Alternative 1, a total of approximately 9,270 LF of public paths and walkways, 0.2 acre of parking areas, and a new boat dock/kayak launch would be added within the Project Area. Starting at the far northern portion of the LOP, approximately 3,940 LF of paved path would be constructed along the proposed floodwall that would connect the Riverwalk in the City of Hackensack and the proposed Fluvial Park. Approximately 700 LF of paved walkway and 1,090 LF of elevated walkway would be constructed within Fluvial Park, with an estimated additional 650 LF of pathway connecting the proposed Fluvial Park to K-town Park along the banks of the Hackensack River. Within K-town Park, Alternative 1 would create a 0.2-acre parking lot and approximately 420 LF of paved public access pathway that would be connected to a 1,140-foot long cantilever riverwalk system. This cantilever riverwalk, which would include the new boat dock/kayak launch at its northern end, would terminate at Riverside Park. Riverside Park would have an estimated additional 1,330 LF of public access pathways.

The operation of the public paths and walkways, parking facilities, and new boating opportunities described above would integrate the public realm features, enhance connectivity between the proposed recreational areas, and improve access to recreational land and the Hackensack River waterfront within the Project Area. Please see **Figure 4.11-1** and **Section 3.11** for additional details regarding these proposed recreational features and amenities.

Table 4.11-2: Proposed Recreational Areas and Facilities

Recreational Facility/Area	Acres Added	Benefits
Fluvial Park	3.8	• Conversion of undeveloped land into public open space • Increased capacity to meet the demand for recreational services • Addition of a diversity of recreational facilities including a seating plaza/performance area
Riverwalk/Cantilever System	2.2	• Conversion of developed and undeveloped land into public open space with paths and walkways • Conversion of private property (e.g. Little Ferry Sea Plane Base) into a publicly accessible recreational area • Addition of boat dock and kayak launch would add diversity to the types of recreational facilities in the Project Area
K-Town Park	1.4	• Conversion of developed land, including vacant properties and a paved lot, into public open space • Creation of multi-use open active recreational space, passive open space, a 0.2-acre asphalt parking lot, and a paved public access pathway
Riverside Park	2.2	• Conversion of developed and undeveloped land into public open space • Creation of an open passive recreational space and a paved public access pathway
DePeyster Creek Park	0.6	• Conversion of undeveloped land into public open space • Creation of open passive recreational space
Total	**10.1**	

Mathematical inconsistencies due to rounding.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.11-1: Existing and Proposed Recreational Areas within the Project Area under Alternative 1

Indirect Impacts

Alternative 1 would not be expected to induce any changes in the Project Area that would adversely impact the use, access, noise environment, or aesthetics of the existing or planned recreational resources. In addition, Alternative 1 would not be expected to induce any changes in the Project Area (e.g., increased tourism or future development) that would adversely impact the supply, demand, or capacity of existing recreational resources.

The majority (i.e., 88 percent; with Indian Lake Park being the only exception) of the publicly accessible recreational areas within the Project Area are located within the 100-year floodplain. Alternative 1 would result in ***long-term beneficial*** effects to recreational resources due to increased flood protection against coastal storms, which would reduce the frequency of road closures and improve public access to recreational areas and facilities, as well as reduce flood-related closures of parks and marinas.

Mitigation Measures and BMPs

No potentially significant adverse impacts to recreation resources have been identified from the proposed construction or operation of Alternative 1. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase for Alternative 1, consultation with recreational service providers regarding the proposed footprint of Alternative 1 would occur in order to minimize impacts to existing recreational areas and facilities. Specifically, coordination with the Little Ferry Marina and Riverside Boat Works during the final design and permitting phases of the Proposed Project would occur to develop a plan to reduce disruptions to these marinas, and establish long-term access for these marinas into the Alternative 1 design to reduce long-term marina impacts.
- During the construction phase of Alternative 1, a TMP would be implemented to provide both recreational services providers and the public with information on road closures and detours. This would allow users and proprietors of recreational facilities to plan their travel routes. Furthermore, road/lane closures would be planned to the extent possible to occur during periods of low recreational services demands.
- During construction, contractors would coordinate with the Little Ferry Marina and Riverside Boat Works to ensure access is maintained to and from the Hackensack River (i.e., through the use of boat cranes, temporary docks, or temporary boat ramps).

4.11.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant adverse*** impacts to the accessibility of recreational resources due to potential lane closures and staging areas during the construction of Alternative 2.
- ***Long-term beneficial*** changes to the accessibility of recreational areas due to the creation of new paths and walkways, parking facilities, and boating opportunities.
- ***Long-term beneficial*** effects due to the creation of new recreational areas and facilities, including the conversion of undeveloped and developed properties into recreational areas; and improvements to existing recreational areas and facilities.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term beneficial*** effects by increasing inland flood protection against heavy precipitation events, which would reduce the frequency of road closures and improve access to recreational areas and facilities.
- ***Long-term beneficial*** effects to the supply and capacity of recreational facilities and areas by reducing flood-related closures of parks and marinas.

The following subsections provide greater detail.

Direct Impacts

Recreational Resources Displacements

Under Alternative 2, no existing recreational facilities would be permanently displaced or relocated by the construction or operation of the Proposed Project.

Use, Access, Noise, and Aesthetics of Recreation

During the construction phase of Alternative 2, partial lane closures would be necessary to construct the green infrastructure systems along some roads. Partial lane closures could cause minor increases in travel time to recreational facilities, thereby impacting accessibility to recreational areas within the Project Area. As such, any partial lane closures would at the most result in ***short-term, less-than-significant adverse*** impacts to the accessibility of recreational resources within the Project Area.

In addition, during construction of Alternative 2, the presence of staging areas within the parking lots and driveways of Little Ferry Public Schools, Robert Craig Elementary School, Joseph Street Park, and Willow Lake Park could reduce access to existing recreational facilities at these locations. However, the duration of construction at any of these recreational areas would only last between 20 and 170 days, and other recreational areas would remain open while construction is occurring. Therefore, construction of Alternative 2 would result in ***short-term, less-than-significant adverse*** impacts to the accessibility and use of recreational facilities within the Project Area.

Unlike Alternative 1, the construction of Alternative 2 would not require the closure of Riverside Avenue, and the construction of Alternative 2 would preserve access to the Hackensack River from the Little Ferry Marina and Riverside Boat Works. The construction of Alternative 2 would therefore have ***no impact*** on boat access at these two marinas, and would require fewer road closures than Alternative 1.

Based on an examination of the Proposed Project components under Alternative 2, the operation of Alternative 2 would not result in adverse effects to the use, access, noise environment, or aesthetics of existing or planned recreational resources within the Project Area.

Availability of Recreation

The operation of Alternative 2 would result in ***long-term, beneficial*** changes to the amount of publicly accessible recreation land within the Project Area due to creation of new recreational areas and facilities and improvements to existing open spaces/public amenities, including the conversion of undeveloped, developed, or abandoned/poorly maintained properties into recreational areas (see **Figure 4.11-2**). Specifically, Alternative 2 would convert 20.0 acres of land in the Project Area to accessible, public recreational land, which is approximately 9.9 acres more than Alternative 1. Approximately 147 acres of parks and other recreational fields/facilities exist currently; Alternative 2 would represent an increase of approximately 14 percent in total recreational land within the Project Area. The proposed new parks and open space would be located within 500 feet of approximately 550 households, and within 0.25 mile of approximatley 7,300 residents (NJDEP 2018). Under Alternative 2, there would be 0.3 acre of vehicle parking and access created for new recreational facilities, in comparison to 0.2 acre under Alternative 1. Unlike Alternative 1, improvements to existing open space/public amenities would also be made that would provide approximately 11.2 acres of enhancements to existing open spaces/recreational areas in the Project Area, specifically within Willow Lake Park, Little Ferry Public Schools, Robert Craig Elementary School, and Joseph Street Park. Overall, the proposed parks and open space improvements would provide 9,900 LF of new trails and walkways, waterfront access (including boating opportunities) to the public (i.e., Fluvial Park, DePeyster Park, and Riverside Park), landscaping and aesthetic enhancements (e.g., upland and wetland habitat creation), and new facilities and amenities (e.g., sports fields, play areas). **Table 4.11-3** identifies the acreage of each proposed recreational facility and its associated benefits to recreational resources in the Project Area. Please see **Section 2.5.3** for additional details regarding these proposed recreational features and amenities.

In comparison to Alternative 1, Alternative 2 would create approximately 630 more LF of new paths and trails. However, unlike Alternative 1, these trails would each function primarily as individual features within their designated park footprint, and would not be integrated and connected along the Hackensack River. Therefore, although Alternative 2 would create more paths and trails and improve overall accessibility of recreational facilities within the Project Area, the proposed parks and open space improvements would also be more fragmented than under Alternative 1 in terms of connectivity between recreational features. However, recreational benefits would extend throughout the Project Area under Alternative 2 versus only along the Hackensack River. Alternative 2 would also include the conversion of existing private boat docks and a boat launch (capable of supporting trailered vessels) at the proposed Riverside Park into public facilities, and the creation of a kayak launch at the proposed Fluvial Park.

Table 4.11-3: Proposed Recreational Areas and Facilities

Recreational Facility/Area	Acres	Type	Benefits
Proposed New Parks (Total: 20.0 acres)			
Fluvial Park	4.4	New Park	• Conversion of undeveloped, vacant riverfront into public open space • Creation of 0.2 acre of vehicle access and parking • Increased capacity to meet the demand for recreational services • Addition of a diversity of recreational facilities including sports fields and a kayak launch
Riverside Park	2.6	New Park	• Conversion of developed and undeveloped land into public open space • Creation of 0.1 acre of vehicle parking • Creation of open passive recreational space and walking paths • Conversion of an existing private boat dock into a public boat dock and boat launch
DePeyster Creek Park	8.0	New Park	• Conversion of inaccessible riverfront and undeveloped land into public open space • Creation of new trails and plazas

Recreational Facility/Area	Acres	Type	Benefits
Caesar Place Park	4.0	New Park	• Conversion of undeveloped land into public open space • Creation of an elevated walkway with potential outlooks and viewing platforms
Avanti Park	1.0	New Park	• Conversion of an undeveloped lot into public open space for passive and active recreation • Creation of publicly accessible elevated walkway
Proposed Open Space Improvements (Total: 11.2 acres)			
Willow Lake Park	7.0	Open Space Improvement	• Addition of open lawn for informal active play • Improved pedestrian circulation and expansion of existing pedestrian trails • Landscape and aesthetic improvements
Little Ferry Public Schools	2.3	Open Space Improvement	• Improvements to existing sports fields for improved passive and active recreational use • Creation of a new permeable play surface • Landscape and aesthetic improvements
Robert L. Craig Elementary School	1.7	Open Space Improvement	• Creation of a new sports field • Creation of a new permeable play surface • Landscape and aesthetic improvements
Joseph Street Park	0.2	Open Space Improvement	• Landscape and aesthetic improvements

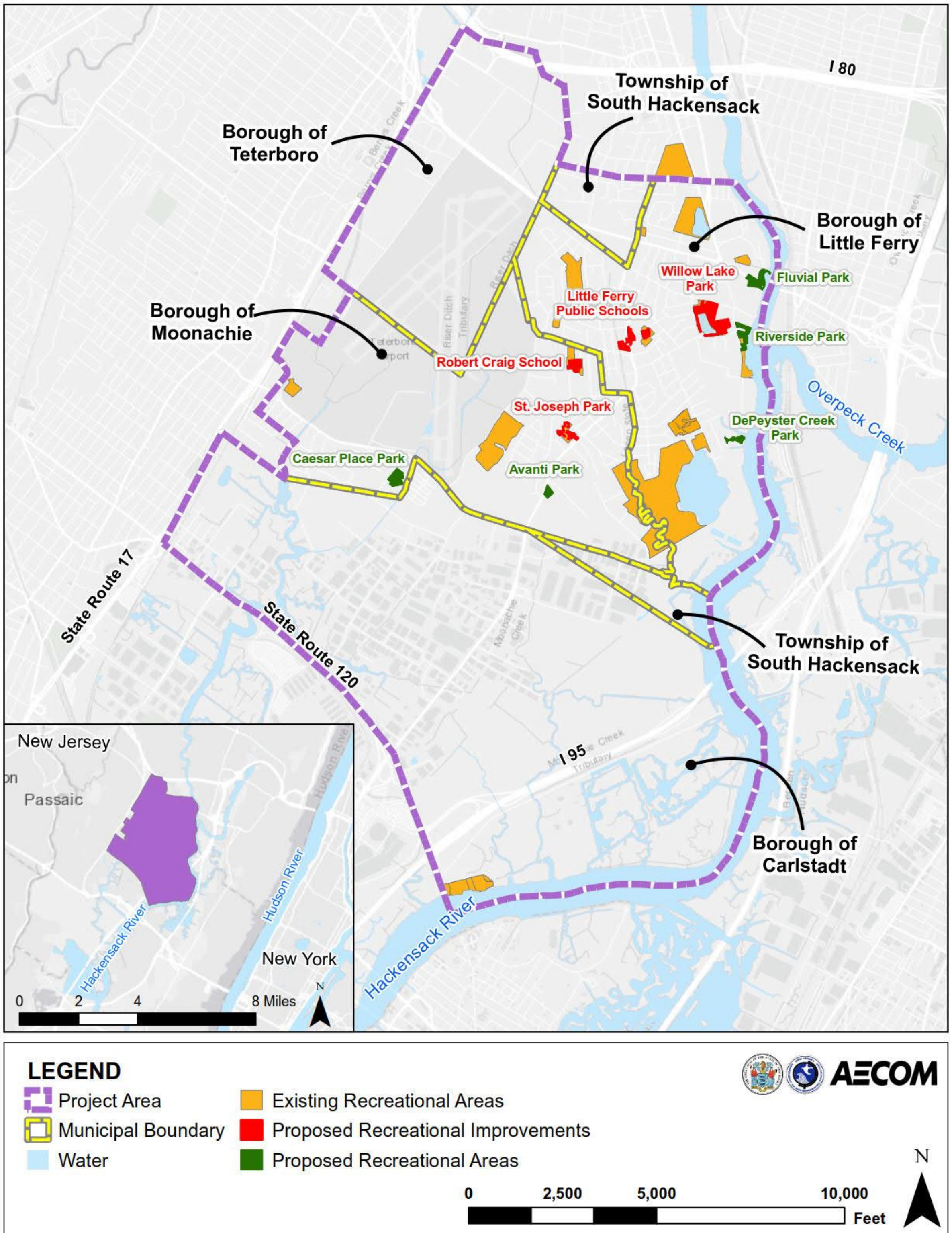


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Figure 4.11-2: Existing and Proposed Recreational Areas within the Project Area under Alternative 2

Indirect Impacts

Alternative 2 would not be expected to induce any changes in the Project Area that would adversely impact the use, access, noise environment, or aesthetics of the existing or planned recreational resources. In addition, Alternative 2 would not be expected to induce any changes in the Project Area (e.g., increased tourism or future development) that would adversely impact the supply, demand, or capacity of existing recreational resources.

Alternative 2 would result in ***long-term beneficial*** effects to recreational resources due to increased flood protection against inland flooding, particularly within the East Riser Ditch and Losen Slote drainage areas (see **Section 4.17.4.3**). In addition, Alternative 2 components would improve stormwater infiltration within the Project Area through the addition of green infrastructure and landscape enhancements (i.e., wetlands), which in turn could improve stormwater drainage and treatment within the existing and proposed parks, thereby increasing the value, use, and accessibility of recreational resources in the Project Area.

Mitigation Measures and BMPs

No potentially significant adverse effects to recreation resources have been identified from the proposed construction or operation of Alternative 2. With the exception of coordinating with the Little Ferry Marina, the same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2 (see **Section 4.11.4.2**).

4.11.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer stormwater improvements due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and force main C. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences.

<u>Recreational Resources Displacements</u>

Under Alternative 3, no existing recreational facilities would be permanently displaced or relocated by the construction or operation of the Proposed Project.

<u>Use, Access, Noise, and Aesthetics of Recreation</u>

During the construction of Alternative 3, ***short-term, less-than-significant adverse*** impacts to recreation within the Project Area due to potential increases in travel time from partial lane closures and the accessibility of open spaces undergoing renovations and improvements (i.e., Willow Lake Park, Joseph Street Park, Little Ferry Public Schools, and Robert Craig Elementary School) during construction would be as described under Alternative 2.

<u>Availability of Recreation</u>

The operation of Alternative 3 would result in ***long-term, beneficial*** impacts to the amount of publicly accessible recreation land within the Project Area due to creation of new recreational areas and facilities and improvements to existing open spaces/public amenities, including the conversion of undeveloped, developed, or abandoned/poorly maintained properties into recreational areas (see **Figure 4.11-3**). However, Alternative 3 would create only approximately 7.6 acres of new recreational land in the Project

Area, which is approximately 2.5 acres less than Alternative 1 and 12.4 acres less than Alternative 2. However, the proposed new parks and open space would still be located within 500 feet of approximately 300 households, and within 0.25 mile of approximately 5,000 residents (NJDEP 2018). Unlike Alternative 1, improvements to existing open space/public amenities would also be made that would provide approximately 11.2 acres of enhancements to existing open spaces/recreational areas in the Project Area, specifically within Willow Lake Park, Little Ferry Public Schools, Robert Craig Elementary School, and Joseph Street Park. Overall, the proposed parks and open space improvements would also provide approximately 6,400 LF of new trails and walkways, waterfront access (including boating opportunities) to the public (i.e., Riverside Park), landscaping and aesthetic enhancements (e.g., upland and wetland habitat creation), and new facilities and amenities (e.g., sports fields, play areas). Under Alternative 3, Willow Lake Park improvements would include slightly more recreational improvements, as summarized in **Table 4.11-4**. Please see **Section 2.5.3** for additional details regarding these proposed recreational features and amenities.

Beneficial impacts associated with the proposed recreational areas and improvements would be as described under Alternative 2. The Willow Lake Park improvements under Alternative 3 would include an additional approximately 540 LF of paths compared to Alternative 2, but overall beneficial impacts under Alternative 3 would be slightly less than under Alternative 2 due to the exclusion of Fluvial Park and DePeyster Creek Park.

Table 4.11-4: Improvements to Willow Lake Park Recreational Area and Facilities

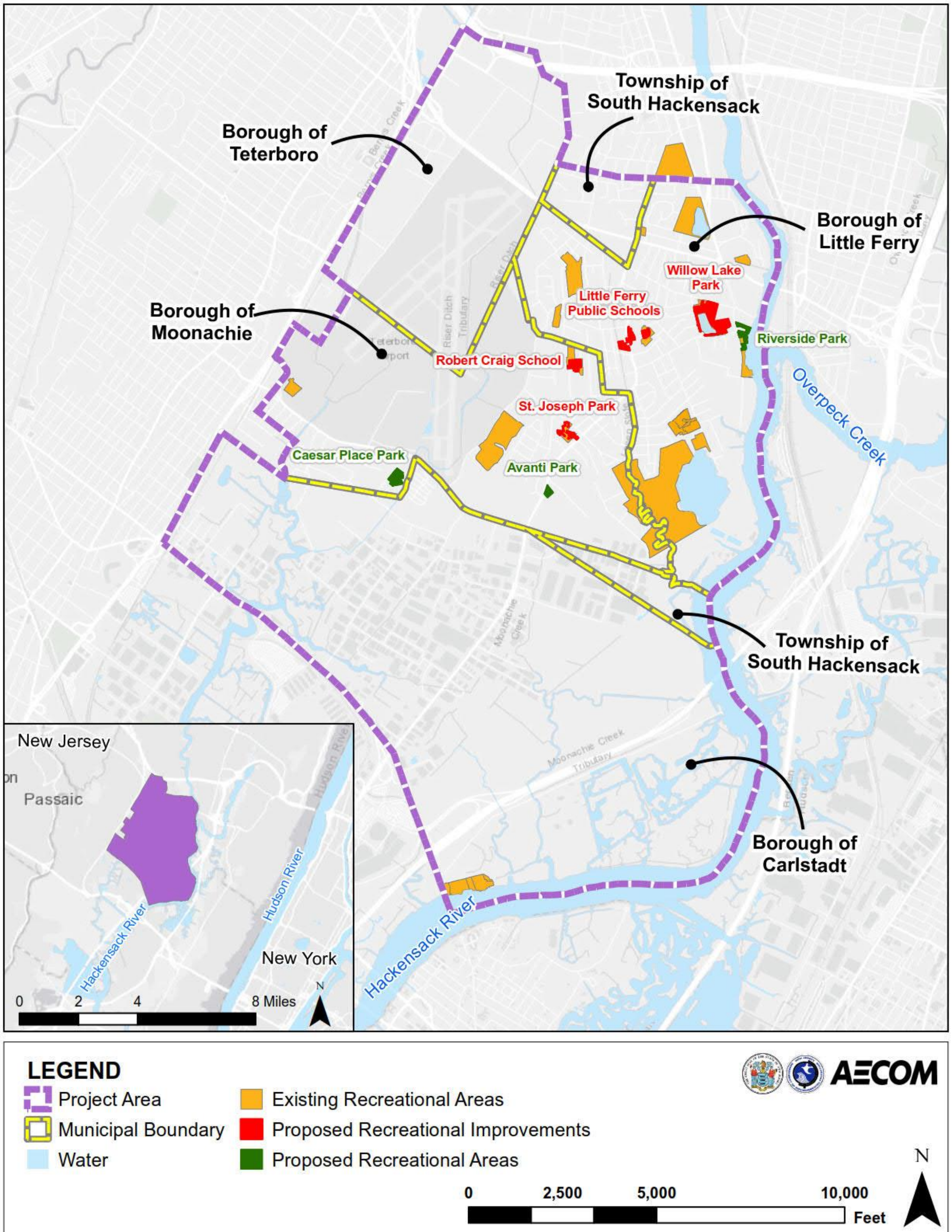
Existing Recreational Facility/Area	Acres Improved	Benefits
Willow Lake Park	7.0	• Addition of two open lawns for informal active play • Creation of plazas and a permeable play surface • Improved pedestrian circulation and expansion of existing pedestrian trails

Indirect Impacts

Indirect impacts would be the same as described under Alternative 2. However, under Alternative 3, Fluvial Park, DePeyster Creek Park, and the Losen Slote pump station C and force main C would not be constructed. Therefore, ***long-term, beneficial*** effects on recreational resources from improved stormwater conveyance, infiltration, and treatment within the Project Area would be slightly less than Alternative 2.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.11.4.3**).



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.11-3: Existing and Proposed Recreational Areas within Project Area under Alternative 3

4.12 Utilities and Service Systems

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on utilities and service systems, as described in **Section 3.12**, in and around the Project Area. Impacts to utilities and service systems, which include sanitary wastewater collection and treatment, water supply and distribution, electricity, natural gas, solid waste, stormwater management, and communication systems, can be either direct or indirect. A direct impact would occur if the Proposed Project would impact the delivery of utilities to customers during project construction or operation, or if it would require the relocation of utility infrastructure. An indirect impact would occur if the Proposed Project would induce other changes that could affect utilities. For example, an indirect effect could include changes in levels of security or reliability as a result of new flood protection measures in the Project Area.

This analysis specifically addresses the potential for the Proposed Project's considered alternatives to affect these systems during both construction and operational activities, either by affecting them directly or by causing indirect effects that alter their functionality. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.12.1 Definition of Study Area

As described in **Section 3.12**, the study area for this resource area includes the existing and planned utility services within the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to utility resources.

4.12.2 Thresholds of Significance

The significance criteria used to evaluate the potential direct and indirect effects of the alternatives on utility services are shown in **Table 4.12-1**.

4.12.3 Analysis Methodology

The Build Alternatives and the No Action Alternative were each evaluated to determine their potential to impact utility services within the Project Area. To conduct this analysis, each considered alternative was overlaid with existing (and planned) utility services, and relationships between project components and these resources were identified. Using these data, potential direct impacts to hard utility infrastructure, as well as corresponding disruptions in service, were identified. In addition, a qualitative analysis of anticipated changes to the supply, demand, and security of utility services was conducted. This qualitative analysis considered other potential impacts to the Project Area from implementation of the Proposed Project, and compared these potential changes with the existing conditions described in **Section 3.12**.

Overall, potential impacts were analyzed in terms of potential infrastructure relocations and disruptions to services; short-term and long-term changes to supply, demand, and capacity of services; and changes in security or reliability of services, as affected both directly and indirectly by each considered alternative. Where potential adverse effects were identified, the analysis recommended mitigation measures, as appropriate.

Table 4.12-1: Utilities and Service Systems Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Utilities and Service Systems Change	• Would not relocate existing utilities infrastructure • Would not disrupt utilities or service systems, including causing outages or the decrease in availability or level of service (e.g., reduced sewer capacity, reduced water pressure) • Would not increase utility consumption beyond existing or planned capacity
	Indirect Utilities and Service Systems Change	• Would not induce any further changes to increase the demand of utilities services beyond existing or planned capacity • Would not increase risk of utilities infrastructure to identifiable hazards, such as flooding • Would not induce increases to prices of utilities for consumers
	Applies to All Effect Types	• No discernable changes to or decreases in utilities or service systems in the Project Area • Would only alter utilities or service systems for an indiscernible or negligible period of time • Changes to utilities and service systems would not conflict with laws or regulations
Less-than-Significant	Direct Utilities and Service Systems Change	• Would require minor relocations of existing utilities infrastructure that would not result in substantial service disruption • Would result in temporary disruptions to utilities and service services • Would minimally or temporarily increase utility consumption, but not above existing capacity
	Indirect Utilities and Service Systems Change	• Would not induce any further changes to increase the demand of utilities services such that supply or distribution capacities are likely to be exceeded • Would temporarily increase risk of utilities infrastructure to identifiable hazards, such as flooding • Would temporarily induce an increase in the price of utilities for consumers
	Applies to All Effect Types	• Utilities and service systems would only be altered/diminished for a short, finite period • Short-term impacts would be localized in specific areas and would not substantially affect or diminish utilities or service systems throughout the Project Area • Changes to utilities and service systems would not conflict with laws or regulations

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Utilities and Service Systems Change	• Would require relocations of existing utilities infrastructure that would result in substantial service disruption • Would result in permanent, prolonged, or repeated disruptions to utilities and service systems • Would substantially or permanently increase utility consumption above existing or planned capacity
	Indirect Utilities and Service Systems Change	• Would induce further changes that would increase the demand of utilities services such that supply or distribution capacities are likely to be exceeded • Would increase long-term risk of utilities infrastructure to identifiable hazards, such as flooding • Would induce long-term increases to prices of utilities for consumers
	Applies to All Effect Types	• Utilities or service systems would be adversely altered or diminished for an extended or permanent period • Impacts would substantially affect or diminish utilities and service systems throughout the Project Area • Changes to utilities and service systems may conflict with existing laws and regulations
Beneficial	Direct Utilities and Service Systems Change	• Would result in changes that improve the capacity, delivery, or efficiency of utilities and service systems in the Project Area • Would decrease utility consumption
	Indirect Utilities and Service Systems Change	• Would induce further changes that would decrease the demand of utilities services • Would decrease risk of utilities infrastructure to identifiable hazards, such as flooding • Would induce long-term decreases to prices of utilities for consumers
	Applies to All Effect Types	• Would result in utilities or service systems benefits, improvements, and/or increases in the Project Area

4.12.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to utilities and service systems associated with implementation of the Build Alternatives and the No Action Alternative, including both proposed construction and operational activities.

4.12.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be constructed and no changes attributable to the Proposed Project would occur to the existing utilities and service systems within the Project Area. As such, there would be no direct impacts to utility services.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, potentially significant adverse*** impacts on utility services by damaging infrastructure, increasing utility prices, and increasing disruptions to utility services. Per the significance criteria, the No Action Alternative:

- *Could increase long-term risk of utilities infrastructure to identifiable hazards, such as flooding*
- *Could induce long-term increases to prices of utilities for consumers*
- *Could adversely alter or diminish utilities or service systems for an extended or permanent period*
- *Could substantially affect or diminish utilities and service systems throughout the Project Area*

Flooding within the Project Area would be expected to continue to have indirect impacts on utility services. Overall, the greatest impacts to utilities services would be expected to result from coastal storm surges and inland flooding from the Hackensack River, Berry’s Creek, and associated ditches during substantial storm events. Inland flooding resulting from inadequate stormwater drainage could lead to increased utility damages and disruptions, as described below for instances of coastal storm surges. However, the magnitude of such disruption would depend on the precise circumstances of each situation, including the location and severity of the stormwater drainage issues and the type and durability of the utilities present in those locations.

Flood events can damage and/or inhibit operations of both above-ground and underground infrastructure. Major above-ground infrastructure in the Project Area includes the Little Ferry Water Pollution Control Facility, electric substations in Little Ferry and Carlstadt, and the LNG tanks in Carlstadt. Each of these facilities is located within the 100-year floodplain. In addition, the Project Area contains numerous sanitary wastewater and stormwater facilities, such as pump stations and tide gates, and an extensive network of overhead electric lines, all of which are also susceptible to damage or disruption during severe flood events.

Underground infrastructure in the Project Area includes the various collection and distribution pipe networks, such as for natural gas or potable water. The composition of these underground infrastructure networks varies between and within utility services, but some materials have an increased susceptibility to impacts from extreme flood events. For example, the PSE&G natural gas pipes and SUEZ water distribution pipes both heavily utilize cast iron (PSE&G n.d., NJBPU 2016). When cast iron ages, it can begin to leak, and during severe flooding (e.g., coastal storm surges), those pipes can be infused with floodwaters (PSE&G n.d., PSE&G 2016d). This can further damage the infrastructure and disrupt service to consumers. In recognition of this susceptibility, PSE&G and SUEZ are both working to make necessary pipe replacements (PSE&G n.d., NJBPU 2016); however, the ongoing potential for damage to these and other utility services remains.

As described in **Section 3.10**, climate change and sea level change are also expected to impact the Project Area. Under the NOAA Intermediate-Low scenario, 1.2 feet of SLR would lead to regular tidal flooding of the LNG tanks in Carlstadt. SLR of 2.4 feet would begin to encroach upon the Little Ferry Water Pollution Control Facility property and would lead to regular tidal flooding of many industrial and residential properties in Carlstadt, Moonachie, South Hackensack, and Little Ferry.

Regular and increased flooding of industrial and residential properties could result in substantial damage to underground utility infrastructure that was not originally designed for inundated conditions. In conjunction with this anticipated SLR, the frequency and severity of intense precipitation events is expected to continue to increase through 2075. This trend could result in similar impacts to utility services by exacerbating inland flooding and further overwhelming the inadequate and aging existing stormwater infrastructure (see **Section 1.4.2** and **Section 3.12.3.6**).

Under the No Action Alternative, damages to utility infrastructure caused by continued and increased flooding within the Project Area would lead to additional adverse impacts. Damaged infrastructure would result in increased repair costs for the utility providers, which would in turn be paid by consumers via their regular bills. Delivery of utility services would also be substantially disrupted both during and after large flood events.

4.12.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to utility services in the Project Area from necessary utility relocations and associated temporary service disruptions during the construction phase of Alternative 1.
- ***Short-term, less-than-significant, adverse*** impacts to the demand on existing utility services during the construction phase of Alternative 1 if contractors use local utilities (e.g., electricity or water) for specific construction activities.
- ***Short-term, less-than-significant, adverse*** impacts to stormwater conveyance due to the dewatering and flow diversion of Berry’s Creek during construction of the Berry’s Creek storm surge barrier due to the use of cofferdams and water diversion practices.
- ***Long-term, less-than-significant, adverse*** impacts to existing electricity demand in the Project Area due to the operation of proposed public lighting features and the Berry’s Creek storm surge barrier.
- ***Long-term, less-than-significant, adverse*** impacts on the amount of solid waste collected within the Project Area at the public parks and pathways.
- ***Long-term, less-than-significant, adverse*** impacts on the demand on the telecommunication grid from the installation of a landline telephone at the Berry’s Creek storm surge barrier.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against coastal storm surges, which would thereby reduce damage to utilities infrastructure and reduce service disruptions for consumers.
- ***Long-term, beneficial*** effects on the prices of utility services.

The following subsections provide greater detail.

Direct Impacts

Utility Infrastructure Relocations and Service Disruptions

Construction of Alternative 1 would require the relocation of sanitary wastewater, underground electric, natural gas, and stormwater utility lines where they cross the LOP. During utility relocations, temporary disruptions of service would be expected. Generally, existing utility infrastructure can remain functioning throughout the majority of the relocation process; however, brief disruptions would be necessary when the new infrastructure is made operational. Further, it is possible that utility services could be temporarily disrupted while construction activities are occurring in their near vicinity. This situation could arise if the utility providers and construction contractors determine that operating near live utility lines would pose a safety concern. In order to minimize these impacts, the utility providers would provide advance notice to all affected customers, and the service disruptions would be scheduled for times likely to result in the least inconvenience to consumers. All utility relocation efforts would be coordinated by the Proposed Project's contractors, and all costs would be paid from the Proposed Project's budget.

In addition, overhead electric lines are located within the footprint of Alternative 1 in numerous locations. Construction is generally expected to occur around overhead lines without impacting them, but minor relocations could be necessary. Finally, existing stormwater outlets along the Hackensack River and/or Berry's Creek would be incorporated into the stormwater drainage design of the LOP. Drainage in the Project Area would not be impacted during construction of Alternative 1. Therefore, Alternative 1 would have ***short-term, less-than-significant adverse*** impacts on utility infrastructure and service within the Project Area.

Operation of Alternative 1 would not require any permanent relocations of or long-term disruptions to existing utility infrastructure and services.

Supply, Demand, and Capacity of Utilities

Construction and operation of Alternative 1 would not affect the supply, demand, or capacity of sanitary wastewater, or natural gas infrastructure or services.

Alternative 1 would alter the existing stormwater drainage infrastructure along the Hackensack River and Berry's Creek. However, the LOP would be constructed with all necessary stormwater infrastructure to ensure that it does not adversely affect existing drainage. To this end, the LOP design includes extensive use of drainage swales along the floodwall segments, approximately 43 stormwater outlets, and added pervious surfaces (see **Section 2.5.2.3**) within the Project Area.

Construction of Alternative 1 would not significantly impact the supply, demand, or capacity of existing utilities. All construction activities are expected to be completed using diesel-powered equipment, and would not require connections to existing utilities. However, it is possible that individual contractors could arrange to use local electric or water utilities during specific construction activities. If this were to occur, they would coordinate directly with utility providers and/or local officials to ensure that they would not significantly impact the demand or capacity of utility services. Use of local utilities by contractors could lead to ***short-term, less-than-significant adverse*** impacts on the supply and demand of utilities. Additionally, construction of the Berry's Creek storm surge barrier would require the channel to be dewatered, using a cofferdam and water diversion equipment, within the construction footprint. Although the water diversion equipment would be sufficient to maintain normal flow of Berry's Creek around the construction footprint, there would be the potential for ***short-term, less-than-significant adverse*** impacts to overall stormwater conveyance if an unusually large storm event occurred during these activities.

Operation of Alternative 1 would result in a long-term, minor increase in electricity demand from two primary proposed components. First, Alternative 1 includes numerous public realm features, as described in **Section 2.5.2.1**. To promote public safety, Fluvial Park, K-Town Park, Riverside Park, DePeyster Creek Park, and the cantilever riverwalk would include lighting features, which would require nominal amounts of electricity to operate. Second, the Berry's Creek storm surge barrier would be powered primarily by electricity. It would be connected to the electric grid via overhead lines that tap into existing overhead power lines along Paterson Plank Road, and would be constructed and wired in accordance with all applicable building code requirements. Electricity would power the proposed surge gates and pump station. The typical monitoring and control equipment associated with these features would draw a small amount of electricity on a continuous basis to operate. The surge gates and pump station would consume electricity intermittently, as they would only operate during heavy flood events.

Additionally, the surge gates would be closed prior to the initiation of the pump station so that peak electricity consumption is reduced. Operation of the pump station is expected to represent peak electrical consumption during the operation of the Berry's Creek storm surge barrier. This peak electrical consumption would be expected to persist for several days during each flooding event until the surge gates are reopened when the flood has sufficiently receded. An emergency backup diesel generator would also be located at the Berry's Creek storm surge barrier, which would be capable of operating the facility for at least 3 days in the event of an electric power outage. Electric demand associated with Alternative 1 would not be considered substantial in relation to existing demands, and sufficient electricity is available from PSE&G's existing sources to serve the public lighting features and Berry's Creek storm surge barrier. Therefore, Alternative 1 would have ***long-term, less-than-significant adverse*** impacts on the supply and demand of electricity within the Project Area.

Solid waste receptacles would be available at Fluvial Park, K-Town Park, Riverside Park, DePeyster Creek Park, and along the cantilever riverwalk. Disposal of collected refuse would be facilitated in the same manner as for the existing parks within the Project Area. The amount of solid waste collected from the existing parks would not be anticipated to be significant relative to the amount of solid waste currently generated within the Project Area. Therefore, Alternative 1 would have a ***long-term, less-than-significant adverse*** impact on the amount of solid waste generated within the Project Area.

The only telecommunication feature that would be included under Alternative 1 is a landline telephone that would be installed in the pump station at Berry's Creek. Numerous landline telephone providers are available within the Project Area; therefore, the addition of this phone would represent a ***long-term, less-than-significant adverse*** impact on the capacity of the existing telecommunication grid.

Indirect Impacts

<u>Supply, Demand, and Capacity of Utilities</u>

Construction and operation of Alternative 1 would not be expected to induce any changes in the Project Area that would impact the supply, demand, or capacity of existing utilities. For example, increased development within the Project Area is not anticipated to occur as a result of Alternative 1 because the area is already highly developed and the majority of undeveloped land is protected under conservation easements.

Security of Utilities

The construction phase of Alternative 1 would have no effect on the risks of existing utility services to identifiable hazards, such as flooding.

Operation of Alternative 1 would provide flood protection within the Project Area against coastal storm surges (to an elevation of 7 feet [NAVD 88]) for approximately the next 50 years. Increased flood protection provided by Alternative 1 is discussed in **Section 4.17.4.1**. This would benefit both the Little Ferry Water Pollution Control Facility and the underground utility infrastructure. While the BCUA is currently undergoing several projects to improve the resistance and resiliency of this facility (see **Section 5.5**), much of the BCUA property remains below 7 feet (NAVD 88). The additional flood protection provided by Alternative 1 would help the BCUA property to remain dry during Hackensack River flood events, which would further assist the facility to maintain full operational capacity. Underground infrastructure in areas below 7 feet (NAVD 88) would benefit from increased flood protection by avoiding the possible flooding damage identified under the No Action Alternative in **Section 4.12.4.1**.

By potentially reducing damage to utility infrastructure, Alternative 1 would also provide secondary benefits to the Project Area. Increased flood protection would likely reduce the frequency and severity of utility disruptions to consumers both during large flood events (e.g., power outages) and following damaging floods (i.e., while damaged infrastructure is being repaired or replaced). Reduced utility disruptions could lead to more rapid recovery and reduced loss of productivity for both residents and businesses following flood events. Therefore, Alternative 1 would have ***long-term beneficial*** impacts on the Project Area by increasing flood protection against coastal flooding, and thereby reducing potential future utilities damage and service disruptions.

However, Alternative 1 would not provide additional protection against inland flooding that results from inadequate stormwater drainage. Alternative 1 also would not provide additional flood protection to the LNG tanks or electric substation in Carlstadt, as these facilities are not located behind the LOP. Additionally, PSE&G completed upgrades to the electric substation in Little Ferry in 2016 that raised the substation to an elevation of 9.8 feet (NAVD 88; see **Appendix C**); therefore, Alternative 1 would not provide any additional protection to this facility. As such, these effects would remain the same as identified under the No Action Alternative.

Utility Prices

Construction of Alternative 1 would have no effects on the prices of utilities within the Project Area. Operation of Alternative 1 could lead to reduced future damage to utility infrastructure during coastal storm events. This potentially reduced damage could translate into lower labor and monetary costs for the utility providers to make necessary repairs, and, in turn, lower utility costs for consumers on their regular utility bills as compared to if utility infrastructure was subject to increased future damage from continued flooding (i.e., the No Action Alternative). Therefore, Alternative 1 would have ***long-term beneficial*** impacts on the prices of utilities services.

Mitigation Measures and BMPs

No potentially significant adverse impacts to utilities and service systems have been identified from the proposed construction or operation of Alternative 1. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase for Alternative 1, consultation with utility providers regarding the proposed footprints of the various Alternative 1 components would occur in order to minimize impacts to existing utility services.
- Prior to the start of construction, utility providers would be consulted with to: (1) have all underground utility lines flagged in the field where they intersect with the temporary easements; and (2) identify proper measures to take while working near utilities (e.g., overhead power lines) to prevent damage to the utilities and ensure the safety of both construction personnel and the public.
- During construction, contractors would coordinate with utility providers and property owners to facilitate the efficient relocation of all necessary utilities. Utility providers would provide advance notice to all affected users of the necessary temporary service disruptions. Furthermore, these disruptions would be planned to the extent possible to occur during periods of low utility demand.

4.12.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to utility services in the Project Area from necessary utility relocations and associated temporary service disruptions during the construction phase of Alternative 2.
- ***Short-term, less-than-significant, adverse*** impacts to the demand on existing utility services during the construction phase of Alternative 2 if contractors use local utilities (e.g., electricity or water) for specific construction activities.
- ***Short-term, less-than-significant, adverse*** impacts to stormwater conveyance in East Riser Ditch during construction due to the use of cofferdams and water diversion practices.
- ***Long-term, less-than-significant, adverse*** impacts to existing electricity demand in the Project Area due to the operation of proposed public lighting features and the three proposed new pump stations.
- ***Long-term, less-than-significant, adverse*** impacts on the amount of solid waste collected within the Project Area at the public parks.
- ***Long-term, beneficial*** impacts on stormwater drainage in the Project Area due to improvements to East Riser Ditch and the three proposed new pump stations.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against inland flooding, which could thereby reduce damage to utilities infrastructure and reduce service disruptions for consumers.
- ***Long-term, beneficial*** effects on the prices of utility services.

The following subsections provide greater detail.

Direct Impacts

<u>Utility Infrastructure Relocations and Service Disruptions</u>

The Alternative 2 components would generally retain greater flexibility in their design and implementation in comparison to the Alternative 1 LOP, which would be geographically constrained by the Hackensack River and existing development and would require substantial subsurface excavation. Therefore, it would be anticipated that the majority of the Alternative 2 components would be constructed without the need to relocate existing utility infrastructure or disrupt service.

However, several components would require excavation in areas likely to contain utility lines (i.e., rights-of-way), so alterations to utility infrastructure would be possible. Accordingly, construction of Alternative 2 would require coordination with utility companies regarding overhead and underground electric, natural gas, potable water, sanitary sewer, stormwater, and telecommunication infrastructure. Utility relocation or service disruption impacts and mitigation, when necessary, would be similar to Alternative 1. Therefore, construction of Alternative 2 would lead to ***short-term, less-than-significant adverse*** impacts to utilities systems due to the potential for utility relocations and service disruptions. The potential for utility relocation and service disruption impacts by the green infrastructure systems, parks and open space improvements, and grey infrastructure are described below.

Green infrastructure systems would typically be located and designed to accommodate existing utilities. The trench excavations would be offset at least 3 feet from the outside edge of all existing underground utilities, and offset 5 feet from existing utility poles. The vertical sides of the trenches would be lined with an impermeable membrane to prevent lateral water movement if needed to protect utilities. Diversion piping to green infrastructure systems or underdrains may need to cross over or under existing utility lines, but this would typically be done without permanently altering or relocating the existing utilities. However, underdrains from the green infrastructure systems generally would reconnect to the existing stormwater sewer system by tying into an existing catch basin to minimize impacts to the roadway. Depending on the condition of the catch basins, some may need to be replaced if they are not sufficiently capable of accommodating the new underdrains.

Construction associated with the new and improved parks/open spaces would mostly consist of land surface alterations (i.e., regrading, new plantings, etc.). These activities would therefore pose limited risk to existing underground utility lines. However, there would be several locations where construction activities (i.e., more substantial excavations, pile driving, etc.) would require deeper ground disturbance. Features that require these construction activities, such as elevated boardwalks, would be designed around existing utility lines to the extent possible. Utility lines would only be relocated under circumstances in which the construction design cannot be sufficiently adjusted.

Construction of the grey infrastructure improvements has the highest likelihood of utility conflicts. For example, several stormwater mains, catch basins, and discharge outlets are located within or adjacent to the East Riser Ditch temporary easement. Due to the nature of the channel improvements, it may not be possible to avoid impacts to these features, so the East Riser Ditch improvements would include accommodations or redesign of existing stormwater infrastructure. Additionally, numerous utility lines are located in the rights-of-way where Losen Slote force mains A and C are proposed. However, due to the high costs of utility relocations within rights-of-ways, it would be expected that installation of the force mains would be designed to avoid existing utilities to the extent practical.

Operation of Alternative 2 would not require any permanent relocations of or long-term disruptions to existing utility infrastructure and services.

Supply, Demand, and Capacity of Utilities

Construction and operation of Alternative 2 would not affect the supply, demand, or capacity of sanitary wastewater, natural gas, or telecommunication infrastructure or services.

Construction of Alternative 2 would not significantly impact the supply, demand, or capacity of existing utilities similar to Alternative 1. Most construction activities would be expected to be completed using diesel-powered equipment, and would not require connections to existing utilities. However, it is possible that individual contractors could arrange to use local utilities (i.e., water or electricity) for specific construction activities, or to operate their construction trailers. If this were to occur, they would coordinate directly with utility providers and/or local officials to ensure that they would not significantly impact the demand or capacity of utility services. Use of local utilities by contractors could lead to ***short-term, less-than-significant adverse*** impacts on the supply and demand of utilities. Additionally, cofferdams would be used to dewater certain stretches of East Riser Ditch during the construction of the forebay and force main discharge structures, respectively. Although water diversion equipment would be used to establish adequate flow conveyance around the in-channel construction sites, as per standard in-water construction practices, ***short-term, less-than-significant adverse*** impacts to stormwater conveyance could result from this process.

Similar to Alternative 1, operation of Alternative 2 would result in a long-term, minor increase in electricity demand from two primary proposed components. First, lighting features would be installed at several of the proposed new and improved public parks/open spaces, including Fluvial Park, Riverside Park, DePeyster Creek Park, Caesar Place Park, Avanti Park, and Willow Lake Park. These lights would operate on a consistent basis and require nominal amounts of electricity.

Second, the three proposed pump stations would be powered primarily by electricity. They would be connected to existing overhead power lines adjacent to each location, and would be constructed and wired in accordance with all applicable building code requirements. The typical monitoring and control equipment associated with these features would draw a small amount of electricity on a continuous basis to operate, while the pumps would consume greater amounts of electricity on an intermittent basis, as they would typically only operate during heavy precipitation events. Peak electrical consumption would be expected to persist for several hours or days at a time, depending on the intensity of the precipitation events. Emergency backup diesel generators would also be located at the pump stations, which would be capable of operating the facilities for at least 3 days in the event of an electric power outage. Electric demand associated with Alternative 2 would not be considered substantial in relation to existing demands, and sufficient electricity is available from PSE&G's existing sources to serve the proposed public lighting features and pump stations. Therefore, Alternative 2 would have ***long-term, less-than-significant adverse*** impacts on the supply and demand of electricity within the Project Area.

Operational use of existing stormwater drainage infrastructure would be limited to the proposed green infrastructure systems, some of which would include underdrains that tie into existing stormwater catch basins. However, the purpose of the green infrastructure is to capture stormwater before it enters the existing drainage infrastructure and increase its ability to infiltrate back into the ground. Therefore, although underdrains would discharge into the existing drainage infrastructure, this stormwater would represent a minor overall reduction as compared to existing conditions. Additionally, the grey infrastructure components of Alternative 2 would lead to larger benefits to stormwater management in the Project Area. Increased channel capacity of East Riser Ditch and the three proposed new pump stations would substantially improve the conveyance of stormwater out of the developed portions of the Project Area. Discussion of specific improvements in stormwater drainage is provided in **Section 4.17.4.3**. Overall, operation of Alternative 2 would result in ***long-term, beneficial*** impacts to stormwater drainage in the Project Area.

Under Alternative 2, solid waste receptacles would be installed at Fluvial Park, Riverside Park, DePeyster Creek Park, Caesar Place Park, Avanti Park, and Willow Lake Park. Impacts to solid waste would be similar to those described under Alternative 1. Therefore, Alternative 2 would have ***long-term, less-than-significant adverse*** impacts on the amount of solid waste generated within the Project Area.

Indirect Impacts

Supply, Demand, and Capacity of Utilities

Similar to Alternative 1, construction and operation of Alternative 2 would not be expected to induce any changes in the Project Area (e.g., future development) that would impact the supply, demand, or capacity of existing utilities.

Security of Utilities

The construction phase of Alternative 2 would have no effect on the risks of existing utility services to identifiable hazards, such as flooding.

As described under the No Action Alternative, inland flooding resulting from inadequate stormwater drainage can lead to damages and disruptions of underground utility infrastructure. However, the magnitude of such disruption depends on the precise circumstances of each situation, including the location and severity of the stormwater drainage issues and the type and durability of the utilities present in those locations. As such, improved stormwater drainage resulting from Alternative 2 could lead to a decrease in the risk of underground utilities to flooding damages or disruptions. However, this decreased risk would be expected to be minor due to both the low existing vulnerability of these utilities to flooding damages, and the unique conditions that would result in flood risk reductions. Therefore, Alternative 2 could have ***long-term, beneficial*** impacts on utilities in some portions of the Project Area by increasing protection against inland flooding, and thereby reducing potential future utilities damage and service disruptions.

The major above-ground utility infrastructure in the Project Area would not be expected to receive any additional inland flood protection under Alternative 2. As such, impacts to these facilities would be the same as under the No Action Alternative. Additionally, Alternative 2 would not provide any increased coastal flood protection to the Project Area; thus, potential impacts to above-ground and underground utility infrastructure from coastal flooding would also be the same as those identified under the No Action Alternative.

Utility Prices

Construction of Alternative 2 would have no effects on the prices of utilities within the Project Area.

Operation of Alternative 2 could lead to reduced future damage to utility infrastructure from inland flooding, which could translate into lower labor and monetary costs for the utility providers, as described under Alternative 1. Therefore, Alternative 2 could have ***long-term, beneficial*** impacts on the prices of utilities services. However, the increased flood protection provided to utilities, and consequently the potential reductions in damage, would be expected to be negligible.

Mitigation Measures and BMPs

No potentially significant adverse effects to utilities and service systems have been identified. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified less-than-significant impacts.

4.12.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project would interact with existing utilities onsite or nearby, and thus would not change the impact analysis.

Due to the overall similarity between Alternative 2 and Alternative 3, utilities that would potentially be impacted by Alternative 3 directly are generally the same as those that would be impacted under Alternative 2. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences.

Direct Impacts

Utility Infrastructure Relocations and Service Disruptions

Compared to Alternative 2, Alternative 3 would have less ground-disturbing activities. Thus, ***short-term, less-than-significant, adverse*** impacts associated with utility relocation and service disruption could be fewer. However, based on preliminary geographic data for utilities infrastructure, the removal of the two parks (Fluvial Park and DePeyster Creek Park) from Alternative 3 would not substantially change the need for utility relocations or service disruptions, as there appear to be very few existing utilities in those areas. A greater number of utilities intersect with the construction easement of Losen Slote force main C. However, as described under Alternative 2, it is assumed that the force main would be designed around existing utility infrastructure to the extent practical, and thus would not result in extensive impacts. Therefore, even though Alternative 3 contains fewer components than Alternative 2, its construction would not likely result in substantially fewer impacts than would be expected from construction of Alternative 2.

Supply, Demand, and Capacity of Utilities

Similar to Alternative 2, ***short-term, less-than-significant adverse*** impacts could occur on the supply and demand of utilities under Alternative 3 if contractors use local utilities during construction. However, under Alternative 3, there would be approximately 1,600 fewer man-days of effort required for construction compared to Alternative 2.

Operation of Alternative 3 would result in ***long-term, less-than-significant adverse*** impacts from a long-term, minor increase in electricity demand from the same sources described under Alternative 2 (e.g., lighting features at the parks and pump stations). However, Alternative 3 would include two fewer parks and one less pump station than Alternative 2, thus overall electricity use under Alternative 3 would be slightly less.

Operational use of existing stormwater drainage infrastructure by proposed green infrastructure systems and stormwater conveyance improvements in the East Riser Ditch drainage basin under Alternative 3 would be the same as described for Alternative 2. Additionally, Alternative 3 would result in similar stormwater conveyance improvements to those described under Alternative 2, except that Alternative 3 would not include Losen Slote pump station C. Therefore, there would be slightly less improvement to stormwater conveyance in the Losen Slote drainage basin under Alternative 3. Discussion of specific improvements in stormwater drainage under Alternative 3 is provided in **Section 4.17.4.4**. Overall, operation of Alternative 3 would result in slightly less ***long-term, beneficial*** impacts to stormwater drainage in the Project Area than Alternative 2.

Under Alternative 3, solid waste receptacles would only be installed at Riverside Park, Caesar Place Park, Avanti Park, and Willow Lake Park. Impacts to solid waste would be slightly less than those described under Alternatives 1 and 2. Therefore, Alternative 3 would have ***long-term, less-than-significant adverse*** impacts on the amount of solid waste generated within the Project Area.

Indirect Impacts

Security of Utilities

As described under the No Action Alternative, inland flooding resulting from inadequate stormwater drainage can lead to damages and disruptions of underground utility infrastructure. However, the magnitude of such disruption depends on the precise circumstances of each situation, including the location and severity of the stormwater drainage issues and the type and durability of the utilities present in those locations. As such, improved stormwater drainage resulting from Alternative 3 could lead to decreases in the risks of underground utilities to flooding damages or disruptions. However, these decreases would be expected to be minor due to both the low existing vulnerability of these utilities to flooding damages, and the unique conditions that would result in flood risk reductions. Therefore, Alternative 3 could have ***long-term, beneficial*** impacts on utilities in some portions of the Project Area by increasing protection against inland flooding, and thereby reducing potential future utilities damage and service disruptions. However, Alternative 3 would be expected to provide less flood protection to the Project Area than Alternative 2 (see **Section 4.17.4.4**), so any beneficial impacts to utilities would be less than those that would be provided under Alternative 2.

Utility Prices

Impacts on utility prices from the operation of Alternative 3 would be the same as those described under Alternatives 1 and 2. Therefore, Alternative 3 would be expected have slightly less ***long-term, beneficial*** impacts on the prices of utilities services. However, the increased flood protection provided to utilities, and consequently the potential reductions in damage, would be expected to be negligible.

Mitigation Measures and BMPs

No potentially significant adverse effects to utilities and service systems have been identified. The same mitigation measures and BMPs identified under Alternatives 1 and 2 would be implemented to further reduce the identified less-than-significant impacts.

4.13 Public Services

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on public services in the Project Area. Impacts to public services, which include police departments/services, fire departments/services, EMS, schools, municipal buildings, community facilities, institutional residences, and health care facilities, can be either direct or indirect. For the purposes of this analysis, direct impacts are those that would result in the physical displacement of an existing facility, disruption to a facility's property area or direct ability to provide service(s), and/or alterations in access to a facility. An indirect impact would occur if the Proposed Project would induce other changes that could affect public services. For example, should the Proposed Project induce other changes that would increase the demand on public services such that it exceeds capacity, an indirect impact would occur.

This analysis addresses the potential direct and indirect effects to existing public services during the construction and operation of the Proposed Project. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.13.1 Definition of Study Area

As described in **Section 3.13**, the study area for this resource area includes the existing and planned public services within the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to public services in accordance with 40 CFR 1508.27.

4.13.2 Thresholds of Significance

The significance criteria used to evaluate the potential direct and indirect effects of the alternatives on public services are shown in **Table 4.13-1**.

4.13.3 Analysis Methodology

To conduct this analysis, existing and planned public services facilities were overlaid with each considered alternative, and relationships between project components and these resources were identified. Using these data, potential direct impacts to hard infrastructure, and corresponding disruptions in service (e.g., through proposed road closures) in specific locations were identified. In addition, a qualitative analysis of anticipated changes to the supply of and demand for public services was conducted. This qualitative analysis considered other potential impacts to the Project Area from implementation of the Proposed Project, and compared these potential changes with the existing conditions.

Overall, potential impacts were analyzed in terms of potential relocations or displacements; disruptions to services; short- and long-term changes to supply, demand, and capacity of services; and changes in the security and reliability of services, as affected both directly and indirectly by each considered alternative. Where potential adverse effects were identified, the analysis recommended mitigation measures, as appropriate.

Table 4.13-1: Public Services Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Public Services Change	• Would not disrupt public services, including causing changes to physical infrastructure or access to a public service • Would not relocate existing public services facilities • Would not change the level of service, response times, service demand, or communication abilities between entities
	Indirect Public Services Change	• Would not induce any further changes to increase the demand on public services • Would not increase risk of public service facilities to identifiable hazards • Would not induce increases in student/teacher ratios or change in school district zoning
	Applies to All Effect Types	• Would result in no discernable changes to/decreases in public services in the Project Area • Would only alter public services for an indiscernible or negligible period of time
Less-than-Significant	Direct Public Services Change	• Would result in temporary disruptions to public services, such as a change in infrastructure or access • Would require minor relocations of public services that would not result in substantial service disruption • Would result in a minor, temporary change in the level of service, response times, service demand, or communication abilities
	Indirect Public Services Change	• Would induce increases in the demand on public services, but would not exceed available capacity • Would temporarily increase risk of public service facilities to identifiable hazards • Would induce temporary increases in student/teacher ratios
	Applies to All Effect Types	• Public services would only be altered/diminished for a short, finite period, and would not exceed available capacity • Short-term impacts would be localized in specific areas and not substantially affect or diminish public services throughout the Project Area

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Public Services Change	• Would result in substantial or long-term disruptions to public services, such as change in infrastructure or access • Would require relocations of public services that would result in substantial service disruption • Would result in a substantial or long-term change in the level of service, response times, service demand, or communication abilities
	Indirect Public Services Change	• Would induce increase in the demand on public services that would exceed available capacity • Would increase risk of public service facilities to identifiable hazards
	Applies to All Effect Types	• Public services would be adversely altered/diminished for an extended or permanently • Impacts would substantially affect or diminish public services throughout the Project Area • Changes to public services may or would conflict with existing laws and regulations
Beneficial	Direct Public Services Change	• Would result in changes that improve the capacity, delivery, or efficiency of public services in the Project Area
	Indirect Public Service Change	• Would induce further changes that would decrease the demand on public services • Would decrease risk of public services to identifiable hazards
	Applies to All Effect Types	• Would result in public services benefits, improvements, and/or increases in the Project Area

4.13.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to public services associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.13.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be built and no changes attributable to the Proposed Project would occur to existing or planned public services within the Project Area. As such, there would be no direct impacts on public services from the Proposed Project.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, potentially significant adverse*** impacts on public services by increasing disruptions to service; increasing response times; reducing access to or from public services; reducing the supply, increasing the demand, and reducing the capacity and reliability of public services in the Project Area. Per the significance criteria, the No Action Alternative:

- *Could induce an increase in the demand of public services that could exceed available capacity*
- *Could increase the risk of public service facilities to identifiable hazards, such as flooding*
- *Public services could be adversely altered/diminished for an extended or permanent period*
- *Impacts could substantially affect or diminish public services throughout the Project Area*

The greatest overall impacts to public services would be expected to occur as a result of continued and increased coastal storm surges and fluvial flooding. Flooding could damage infrastructure and property associated with various public services within the Project Area; more than 75 percent of the public service infrastructure in the Project Area is located within the 100-year floodplain (i.e., total of 37; see **Section 3.13.3**). Flood damage to public service facilities would likely result in physical displacement and relocation of public services facilities on at least a temporary, if not permanent, basis. Compromised public service facilities would result in disruptions to services, the duration and severity of which would depend on numerous circumstantial factors, such as tidal height at the time of landfall of a storm.

The response times of police departments, fire departments, and EMS is dependent on accessibility to businesses or residents requesting assistance. Flood events can damage or inhibit the use of infrastructure (e.g., road closures), causing increases in the response times of police, fire, and EMS within the Project Area. Road closures would also have the potential to inhibit the ability of residents to access public services during flooding events. The Concentra Urgent Care health care facility in the Borough of Teterboro, for example, lies outside of the 100-year floodplain, but limited access to this facility during severe floods would diminish its ability to provide affected residents with health care services in a timely manner. In the case of police, fire, and EMS services, any increase in response time or accessibility has the potential to result in loss of life.

Flooding events could cause changes to the supply or availability of public services within the Project Area. Flooding of public service facilities could cause closures and force the relocation of public service facilities within (or outside of) the Project Area, resulting in a reduced supply of public services, or increased response times. For example, during Hurricane Sandy, tidal flooding forced the closure and relocation of two municipal buildings and one police station in the Borough of Moonachie (see **Section 3.13**). Additionally, all four of the schools in Little Ferry were forced to close, and students and faculty were displaced. Memorial Middle School was closed for two weeks before reopening at the former Roman Catholic School in Lyndhurst (Smith 2012). Robert Craig Elementary School students were bused to Wood-Ridge for approximately two months after the storm, before relocating into trailers for the remainder of the school year (Nicholaides and Cattafi 2017, Sullivan 2013). Generally, the school buildings were not fully renovated until the beginning of the 2013-2014 school year. Currently, six schools out of a total of seven in the Project Area are within the 100-year floodplain.

The demand for public services temporarily, but substantially, increases during flooding events, as flooding results in an increase in call volumes from affected residents, businesses, or other users requesting emergency assistance. As the frequency and severity of these events increase over time, the periodic increased demand on these emergency services would increase proportionately. An increased demand for public services during flood events could surpass the ability of the public services to effectively respond to calls. Furthermore, an increase in demand during flood events in conjunction with a reduced supply of public services due to flood-related displacements and road closures could overwhelm the capacity of public services to reliably provide services within the Project Area.

4.13.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant adverse*** impacts to response times due to road and/or lane closures during the construction phase of Alternative 1.

Alternative 1 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant adverse*** impacts to existing demand on public services during the construction phase of Alternative 1, due to an influx of construction workers into the Project Area.
- ***Long-term beneficial*** impacts to demand for public services in the Project Area due to fewer flood-related emergency calls.
- ***Long-term beneficial*** effects by increasing flood protection against coastal storm surge, which would thereby reduce interruptions in service and increase reliability of public services, including fewer flood-related road closures.

The following subsections provide greater detail.

Direct Impacts

Public Service Relocations and Service Disruptions

No public service infrastructure would be directly disrupted or physically impacted as a result of the construction or operation of Alternative 1. Additionally, there would be no service disruptions as a result of impacts to the communication ability of public services within the Project Area due to any component of Alternative 1.

Response Time of Public Services

Alternative 1 would require temporary road/lane closures or realignments, which could cause disruptions to public services during the construction phase of the Proposed Project. Generally, public services in the Project Area would continue unimpeded for the majority of the construction process; however, temporary reductions in accessibility to or from various portions of the Project Area would be necessary while the Proposed Project is completed. These proposed road/lane closures or realignments could impede vehicle access to or from public service facilities, and could cause delays in the response times of police and fire departments and EMS. For example, construction of Alternative 1 would require the closure or realignment of portions of Main Street (east of Bergen Turnpike), Riverside Avenue (south of Washington Avenue), Dietrich Street (east of Maiden Lane), and Commerce Boulevard. These three roads are dead-end-roads; therefore service to the buildings, infrastructure, and residents along these roads could be reduced during the construction phase. As such, ***short-term, less-than-significant adverse*** impacts to response times at these specific locations due to road/lane closures or realignments during the construction phase of Alternative 1 would be expected.

Indirect Impacts

Supply, Demand, and Capacity of Public Services

During the construction of Alternative 1, there would be a temporary increase in the population within the Project Area during the work day due to an influx of approximately 490 job-years over the course of a 3-year period, with a peak construction year of 2021 (NJDEP 2018). This increase in daytime population during the construction period could lead to an increase in the demand for public services, such as in the case of an emergency medical situation. However, the increase in demand from the influx in workers is expected to have a ***short-term, less-than-significant adverse*** impact on public services as it is expected that the capacity of the public services within the Project Area would be able to meet the potential increase in demand.

As described in **Section 4.1.2.2**, Alternative 1 would reduce the risk of flooding from storm surges within the Project Area. During flood events, the demand for services from police and fire departments, EMS, and healthcare facilities increases. The services provided by these public services are often heavily utilized during flood events as they provide rescue and emergency response services. A spike in demand during flood events has the potential to increase response times and overwhelm the capacity of public services. However, operation of Alternative 1 would reduce flooding within the Project Area, thereby concurrently resulting in a ***long-term beneficial*** impact (i.e., decrease) in demand for public services in the Project Area due to fewer flood-related emergency calls. In addition, Alternative 1 would reduce the number of future flood-related road closures in the Project Area that impede public service provision.

Security of Public Services

Operation of Alternative 1 would provide the Project Area with increased protection against storm surge flooding. Under Alternative 1, a reduction in flooding would result in greater reliability of public services through fewer flood-related closures of public service facilities. Therefore, Alternative 1 would have a ***long-term beneficial*** impact of fewer interruptions to services and greater security within the Project Area.

Mitigation Measures and BMPs

No potentially significant adverse impacts to public services have been identified from the proposed construction or operation of Alternative 1. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- During the final design phase for Alternative 1, consultation with public services providers regarding the proposed footprints of the various Alternative 1 components would occur in order to minimize impacts to existing public services.

- During the construction phase of Alternative 1, a TMP would be implemented to provide emergency service providers and the public with information on road closures and detours. This would allow first responders to plan their travel routes. Furthermore, road/lane closures or realignments would be planned to the extent possible to occur during periods of low public services demands.
- During construction, contractors would coordinate with public services providers to provide them with up-to-date information on the total numbers of workers within the Project Area during the work day, to ensure that public services could meet the demand of the increased population size.
- During construction, contractors would limit construction activities around noise-sensitive public facilities (i.e., libraries, schools, religious facilities), and implement the mitigation measures and BMPs set forth in **Section 4.8.4.2**. Additionally, a Public Safety Plan would be developed and implemented during construction.

4.13.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to response times due to lane closures or construction-related traffic during the construction phases of Alternative 2.
- ***Short-term, less-than-significant, adverse*** impacts on the access to and from existing public service facilities during the construction phases of Alternative 2.
- ***Short-term, less-than-significant, adverse*** disruptions to public service facilities due to construction noise.

Alternative 2 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to existing demand on public services during the construction phase of Alternative 2 due to an influx of construction workers into the Project Area during the work day.
- ***Long-term, beneficial*** impacts to demand for public services in the Project Area due to fewer flood-related emergency calls.
- ***Long-term, beneficial*** effects by increasing flood protection against inland flooding, which would reduce interruptions in service resulting from flood-related road closures and increase reliability of public services.

The following subsections provide greater detail.

Direct Impacts

Public Service Relocations and Service Disruptions

No public service infrastructure would be directly disrupted or physically impacted as a result of construction or operation of Alternative 2. Additionally, there would be no service disruptions as a result of impacts to the communication ability of public services within the Project Area due to any component of Alternative 2.

Response Time of Public Services

Alternative 2 would require temporary lane and driveway closures (see **Section 2.5.3**), which could cause disruptions to public services during the construction phase of the Proposed Project. Generally, public services in the Project Area would continue unimpeded for the majority of the construction process; however, temporary reductions in accessibility to or from various portions of the Project Area would be necessary while the Proposed Project is completed. The proposed road lane closures could impede vehicle access to or from public service facilities, and could cause delays in the response times of police departments, fire departments, and EMS. For example, temporary, lane closures would be needed during the construction of the green infrastructure systems within various roadways; East Riser Ditch improvements on West Commercial Avenue and Amor Avenue; Force Main A along Liberty Street, Lorena Street, Eckel Road, and Birch Street; and force main C along West Park Street and East Park Street. Therefore, service to the buildings, infrastructure, and residents along these roads could be reduced during the construction phase. As such, ***short-term, less-than-significant adverse*** impacts on response times within the Project Area due to an increase in traffic during lane closures would be expected.

Compared with Alternative 1, Alternative 2 is anticipated to cause slightly less potential for delays in response times because no road closures or realignments are proposed. In addition, lane closures are anticipated to be shorter in duration during the construction phase.

Access

During the construction of Alternative 2, the proposed staging areas and temporary lane/driveway closures would also restrict access to and from the public facilities located within or in the vicinity of the Proposed Project footprint. For example, the parking lot and driveway at the Maple Street/Moonachie Road intersection near Joseph Street Park that is shared by Moonachie Senior Citizens Center, Moonachie First Aid & Rescue, and the Moonachie Civic Center would be temporarily impacted for approximately 20 days. Improvements to existing open spaces/public amenities (e.g., Little Ferry Public Schools, Robert Craig School, and Little Ferry Public Library) could lead to traffic congestion around these facilities or the temporary inaccessibility of existing parking or recreational areas within these facilities. The construction of green infrastructure systems along Marshall Avenue, Main Street, and Center Street would occur near the Evangel Christian Church, which could temporarily impact access to the church and on-street parking nearby. Because impacts would be temporary in nature, ***short-term, less-than-significant adverse*** impacts on the access to and from public facilities within and in the vicinity of the Alternative 2 footprint would be expected. In comparison, Alternative 1 would not be expected to directly impact the access of public services.

Disruptions to Public Service Facilities (Noise)

During the construction phases of Alternative 2, construction noise could result in temporary impacts to noise-sensitive public services within the Project Area (e.g., schools, community centers, religious facilities). Specifically, construction noise from improvements to Joseph Street Park could adversely impact the Moonachie Senior Citizens Center and the Moonachie Civic Center due to their close proximity to Joseph Street Park. Improvements to other noise-sensitive receptors, such as Little Ferry Public Schools, Robert Craig School, and the Little Ferry Public Library, would also be conducted immediately adjacent to those respective facilities. Further, Alternative 2 components would be constructed near Evangel Christian Church and First Presbyterian Church, located in the Boroughs of Little Ferry and Moonachie, respectively. Therefore, during the construction of Alternative 2, construction noise could result in ***short-term, less-than-significant adverse*** impacts to noise-sensitive public services. In comparison, Alternative 1 would not be expected to directly impact noise-sensitive public services. For more information on noise related impacts and associated mitigation measures, refer to **Section 4.8.2.3**.

Indirect Impacts

Supply, Demand, and Capacity of Public Services

During the construction of Alternative 2, there would be a temporary increase in the population within the Project Area during the work day due to an influx of approximately 500 job-years over the course of a 3-year period, with a peak construction year of 2020 (NJDEP 2018), in comparison to 490 job-years under Alternative 1. This increase in daytime population during the construction period could lead to an increase in the demand for public services, such as in the case of an emergency medical situation. However, the increase in demand from the influx in workers is expected to have a *short-term, less-than-significant adverse* impact on public services as it is expected that the capacity of the public services within the Project Area would be able to meet the potential increase in demand.

Operation of Alternative 2 would reduce inland flooding within the Project Area from heavy precipitation events through stormwater conveyance, infiltration, and treatment improvements. As described in **Section 4.13.4.2**, there is an increased demand for the emergency services provided by first responders during flood events. As such, a reduction in the frequency of inland flooding would have the potential to benefit public services, especially fire departments, police departments, and EMS, by reducing the number of flood-related emergency calls to first responders. As such, the operation of Alternative 2 would result in ***long-term, beneficial*** effects (i.e., decrease in demand) to public services, due to fewer flood-related emergency calls. However, unlike Alternative 1, Alternative 2 would not result in the beneficial impacts from the reduction of coastal storm surge flooding.

Security of Public Services

A reduction in the frequency of inland flooding would induce an increase in the reliability of public services in the Project Area due to fewer flood-related road closures. This increase in the reliability of the services provided by police departments, fire departments, and EMS would have ***long-term, beneficial*** impacts of fewer interruptions to services and greater security within the Project Area.

In addition, operation of Alternative 2 would improve localized drainage for several facilities (i.e., the Little Ferry Police Department, Little Ferry Municipal Building, Little Ferry First Aid, Moonachie First Aid and Rescue, Little Ferry Public Library, Little Ferry Public Schools, Robert Craig Elementary School, Moonachie Civic Center/Senior Center, Little Ferry Senior Center, First Presbyterian Church, Evangel Christian Church, and Little Ferry Hook and Ladder Company). While the operation of Alternative 2 would induce ***long-term, beneficial impacts*** to the reliability and security of public services within the Project Area, the beneficial impacts from reduced coastal storm surge flooding identified under Alternative 1 would not be realized.

Mitigation Measures and BMPs

No potentially significant adverse effects to public services have been identified from the proposed construction or operation of Alternative 2. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2 (see **Section 4.13.4.2**).

4.13.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer stormwater improvements. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects public services, and thus would not change the impact analysis. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2.

Direct and indirect impacts on public services under Alternative 3 would be the same with the exception of the following impacts:

- Due to less construction activities under Alternative 3, ***short-term, less-than-significant, direct adverse*** impacts on response times, facility access, and disruptions from noise would be expected to be slightly less.
- During the construction of Alternative 3, there would be a temporary increase in the population within the Project Area during the work day due to an influx of approximately 320 job-years over the course of a 3-year period, with a peak construction year of 2020 (NJDEP 2018), in comparison to 490 job-years under Alternative 1 and 500 job-years under Alternative 2. Thus, ***short-term, less-than-significant adverse*** impacts from an increase in demand from the influx in workers during the work day would be less.
- Under Alternative 3, Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and force main C would not be constructed; therefore, ***long-term, beneficial*** effects on the demand and reliability of public services from improved stormwater conveyance, infiltration, and treatment within the Project Area would be slightly less than Alternative 2.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.13.4.3**).

4.14 Biological Resources

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on biological resources in the Project Area. As described in **Section 3.14**, biological resources include terrestrial habitats and wildlife; aquatic habitats and wildlife, including EFH; and special status species. Impacts to biological resources can be either direct or indirect. A direct impact would occur if the Proposed Project would directly alter a biological resource within the Project Area, such as by removing vegetation during construction. An indirect impact would occur if the Proposed Project would induce other changes that could affect biological resources. For example, an indirect impact could occur if the Proposed Project would contribute to habitat degradation and, thus, diminish future food sources for wildlife species. Similarly, an indirect impact could occur by introducing invasive species within the Project Area or causing increased turbidity, sedimentation, or pollutant loads downstream of the Proposed Project activities.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to affect biological resources during both construction and operation, either by affecting these resources directly or by causing indirect effects that alter biological resources later in time or further removed in distance. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.14.1 Definition of Study Area

As described in **Section 3.14**, the study area for biological resources includes the Project Area and areas immediately adjacent to and down gradient from the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to biological resources, in accordance with 40 CFR 1508.27.

4.14.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect biological resources effects of the alternatives are provided in **Table 4.14-1**. The designations of significance thresholds for terrestrial and aquatic habitats were based on the magnitude of potential impacts as determined by a number of factors, including:

- The type and overall quality of the habitat affected
- The location or position of the habitat affected within the context of the landscape
- The amount of remaining similar habitat in the Project Area, greater region, or Hackensack River watershed
- Whether or not the affected habitat is critical to a specific species or wildlife population.

For potential effects to aquatic habitats, functional assessment techniques were used to determine the overall quality of the habitat. Any potential adverse changes to EFH, commercially and ecologically important species, special status species, or species of conservation concern were considered potentially significant.

4.14.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were each evaluated to determine their potential for changes to biological resources within the study area; these resources are described in **Section 3.14**. Potential direct and indirect impacts were identified through review of existing data and reports, formal written requests to and responses from regulatory agencies, and the conduct of field studies. In addition, the potential effects of each considered alternative were reviewed for compliance with Federal and State laws and regulations through coordination and consultation with the NJDEP, USACE, USFWS, and NMFS.

To conduct this analysis, each Build Alternative was overlaid onto the existing biological resources environment using GIS, and spatial relationships between Proposed Project components and biological resources were identified. Using these data, potential direct short- and long-term impacts to biological resources at specific locations, and corresponding potential indirect impacts, were identified.

Potential direct and indirect impacts, including habitat loss and fragmentation, disruptions to migration, and loss of ecological function, were determined by reviewing the proposed alternatives overlaid onto habitat community maps. In addition, areas that may have seasonal construction constraints due to species presence (e.g., overwintering threatened and endangered species) were identified. A qualitative analysis of anticipated changes to biological resources was also conducted following the quantitative analysis. The qualitative analysis considered other potential impacts to the Project Area from implementation of each of the Proposed Project alternatives, and compared these potential changes with the existing conditions described in **Section 3.14**.

Table 4.14-1: Biological Resources Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Biological Resources Change	• Would not remove vegetation from riparian or upland habitats • Would not alter terrestrial or aquatic habitats • Would not fragment/isolate terrestrial or wetland habitat and would not interrupt migratory corridors • Would not impede flow or aquatic organism movement in tidal or non-tidal waterways • Would not displace or degrade aquatic resources, including EFH or intertidal or subtidal benthic communities/habitats • Would not affect special status species and their habitats
	Indirect Biological Resources Change	• Would not result in the introduction or proliferation of invasive species • Would not result in a downstream increase in turbidity, sedimentation, or nutrient/contaminant inputs • Would not induce any further changes that would adversely affect biological resources
	Applies to All Effect Types	• Would result in no discernable changes to biological resources in the Project Area • Would alter biological resources for only an indiscernible or negligible period of time
Less-than-Significant	Direct Biological Resources Change	• Would result in limited vegetation removal from riparian or upland habitats • Would result in limited alteration to terrestrial or aquatic habitats • Would result in limited fragmentation/isolation of terrestrial and wetland habitats, including migratory corridors • Would result in limited impediments to flow or aquatic organism movements in tidal or non-tidal waterways • Would result in limited displacement or degradation of aquatic resources, including EFH or benthic communities • Would not adversely affect special status species and their habitats
	Indirect Biological Resources Change	• Would result in limited proliferation of invasive species • Would result in a minimal downstream increase in turbidity, sedimentation, or nutrient/contaminant inputs • Would induce further changes that would result only in minimal changes to biological resources
	Applies to All Effect Types	• Biological resources would only be altered/diminished for a short, finite period, but would recover • Short-term impacts would be localized in specific areas and not substantially affect or diminish biological resources throughout the Project Area

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Biological Resources Change	• Would remove moderate or substantial amount of vegetation from riparian or upland habitats • Would substantially alter terrestrial or aquatic habitats, including direct loss or degradation of wetlands • Would fragment/isolate terrestrial and wetland habitats, including migratory corridors • Would impede flow or aquatic organism movements in tidal or non-tidal waterways • Would displace or degrade aquatic resources, including EFH or benthic communities • Would adversely affect special status species and their habitats
	Indirect Biological Resources Change	• Would introduce or proliferate invasive species • Would result in a notable downstream increase in turbidity, sedimentation, or nutrient/contaminant inputs • Would induce further changes that would result in moderate to substantial changes to biological resources
	Applies to All Effect Types	• Biological resources would be adversely altered/diminished for an extended or permanent period • Impacts would substantially affect or diminish biological resources throughout the Project Area
Beneficial	Direct Biological Resources Change	• Would increase amount of native vegetation • Would stabilize shorelines and/or protect habitats at higher elevations or upstream • Would improve habitats, including increase in wetland quality or quantity • Would improve habitat connections, including migratory corridors • Would improve flow or aquatic organism movement in tidal or non-tidal waterways • Would improve aquatic resources, including EFH or benthic communities • Would positively affect special status species and their habitats
	Indirect Biological Resources Change	• Would reduce, remove, or better control invasive species • Would result in a downstream decrease in turbidity, sedimentation, or nutrient/contaminant inputs • Would induce additional changes that would result in improvements to biological resources
	Applies to All Effect Types	• Would result in biological resources benefits, improvements, and/or increases in the Project Area

4.14.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to biological resources associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.14.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented and, as such, the biological resources of the study area would not be altered by construction or operation activities associated with the Proposed Project. There would be no project-related, direct impacts to terrestrial habitats and wildlife, aquatic habitats and wildlife, or special status species in the study area.

However, continued and increased flooding in the Project Area over time, as summarized in **Section 4.1.2.1**, could have ***indirect, potentially significant adverse*** impacts on biological resources by changing habitat and diminishing ecological function. Per the significance criteria, the No Action Alternative:

- *Could induce continued and increased shoreline erosion*
- *Could induce habitat alterations (e.g., as marshes flood and become open water)*
- *Could substantially increase downstream turbidity, sedimentation, or nutrient/contaminant inputs as a result of increased flooding*
- *Could induce continued reduction of ecological function.*

Flooding within the Project Area would be expected to continue to, and increasingly, have impacts on biological resources. Even without projected SLR, low-lying open space in the Project Area along Berry's Creek and the Hackensack River is expected to flood more often during more frequent and intense storm events. Open areas, including extensive salt marshes and wetlands that are ecologically important to the Meadowlands District, flood under current conditions and would continue to be flooded with deeper water under the projected SLR scenarios, exacerbating chronic, incremental shoreline erosion and flooding of terrestrial and aquatic environments located along shorelines and low-lying, flood-prone areas.

As the water levels rise, the marshes would not be able to retreat inland due to the existing hard shoreline infrastructure and would turn into open water habitat. Additionally, shoreline erosion would gradually reduce habitat for shoreline and edge-dwelling wildlife. Chronic erosion would increase turbidity in the Hackensack River and its tributaries, further degrading natural systems.

In the absence of effective flood protection structures, severe storm events in the region would continue to result in impacts to biological resources, such as loss of wetlands and other habitats that contribute to regional biodiversity and ecosystem resiliency. These impacts would vary in intensity over time as the sea level is anticipated to rise and the severity of coastal storms is anticipated to increase. Therefore, under the No Action Alternative, ***potentially significant adverse*** changes to the biological resources of the study area would be anticipated.

4.14.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Long-term, potentially significant adverse*** impacts to aquatic habitats from dredge and fill activities and habitat removal associated with the Central Segment and Berry's Creek storm surge barrier.
- ***Short- and long-term, less-than-significant adverse*** impacts to terrestrial habitats in the Project Area from limited removal of vegetation.
- ***Short-term, less-than-significant adverse*** impacts to aquatic habitats, EFH, and aquatic wildlife during construction from in-water work due to increased turbidity.
- ***Short-term, less-than-significant adverse*** impacts to aquatic and terrestrial wildlife, including EFH, EFH species, and threatened and endangered species, from physical disturbance and noise/vibration during construction.
- ***Long-term, less-than-significant adverse*** impacts to aquatic habitats, EFH, and EFH species during the operation of the proposed tide gate and Berry's Creek storm surge barrier from minor hydrology alterations.
- ***Long-term, less-than-significant adverse*** impacts to aquatic and terrestrial wildlife in the study area from limited loss of habitat for foraging, breeding, and spawning of aquatic species; impacts to migration corridors would be minimal.
- ***Long-term, beneficial*** impacts to terrestrial habitats and wildlife from the removal of invasive species and proposed habitat enhancements (i.e., native plantings) in the study area.
- ***Long-term, beneficial*** impacts to aquatic habitats and wildlife, including EFH and EFH species, in the study area by enhancing wetlands.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, less-than-significant adverse*** impacts to terrestrial wildlife due to reductions in riparian habitat along the Hackensack River and upland/shrub habitats.
- ***Long-term, less-than-significant adverse*** impacts to aquatic wildlife, including EFH species, and threatened and endangered species, due to increased human activity along the Hackensack River waterfront.
- ***Long-term, beneficial*** effects to aquatic habitats and wildlife from the removal of invasive plants and planting of native wetland vegetation.
- ***Long-term, beneficial*** effects to habitats, including EFH, in the study area by reducing impacts from flooding events and the effects of SLR, and decreasing associated downstream turbidity, sedimentation, and nutrient/contaminant inputs.

The following subsections provide greater detail. Additional detail regarding EFH and EFH species can be found in the EFH Assessment Report in **Appendix Q**.

Direct Impacts

Direct impacts to terrestrial and aquatic habitats and wildlife are anticipated as part of implementation of Alternative 1 (see **Table 4.14-2**). The following subsections provide additional information on the direct impacts to terrestrial (upland) habitats, aquatic habitats, terrestrial wildlife, aquatic wildlife, and special status species.

Table 4.14-2: Summary of Anticipated Direct Impacts to Terrestrial and Aquatic Habitats under Alternative 1

Impact Type**	Area of Impact to Terrestrial and Aquatic Habitats (acres)*							Total Area of Impact
	Forested Upland	Shrub Uplands	Open Uplands	Forested Mineral Soil Wetlands	Shrub Mineral Soil Wetlands	Open Mineral Soil Wetlands	Waterbodies	
Permanent	2.0	1.1	0.9	0.0	2.7	3.1	0.1	9.9
Temporary	1.5	0.4	0.4	0.0	0.5	0.9	0.1	3.8
Total	**3.5**	**1.5**	**1.3**	**0.0**	**3.2**	**4.0**	**0.2**	**13.7**

* Aquatic habitats identified in this table and discussed in this section are based on field-mapped habitats and do not identify jurisdictional WOUS or wetlands. As such, impact acreages presented here do not directly correlate with acreages presented in Section 4.16 (Water Resources).
Habitats identified in this table do not include all land uses potentially affected by Alternative 1 (e.g., developed and disturbed), but do include those areas providing habitats for biological resources.
**Permanent impacts represent a long-term impact (e.g., permanent loss of habitat or function).
Temporary impacts represent a short-term impact (e.g., the habitat area and function can be restored fully upon completion of construction activities).

Terrestrial (Upland) Habitats

Construction of Alternative 1 would disturb urban and vegetated terrestrial wildlife habitat in the Northern and Central Segments of Alternative 1, including residential, commercial, and industrial areas. No terrestrial habitats would be disturbed in the Southern Segment or at the Berry's Creek storm surge barrier.

Terrestrial habitats present in the Northern and Central Segments include non-vegetated uplands, such as hardened shorelines along the Hackensack River, building exteriors, and unpaved lots, which are generally used by species adapted to an urban environment. Vegetated habitats include maintained lawns and linear scrub/shrub and successional forest habitats located at the top of the bank between industrial and commercial facilities and the hardened shorelines of the Hackensack River. These habitat communities are fragmented and isolated from larger, vegetated habitat patches located in the interior portions of the Project Area by development and roads.

During construction of Alternative 1, terrestrial vegetation within the Project Area would be removed and reseeded with native vegetation where levees are proposed, and replaced with hard structures where flood and cantilever walls are proposed. As shown in **Table 4.14-2**, approximately 6.3 acres of upland habitat would be temporarily (2.3 acres) or permanently (4.0 acres) impacted as a result of Alternative 1. Upland habitats temporarily disturbed during construction activities would result in ***short-term, less-than-significant adverse*** impacts to terrestrial habitats, as these areas would be restored upon completion of ground-disturbing activities. While tree and shrub removal would be limited (i.e., approximately 5.0 acres), this disturbance would change existing habitats important to neo-tropical migratory songbirds and bat species. Due to the diminished quality of habitat being lost and the remaining comparable habitat within and adjacent to the Project Area, construction of Alternative 1 would result in ***long-term, less-than-significant adverse*** impacts to terrestrial habitats primarily from upland habitat alteration (e.g., tree removal, construction of new flood structures).

Upland communities located along the top bank of the Hackensack River in the Northern and Central Segments of Alternative 1 are currently dominated by invasive species and fragmented by the urban landscape. Invasive and non-native plants are of significant concern in New Jersey (Snyder and Kaufman 2004). Invasive species compete with native flora and present a threat to local biodiversity and the persistence of native plant and animal communities. BMPs would be implemented during construction activities to avoid the potential for spreading invasive species to other locations within the Project Area. Invasive and non-native species, such as tree-of-heaven, would be removed during construction of Alternative 1, thereby directly benefiting terrestrial habitats. Additionally, temporarily disturbed upland habitats (2.3 acre) would be replanted with native species, increasing the amount of native vegetation in the terrestrial habitats present in the Project Area. Proposed public open spaces, including Fluvial Park, Riverside Park, and DePeyster Creek Park, would also be planted with native vegetation, including upland (0.7 acre), wetland (1.1 acres), and riparian (0.4 acre) plantings, as well as turf for active recreation. In total, approximately 220 new native trees would be planted under alternative 1 (NJDEP 2018). Permeable pavement would also be used to reduce the overall impervious surface areas in the parks. Specifically, Alternative 1 would convert 10.1 acres of land in the Project Area to accessible, public open space (see **Section 4.11**). Therefore, Alternative 1 would be expected to have ***long-term, beneficial*** impacts on terrestrial habitats from the removal of invasive species.

<u>Aquatic Habitats</u>

Although Alternative 1 was sited and designed to minimize work within aquatic habitats, approximately 7.4 acres of aquatic habitat (wetlands and waterbodies) would be temporarily (1.4 acres of wetlands and 0.1 acre of waterbodies) or permanently (5.8 acres of wetlands and 0.1 acre of waterbodies) impacted (see **Table 4.14-2**). The construction of Alternative 1 would have temporary impacts to aquatic habitats as well as EFH in the study area. During construction, in-water work would be necessary near the proposed new tide gate on the unnamed tributary within the BCUA facility, the Berry's Creek storm surge barrier, and along the LOP; this work would result in temporary fill and minor increases in turbidity. Temporary dewatering would also be necessary for some of this construction (i.e., the Berry's Creek storm surge barrier); however, the dewatered area would be minimized to the extent practicable, and would not be expected to bifurcate the channel entirely. During the final design and permitting phases of the Proposed Project, the EFH assessment would be revisited in consultation with NMFS to evaluate potential impacts to EFH that could result from construction work below mean high water. With mitigation measures, including seasonal restrictions on in-water work during key migration or life cycle periods of fishes (i.e., March 1 through June 30), turbidity barriers, and other measures that would be detailed in the project-specific Stormwater Pollution Prevention Plan (SWPPP), and mitigation to offset loss of intertidal and subtidal shallows and wetlands (see **Section 4.16**), impacts to aquatic habitats and EFH would be minimized and compensated to the extent practicable. Therefore, temporary impacts from in-water work during construction would result in ***short-term, less-than-significant adverse*** effects to EFH and other aquatic habitats.

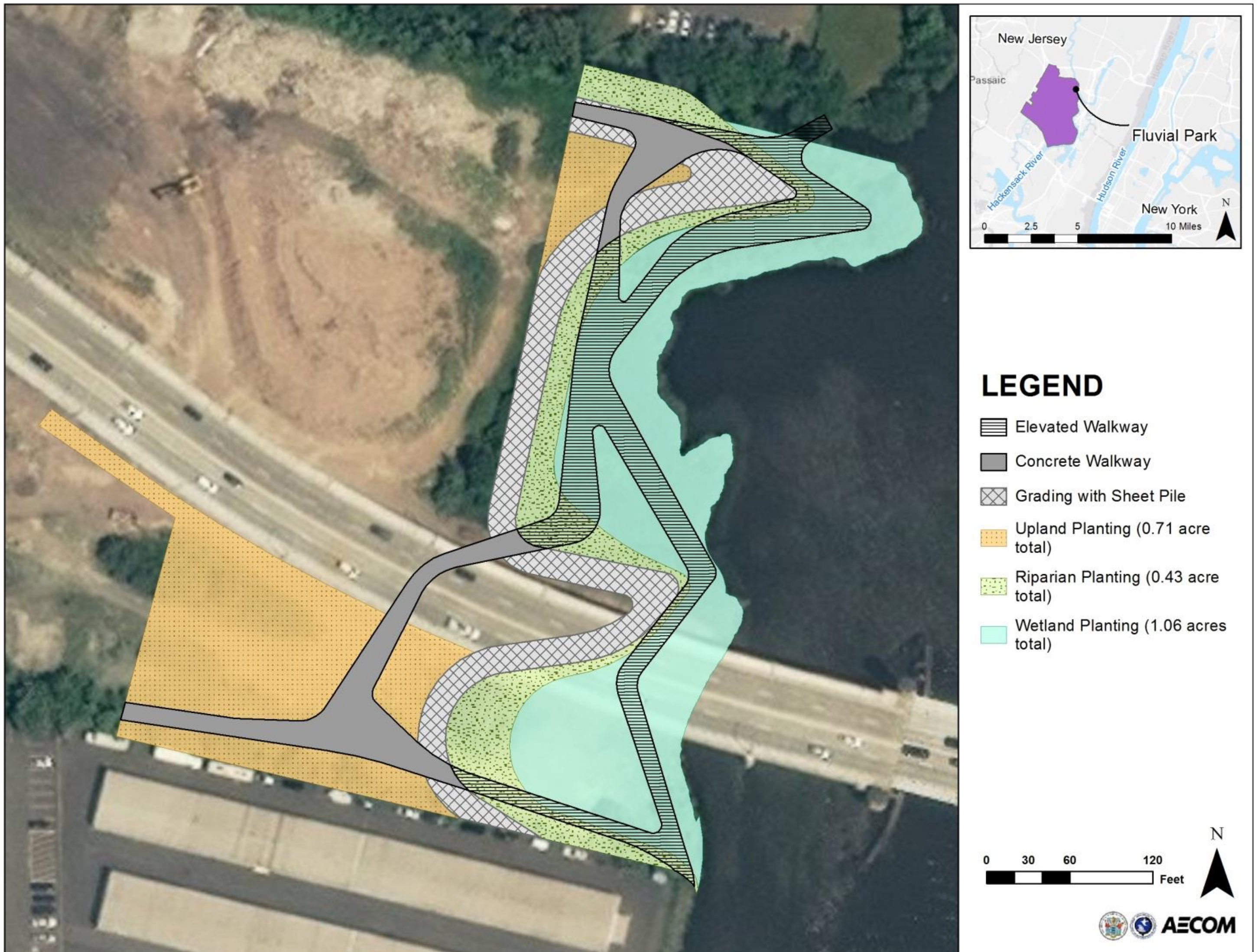
The proposed floodwall would generally be installed in upland areas that have been previously disturbed; however, areas of new, naturally sloping shorelines are proposed and would require excavation and fill adjacent to the existing shoreline. Additionally, some minor areas of fill within the Hackensack River would occur adjacent to the existing hardened shoreline where vegetation is minimal and buildings are in close proximity to the river bank. Further, the proposed boat dock and kayak launch at K-Town Park would permanently impact intertidal wetlands through placement of pilings. These intertidal wetlands were observed to be sparsely vegetated and/or disturbed during the 2016 field investigation. The proposed elevated walkway at Fluvial Park would also require the installation of pilings to support the structure. These piles would directly displace salt marsh habitat (included in the above calculations).Therefore, implementation of Alternative 1 has the potential to result in ***long-term, potentially significant adverse*** impacts to aquatic habitat from dredge and fill activities and permanent loss of habitat in the Central Segment and at the proposed location of the Berry's Creek storm surge barrier.

Construction of the proposed Berry's Creek storm surge barrier near Paterson Plank Road and a tide gate at an unnamed tributary to the Hackensack River, north of Losen Slote and beneath an access road leading to the BCUA, would result in minor permanent impacts to aquatic habitats. The Berry's Creek storm surge barrier would typically operate (i.e., close) when the NWS issues a Coastal Flood Warning for the Project Area; under normal conditions, it would remain open and would not hinder aquatic life movements. The tide gate near the BCUA would prevent twice-daily tides from infiltrating the tributary; however, as the tributary consists of a very short length of open channel prior to transitioning to a subsurface piped conveyance, there is little aquatic habitat upstream of the proposed structure. In addition, the tributary is adjacent to the wastewater treatment facility and filled lands; there is no direct connection to estuarine wetlands. Work that may introduce sediments into the water would be conducted with appropriate sediment and erosion control measures (see **Section 4.16**). Therefore, Alternative 1 has the potential to result in ***long-term, less-than-significant adverse*** impacts to the aquatic habitat in these locations from hydrology alterations.

The creation of new wetlands through implementation of Alternative 1 would enhance vital ecosystem functions within the Project Area. Approximately 1.1 acres of newly created wetland habitat and 0.4 acre of riparian plantings are proposed as part of Fluvial Park (see **Figure 4.14-1**) in the Central Segment of Alternative 1 and would provide additional spawning, forage, and refuge habitat for native and migratory species, including EFH species. This addition of wetland habitat within the Project Area would also reduce density-dependent effects that may be occurring in restricted or isolated habitat parcels, including intra- or inter-species competition, reduced growth rate or fitness among individuals, increased mortality, or diminished recruitment within a population. New wetland habitat would naturally filter the water by storing nutrients and pollutants in the soil and vegetation, thereby creating a cleaner environment for aquatic wildlife. A cleaner environment with native vegetation would improve the quality of the aquatic habitat, providing increased biodiversity and habitat resiliency. As such, Alternative 1 has the potential to result in ***long-term benefits*** to aquatic habitats and wildlife, including EFH and EFH species.

<u>Terrestrial Wildlife</u>

Construction of Alternative 1 would have minimal impacts on urban-tolerant species (e.g., rats, mice, raccoons, deer, and squirrels) that are acclimated to the disturbances of an urban environment, such as the environment within the Northern and Central Segments of Alternative 1. These wildlife species would avoid construction activities and use comparable, nearby habitats. However, while wildlife would be expected to vacate these areas, less mobile species (i.e., small mammals, reptiles, amphibians) could potentially suffer loss of life during land-disturbing activities. Construction activities that involve the generation of noise and vibration during the day may disturb resting nocturnal species, including bats. Also, if work is performed during the nighttime, the use of bright work lights would affect nocturnal species. Physical disturbance and noise effects from construction of Alternative 1 would vary widely among species, but would be temporary and localized in nature. Therefore, the construction of Alternative 1 would result in ***short-term, less-than-significant adverse*** impacts to terrestrial wildlife in the Project Area.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.14-1: Proposed Plantings in the Project Area at Fluvial Park

As discussed in **Section 3.14**, terrestrial wildlife habitat in the Project Area provides refuge for special status species, but is primarily characterized by urban-adapted, generalist species that can tolerate the "built environment" and the high levels of human activity currently present. The majority of these species, aside from avian species, are residents that typically do not migrate. While Alternative 1 would not serve as a barrier to migration, some localized segregation of less mobile species (e.g., reptiles and small mammals) may occur once the proposed infrastructure is in place; these effects would be ***long-term, less-than-significant*** adverse impacts to terrestrial wildlife.

Aquatic Wildlife

As discussed in **Section 3.14**, aquatic wildlife habitat (e.g., the Hackensack River and its tributaries and associated marshes, human-made open-water ponds, and impoundments) in the Project Area supports considerable aquatic wildlife, but is primarily characterized by the prevalence of disturbance-tolerant species. Under Alternative 1, approximately 20,600 LF of floodwalls and/or berms would be constructed along the Hackensack River. No construction-related, noise-generating activity that would produce sound above physical injury or behavioral modification thresholds of aquatic fauna, including EFH species, is anticipated under Alternative 1 (see **Section 4.8.2.2**). Construction of floodwalls may include some temporary in-water work, such as the operation of floating cranes, barges, and supporting marine equipment. The installation of sheeting would be accomplished through vibratory methods, which produce sounds well below auditory impact thresholds for aquatic fauna. It is anticipated that only minor, if any, impacts from pile driving would occur. Piles would be of small diameter and would be driven within an isolation casing or other suitable noise-attenuating device to limit the promulgation of underwater noise. Also, silt curtains or other turbidity barriers would be utilized when possible when working in shallow waters. Seasonal restrictions would be applied to in-water work to minimize or prevent potential impacts during key migration or life cycle periods for aquatic wildlife and EFH species (i.e., March 1 through June 30). Therefore, construction of Alternative 1 would result in ***short-term, less-than-significant*** adverse impacts to aquatic wildlife in the Project Area.

Construction of Alternative 1 would result in increases in turbidity for the duration of in-water construction activities adjacent to watercourses and wetlands in the Project Area, including the construction of the proposed Berry's Creek storm surge barrier and tide gate near the BCUA. The increased turbidity could resuspend contaminants into the water column, smother invertebrates or benthic food resources, interfere with foraging in open waters, smother demersal eggs (e.g., winter flounder eggs and overwintering blue crabs), impair migration for anadromous species, reduce dissolved oxygen levels, and damage gills and impair respiration of fish, especially in early life stages. The increases in turbidity would be short-term in duration and minor, and properly controlled through implementation of the measures outlined in **Section 4.16**. To minimize potential for impacts to finfish during key migration periods, work that may introduce sediments into the water would be conducted with appropriate sediment and erosion control measures in place. In addition, it is expected that most species (including fish, amphibians, reptiles, and invertebrates) would leave the construction area and find comparable, unaffected habitat in the study area during these short-term impacts. Some sessile benthic epifaunal[64] species not able to relocate during construction would endure temporary reductions in water quality. Overall, Alternative 1 would be expected to result in ***short-term, less-than–significant adverse*** impacts to aquatic resources, including EFH species, during construction activities.

[64] Benthic fauna living on the substrate (such as a hard sea floor) or on other organisms.

Operation of the proposed Berry's Creek storm surge barrier and the tide gate beneath an access road leading to the BCUA would have *de minimis* long-term impacts on aquatic wildlife and EFH species. The surge barrier would remain open unless there is a threat of flooding, thus the potential for isolated habitats[65] and density-dependent detrimental effects would be minimal. The tide gate near the BCUA would restrict fish access upstream; however, as the tributary consists of a very short length of open channel prior to transitioning to a subsurface piped conveyance, there is little habitat upstream of the proposed structure. In addition, the tributary is adjacent to the wastewater treatment facility and filled lands; there is no direct connection to estuarine wetlands. Therefore, operation of Alternative 1 has the potential to result in ***long-term, less-than-significant adverse*** impacts to aquatic wildlife in these locations.

The proposed placement of the LOP in specific wetland areas (see **Section 4.19**) would potentially isolate or result in the direct loss of habitat for foraging, breeding, and spawning of aquatic species, including EFH species. Loss of waterfront habitat, especially tidal mudflats, due to dredging, scour, and permanent fill would also adversely affect wading birds, reptiles, and invertebrates; however, it is anticipated that the loss of these habitats would be minimal and occur in discreet locations. Therefore, operation of Alternative 1 would result in ***long-term, less-than-significant*** adverse impacts to aquatic wildlife in the Project Area.

<u>Special Status Species</u>

As discussed in **Section 3.14.3.4**, the USFWS IPaC report identified that no federally listed species are known to inhabit the Project Area. In addition, the NMFS identified that no federally listed species under their jurisdiction are present in the Hackensack River or its tributaries (see **Appendix A**). As such, Alternative 1 would have no effect on federally listed species. The New Jersey Natural Heritage Program identified nine bird species, as special status species, with known occurrences in the immediate vicinity of the Project Area (see **Appendix A**). A table of Federal- and State-listed species documented in the Project Area is presented in **Section 3.14.3.4.**

Based on Project Area-specific surveys of biological resources, 25 State-listed special status bird species were observed in the Project Area (see **Appendix J, Table B-11**). These 25 bird species are also protected by the Migratory Bird Treaty Act (USFWS 2017). Physical disturbance and noise effects from construction of Alternative 1 would vary widely among species, but would be temporary and localized in nature. The terrestrial and aquatic habitats present within the proposed footprint of Alternative 1 are not critical for any of these special status bird species. Comparable habitats, including both uplands and wetlands, are available for these species within and in the vicinity of the Project Area. Alternative 1 would not eliminate or jeopardize an existing or documented habitat for any special status species, and would not jeopardize the continued existence of local populations of any special status species. Any disturbances associated with construction activities would be temporary in nature, would be minimized by bird management activities, and would have no long-term impacts on special status species.

As detailed in the EFH Assessment Report (**Appendix Q**), Alternative 1 may affect, and would be likely to adversely affect, EFH and EFH species during construction due to construction related disturbances, loss of habitat from fill, and minor long-term hydrology alterations. Additionally, proposed habitat creation/enhancement would result in long-term beneficial impacts to EFH and EFH species. Most EFH

[65] Isolated habitats may limit availability of a necessary resource or space, causing competition among individuals in a population.

species would not be expected to be present in the Project Area in high densities due to lack of preferred habitat (i.e., salinity levels, substrate types, etc.), or are highly mobile and would be expected to move out of the affected area during in-water construction activities. In-water construction activities could have minor impacts on forage fish that EFH species depend on, but these impacts would be localized and would not affect the regional populations of forage fish species. EFH species with the highest potential to be impacted include windowpane flounder, winter flounder, and winter skate.

Therefore, construction of Alternative 1 would result in ***short-term, less-than-significant adverse*** impacts to special status species.

Indirect Impacts

Terrestrial (Upland) Habitats

Construction of Alternative 1 would remove vegetation from terrestrial habitats within the Project Area. This could indirectly result in the spread or establishment of invasive species following ground disturbance associated with construction. BMPs during construction, such as thoroughly cleaning construction equipment prior to leaving an area of disturbance and reseeding/replanting with native species, would prevent or minimize the spread or establishment of invasive species. Regular equipment cleaning would also reduce the chance of igniting accumulating debris and reduce the risk of wildland fire. Therefore, construction and operation of Alternative 1 would not be anticipated to result in the introduction or proliferation of invasive species and would not induce further changes that would adversely or beneficially indirectly affect the terrestrial habitats in the Project Area.

Aquatic Habitats

Construction of Alternative 1 would remove vegetation, including common reed, from aquatic habitats within the Project Area. This could indirectly result in the temporary destabilization of the shoreline and an increase in erosion and downstream sedimentation, which could produce effects to downstream aquatic habitats and species. However, implementation of appropriate stormwater management controls (see **Section 4.16**) would ensure the shoreline remains stabilized and no erosion or sediment transport occurs downstream. Additionally, vegetation removal could indirectly result in the spread or establishment of invasive species. Implementation of construction BMPs would prevent or minimize the introduction or proliferation of invasive species. As such, no indirect effects to onsite or downstream aquatic habitats are anticipated.

The proposed habitat improvements associated with Alternative 1 would benefit other aquatic habitat functions, such as providing improved habitat for aquatic species by planting approximately 0.4 acre of riparian habitat and creating approximately 1.1 acres of wetland habitat along the Hackensack River (see **Figure 4.14-1**). When appropriate cover and canopy height is met by native vegetation, marsh breeding birds (e.g., ducks, geese, and waterfowl) would benefit from wetland restoration. Therefore, Alternative 1 would result in ***long-term, beneficial*** impacts to aquatic habitats, including EFH, adjacent to the area of direct effect.

Approximately 43 new storm drainage discharge outlets to the Hackensack River are proposed with the construction of Alternative 1. These new outlets would be appropriately designed and constructed to ensure that they do not contribute to long-term increases in turbidity and sedimentation resulting from runoff and scouring during rain events, which could indirectly adversely affect downstream aquatic communities. As such, no long-term indirect effects are anticipated from these components.

The operation of Alternative 1 would result in a reduction in the potential for tidal wetlands to retreat landward with SLR. In addition, Alternative 1 would reduce impacts from flooding events to existing habitats, as well as decrease associated downstream turbidity, sedimentation, and nutrient/contaminant inputs resultant from flooding that could indirectly adversely affect aquatic habitats. These would be ***long-term, beneficial*** effects to aquatic habitat and EFH within the study area.

<u>Terrestrial Wildlife</u>

Implementation of Alternative 1 would impact riparian habitat (i.e., from construction of the proposed floodwall and hardened shoreline features) along the Hackensack River. Wildlife may concentrate in remaining natural shoreline areas, increasing competition for food resources, shelter, and breeding areas. This would result in density-dependent effects, such as reduced fitness, increased mortality, and decreased growth rates. This competition could occur within a particular species, or among species competing for increasingly limited habitat and resources. However, the affected areas are of generally low quality and limited extent; many of these species would find comparable habitat and resources within and adjacent to the Project Area. In addition, the enhancement components of Alternative 1 along the Hackensack River, including construction of Fluvial Park (i.e., 0.7-acre upland plantings, 0.4-acre riparian plantings, and 1.1-acre wetland plantings; see **Figure 4.14-1**) would serve to partially offset these losses. As such, this would be considered a ***long-term, less-than-significant adverse*** effect to terrestrial wildlife.

In addition, upland meadow and shrub habitats (i.e., along roadways and shorelines of the Hackensack River) in the Northern and Central Segments of Alternative 1 would be removed to emplace Alternative 1 infrastructure. This loss would be partially offset by the replacement of similar habitat, planted with native species, following construction. Alteration of these habitats could produce minor effects to butterflies/moths and other terrestrial insects, especially pollinators, and certain upland bird species that nest and forage in grasslands and shrub areas. Upland meadows are also important foraging habitat for raptors, as they support small mammal populations. In the Project Area, habitat alteration of upland meadow and shrub habitats would be minimal (2.8 acres), and restoration and conservation of these habitats in association with Alternative 1 implementation (i.e., native plantings) would provide indirect benefits to predatory mammals (e.g., fox, coyote) and raptors. As such, this would be considered a ***long-term, less-than-significant adverse*** effect to terrestrial wildlife.

<u>Aquatic Wildlife</u>

Human disturbance would increase in the Project Area during the operational phase of Alternative 1. Specifically, use of proposed walkways above wetlands and use of the proposed boat dock and kayak launch would increase human presence in the vicinity of the Hackensack River and its associated wetlands. This increased human presence may lead to waders and shorebirds avoiding these walkways, while waterfowl would avoid the docks. Indirect impacts would vary among species. Impacts to birds that are disturbance-tolerant and attracted to human activity would be minimal, while impacts to species sensitive to human activity, including increases in noise and trash, would be more detrimental. However, these species would find comparable habitat in the vicinity of the Project Area. Therefore, this would be considered a ***long-term, less-than-significant adverse*** effect to aquatic wildlife and EFH species.

<u>Special Status Species</u>

As discussed above, human disturbance would increase in the Project Area during the operational phase of Alternative 1. Special status species may avoid the borders of habitats that interface with more urban areas and occupy comparable habitat in the vicinity of the Project Area. Specific indirect impacts would vary among species, as some are more urban-tolerant than others. Additionally, human disturbance may affect, but would be unlikely to adversely affect, EFH and EFH species. Therefore, operation of Alternative 1 would result in ***long-term, less-than-significant adverse*** effects to special status species.

Mitigation Measures and BMPs

Potentially significant adverse effects to biological resources have been identified from the proposed construction or operation of Alternative 1. These include potential direct effects to aquatic habitats in the form of dredge and fill activities, alteration of habitat, and placement of new infrastructure. The following mitigation measures and BMPs would be implemented to reduce the identified ***potentially significant adverse*** impacts.

- During the design process, impacts to riparian zones, wetlands, and wetland buffers would be avoided and minimized to the extent practicable. Temporarily impacted wetlands and buffers would be restored immediately following construction. As part of the Alternative 1 permitting process, a compensatory mitigation plan would be developed and implemented to compensate for long-term unavoidable impacts to regulated wetlands and other WOUS associated with dredging, filling, or other permanent alteration (see **Section 4.16**). The plan would be developed in cooperation with the MIMAC (the Interagency Review Team). The plan would consist of purchasing mitigation credits; onsite or offsite creation, restoration, or enhancement of wetlands; or a combination of mitigation methods, in accordance with the Compensatory Mitigation for Losses of Aquatic Resources Final Rule (40 CFR Parts 325 and 332). Wetland and waterbody impacts from construction dredge and fill activities would be coordinated with the NJDEP, USACE, NMFS, and other applicable regulatory agencies during project permitting.
- A bird management plan would be developed and implemented to address project construction timing and location to avoid or minimize effects to bird species, including special status species. Specifically, land disturbance and vegetation clearing recommendations would consider timing to reduce the risk of "take" during the nesting season. Bird management activities, in compliance with State and Federal requirements, would focus first on avoidance of impacts on breeding and nesting birds. Construction managers would work with NJDEP during all project planning activities to identify appropriate construction timing to avoid active bird breeding and nesting in the construction footprint. Where construction timing cannot be altered to avoid the breeding and nesting season, pre-construction surveys for nesting activity would be conducted by qualified avian biologists, and construction activities timed in these locations to follow fledging.
- To minimize the potential for introduction or proliferation of invasive species, construction BMPs that address activities such as soil disturbance, vegetation management and inspection, transport of materials, thoroughly cleaning construction equipment, and revegetation and restoration would be prepared and implemented.
- To reduce wildland fire risks and minimize the potential for ignition, construction BMPs that address activities such as equipment maintenance and cleaning and fire would be prepared and implemented.
- To reduce the risk of erosion, sedimentation, and associated water quality impacts, a project-specific SWPPP would be prepared and implemented in accordance with NJ Stormwater Management Act NJAC 7:8 (see **Section 4.15**). The Bergen County Soil Conservation District

would review and certify the Soil Erosion and Sediment Control Plans as mandated by the Soil Erosion and Sediment Control Act, Chapter 251, Public Law 1975. Silt fences and stabilized entrances to construction sites would be deployed in accordance with the SWPPP. Mulch or other suitable ground cover would be placed on all slopes following grading. Slopes would be seeded with plant materials approved by the Bergen County Soil Conservation District.

- To minimize potential for impacts to finfish during key migration periods, seasonal restrictions (i.e., between March 1 and June 30) would be applied to in-water work during construction and operation activities.
- Construction and operational activities that may introduce sediments into the water would not be conducted without appropriate sediment and erosion control measures in place (see **Section 4.15**).
- In order to minimize the spatial extent and duration of construction impacts to aquatic habitat, EFH, and aquatic wildlife, BMPs such as silt curtains and turbidity barriers would be implemented during the construction phase, construction would be conducted in accordance with Federal and State permits and any site-specific conditions specified therein, and continued consultation with NMFS regarding MSA compliance would occur.
- Noise reducing and/or the quietest practicable construction methods and equipment, such as the use of noise shrouds around pile-driving rigs and equipment with mufflers and noise-attenuation devices, would be used. All equipment would be properly maintained. Stationary equipment, such as generators and compressors, would be enclosed and would use acoustical louvers and/or sound attenuators in the exterior walls of these enclosures to reduce noise emissions through the air inlet and outlet louvers of the pump station (see **Section 4.8**).
- Contractors would utilize specific vibration control measures that can be implemented for pile-driving activities, including predrilling or augering and maximizing the use of vibratory rather than impact pile driving. Additionally, contractors should consider the use of drilled piles instead of impact or vibratory pile driving (see **Section 4.8**).

4.14.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding in the Project Area that results from under-performing stormwater drainage infrastructure, but continued and increased flooding from coastal storm surges (coastal flooding) would continue to adversely affect the Project Area (see **Section 4.1.2**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant adverse*** impacts to terrestrial habitats in the Project Area from the limited removal and disturbance of vegetation during construction activities.
- ***Short-term, less-than-significant adverse*** impacts to aquatic habitats, EFH, EFH species, and aquatic wildlife during construction from in-water work due to limited habitat alteration and increased turbidity.
- ***Short-term, less-than-significant adverse*** impacts to aquatic and terrestrial wildlife, including EFH, EFH species, and threatened and endangered species, from physical disturbance and noise/vibration during construction.
- ***Long-term, less-than-significant adverse*** impacts to aquatic habitats within the upper reach of East Riser Ditch during operation from minor hydrology alterations.

- ***Long-term, beneficial*** impacts to terrestrial habitats and wildlife from proposed habitat enhancements in the Project Area.
- ***Long-term, beneficial*** impacts to aquatic habitats and wildlife, including EFH and EFH species, in the study area through the creation and enhancement of wetlands.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, less-than-significant adverse*** impacts to terrestrial and aquatic wildlife, including threatened and endangered species, due to increased human activity within the Project Area.
- ***Long-term, beneficial*** effects to aquatic habitats and wildlife, including EFH and EFH species, from the proposed stormwater drainage improvements due to the reduction in sedimentation, turbidity, and nutrient/contaminant inputs in downstream aquatic habitats.

The following subsections provide greater detail. Additional detail regarding EFH and EFH species can be found in the EFH Assessment Report in **Appendix Q**.

Direct Impacts

Direct impacts to terrestrial and aquatic habitats and wildlife are anticipated as part of implementation of Alternative 2 (see **Table 4.14-3**). The following subsections provide additional information on the direct impacts to terrestrial (upland) habitats, aquatic habitats, terrestrial wildlife, aquatic wildlife, and special status species.

Table 4.14-3: Summary of Anticipated Direct Impacts to Terrestrial and Aquatic Habitats under Alternative 2

Impact Type**	Area of Impact to Terrestrial and Aquatic Habitats (acres)*							Total Area of Impact
	Forested Upland	Shrub Uplands	Open Uplands	Forested Mineral Soil Wetlands	Shrub Mineral Soil Wetlands	Open Mineral Soil Wetlands	Waterbodies	
Permanent	0.5	0.0	0.1	<0.1	0.0	<0.1	0.1	0.7
Temporary	3.0	6.1	10.6	0.6	0.6	3.5	0.5	24.9
Total	**3.5**	**6.1**	**10.7**	**0.6**	**0.6**	**3.5**	**0.6**	**25.6**

* Aquatic habitats identified in this table and discussed in this section are based on field-mapped habitats and do not identify jurisdictional WOUS or wetlands. As such, impact acreages presented here do not directly correlate with acreages presented in Section 4.16 (Water Resources).
Habitats identified in this table do not include all land uses potentially affected by Alternative 2 (e.g., developed and disturbed), but do include those areas providing habitats for biological resources.
** Permanent impacts represent a long-term impact (e.g., permanent loss of habitat or function). Temporary impacts represent a short-term impact (e.g., the habitat area and function can be restored fully upon completion of construction activities).

<u>Terrestrial (Upland) Habitats</u>

Construction of Alternative 2 would include green infrastructure systems along roadways (rain gardens, bioswales, storage/tree trenches), five new parks (approximately 20.0 acres), five open space improvements (approximately 11.2 acres), East Riser Ditch channel improvements, pump stations in the East Riser Ditch and Losen Slote drainage areas, and an overall reduction of impervious surfaces (net decrease of 3.4 acres). Terrestrial habitats present in the Alternative 2 footprint include non-vegetated uplands, such as building exteriors used by birds, hardened shorelines along the Hackensack River, and undeveloped lots. Vegetated habitats include maintained lawns and athletic fields, disturbed successional shrubland, and disturbed upland deciduous forest. These habitat communities are fragmented and isolated from larger, vegetated habitat patches located in the interior portions of the Project Area by development and roads.

Under Alternative 2, terrestrial vegetation within the Project Area would be removed during construction activities. As shown in **Table 4.14-3**, approximately 20.3 acres of vegetated upland habitat would be impacted. Approximately 19.7 acres would be temporarily impacted during construction; these areas would be restored to pre-Project conditions. Therefore, ***short-term, less-than-significant adverse*** impacts to terrestrial habitats would occur from temporary disturbance during construction activities, as these areas would be restored upon completion of these activities. In addition, to further minimize impacts, temporarily disturbed habitats would be seeded and replanted with native species.

The remaining 0.6 acres of vegetated upland habitat would be permanently impacted. However, unlike Alternative 1, permanent habitat impacts would not result in the permanent loss of habitat from floodwalls and other structures, but rather from long-term enhancements to existing habitat. Under Alternative 2, only a limited number of components would result in the permanent loss of vegetated habitat to accommodate the pump stations, small parking areas, culverts, or walkways. In general, when feasible, these permanent features would be located in non-vegetated or disturbed areas. The remaining areas would encompass habitat enhancements within the new parks, proposed open space improvement areas, and along East Riser Ditch. For example, approximately 1,250 new trees would be planted, and approximately 11.9 acres of vegetated habitat enhancements would occur within the five new parks. In addition, Alternative 2 would convert impervious surfaces to pervious surfaces, resulting in a net decrease of 3.4 acres of impervious surfaces. Therefore, unlike Alternative 1, the implementation of Alternative 2 would be expected to result in an overall ***long-term, beneficial*** impact to terrestrial habitats within the Project Area from the Proposed Project components.

<u>Aquatic Habitats</u>

As shown in **Table 4.14-3**, approximately 5.3 acres of aquatic habitat (wetland and waterbodies) would be impacted. In-water work would occur during the East Riser Ditch improvements (e.g., dredging, culvert/bridge replacements), enhancement of existing wetlands and waterbodies, elevated walkways at Fluvial Park, and Losen Slote pump station discharge locations.

Approximately 5.2 acres of aquatic habitat (forested, scrub, and emergent wetlands, and waterbodies) would be temporarily impacted during construction; these areas would be restored to pre-project conditions. Temporary impacts would be associated with dewatering activities, the placement of temporary fill, work in and around existing wetlands, and grading activities. Dewatering would occur during construction of East Riser Ditch pump station and would entail diversion of water flow from the upstream side of the proposed forebay, over Starke Road, to the downstream side of the tide gate. Dewatering impacts would be localized around the existing tide gate, which already hinders species movement between East Riser Ditch and Berry’s Creek, and aquatic habitats would be expected to recover within a short period of time. In-water work has the potential to introduce sediments into the water, resulting in increased turbidity and potentially resuspension of contaminants. To minimize these potential impacts, BMPs would be implemented, including seasonal restrictions on in-water work during key migration or life cycle periods of fishes (i.e., between March 1 and June 30), turbidity barriers, and other measures that would be detailed in the project-specific SWPPP and Erosion and Sediment (E&S)

Control Plan (see **Section 4.16)**. Dredging of East Riser Ditch would result in limited habitat alterations to the waterway (e.g., water depth), but the channel would be expected to return to similar habitat in a short period of time following construction. The channel boundaries and riparian zone would be revegetated with native vegetation consistent with the habitat type. Therefore, ***short-term, less-than-significant adverse*** impacts to aquatic habitats would occur from temporary disturbance during construction activities because these areas would be restored upon completion of these activities.

During operation of Alternative 2, the East Riser Ditch improvements would result in minor hydrology alterations, such as reduced water depths or increased water velocity, upstream of the proposed work (i.e., in the upper reach of East Riser Ditch). These alterations would be expected to result in ***long-term, less-than-significant adverse*** impacts to aquatic habitats in that ditch, but impacts would be localized and limited to a small portion of aquatic resources throughout the Project Area.

The remaining 0.1 acre of aquatic habitat (waterbodies) would be permanently impacted, which is 5.8 acres less than Alternative 1. In addition, unlike Alternative 1, permanent aquatic habitat impacts would not generally result in the permanent loss of habitat from floodwalls and other structures, but rather from long-term enhancements to existing habitat. Under Alternative 2, only a limited number of components would result in the permanent loss of aquatic habitat, such as culvert/bridge replacements, pilings for elevated walkways in Fluvial Park, and kayak/boat launches at Fluvial Park and Riverside Park. In general, when feasible, these permanent features would be located in previously disturbed areas or low quality habitats. The remaining areas would encompass habitat enhancements within the new parks, proposed open space improvement areas, and along East Riser Ditch. In addition, Alternative 2 would include approximately 7.2 acres of wetland creation and habitat enhancements; thereby providing additional spawning, forage, and refuge habitat for native and migratory species. Along East Riser Ditch, the re-vegetation of channel boundaries and adjacent areas within the riparian zone with native plant species would further benefit aquatic habitat by improving the quality of the waterway through shading, filtering, and moderating stream flow. As such, unlike Alternative 1, the implementation of Alternative 2 would be expected to result in an overall ***long-term, beneficial*** impact to aquatic habitats, including EFH, within the Project Area.

Similar to Alternative 1, Alternative 2 would have ***short-term, less-than-significant adverse*** impacts to EFH during in-water work along the Hackensack River. Construction of the elevated walkways at Fluvial Park and the kayak/boat launches at Fluvial Park and Riverside Park have the potential to result in minor increases in turbidity within these localized areas. Overall, long-term impacts would be expected to be negligible given the existing habitat quality and developed nature of the Project Area; however, during the permitting phase of the Proposed Project, the EFH assessment would be revisited in consultation with NMFS to evaluate potential impacts to EFH that could result from construction work below mean high water. With mitigation measures, including seasonal restrictions on in-water work during key migration or life cycle periods of fishes (i.e., between March 1 and June 30), turbidity barriers, and other measures that would be detailed in the project-specific SWPPP or incorporated into permit conditions, and mitigation to offset loss of intertidal and subtidal shallows and wetlands (see **Section 4.16**), potential EFH impacts would be minimized and compensated to the extent practicable.

Terrestrial Wildlife

Similar to Alternative 1, Alternative 2 would occur primarily within an urban environment, dominated by urban-tolerant species. Construction of Alternative 2 would be expected to have minimal impacts on urban-tolerant species that are acclimated to the increased disturbance (e.g., noise). These wildlife species would avoid construction activities and use comparable, nearby habitats. However, while wildlife would be expected to vacate these areas, less mobile species (i.e., small mammals, reptiles, amphibians) could potentially suffer loss of life during land-disturbing activities. Construction activities that involve the generation of noise and vibration during the day may disturb resting nocturnal species, including bats. Also, if work is performed during the nighttime, the use of bright work lights would affect nocturnal species. Physical disturbance and noise effects from construction of Alternative 2 would vary widely among species, but would be temporary and localized in nature. Therefore, the construction of Alternative 2 would result in ***short-term, less-than-significant adverse*** impacts to terrestrial wildlife in the Project Area. Unlike Alternative 1, the Alternative 2 components would not result in localized segregation of less mobile species or the fragmentation or alteration of terrestrial habitats.

As discussed above, Alternative 2 would provide vegetated habitat enhancements within the Project Area through the creation of new parks, existing open space/public amenity improvements, and along East Riser Ditch. As such, the implementation of Alternative 2 would be expected to result in an overall ***long-term, beneficial*** impact to terrestrial wildlife that utilize the Project Area for cover, foraging, breeding, and nesting.

<u>Aquatic Wildlife</u>

As discussed in **Section 3.14**, aquatic wildlife habitat (e.g., the Hackensack River and its tributaries and associated marshes, and human-made open-water ponds, and impoundments) in the Project Area supports considerable aquatic wildlife, but is primarily characterized by the prevalence of disturbance-tolerant species. Construction activities would include some short-term in-water work when installing pilings for the elevated walkways, constructing the kayak/boat launches, during the East Riser Ditch improvements (e.g., dredging and culvert/bridge replacements), and at the Losen Slote discharge locations. Thus, during the construction phase, wading birds, amphibians, reptiles, fish (including EFH species), and invertebrates would have the potential to be disturbed within and in the vicinity of the Alternative 2 footprint from increased noise, human activity, and turbidity. However, following construction, these localized areas of impact would likely recover to pre-Project conditions within a short period of time.

No construction-related, noise-generating activity that would produce sound above physical injury or behavioral modification thresholds for aquatic fauna is anticipated under Alternative 2 (see **Section 4.8.2.3**). Only minor effects from the installation of the pilings and kayak/boat docks in the Hackensack River are anticipated because impacts would be localized to small areas along a previously disturbed shoreline. Further, piles would be small in diameter and would be driven within an isolation casing or other suitable noise-attenuating device to limit the promulgation of underwater noise. The use of silt curtains or other turbidity barriers would be utilized whenever possible when working in shallow waters. Seasonal restrictions would be applied to in-water work to minimize or prevent potential impacts during key migration or life cycle periods for aquatic wildlife, including EFH species (i.e., between March 1 and June 30). Therefore, construction of Alternative 2 would be expected to result in ***short-term, less-than-significant adverse*** impacts to aquatic wildlife in the Project Area.

As discussed above, Alternative 2 would provide the creation of new aquatic habitat as well as enhancements to existing habitat within the Project Area through the creation and enhancement of wetlands in the proposed new parks. In addition, the East Riser Ditch improvements (e.g., dredging and culvert/bridge replacements) would provide improved conveyance within this waterway; thereby providing improvements to water quality. Dredging would also alter the substrate, water depth, and velocity of the waterway; however, the aquatic community would be expected to recover to pre-Project conditions within a short period of time following construction. The existing aquatic wildlife, comprising a prevalence of pollution- and disturbance-tolerant species, would be anticipated to continue using East Riser Ditch, including both the lower and upper reaches. Native plantings proposed within the riparian zone would provide shade and cooler water temperatures, which would increase dissolved oxygen in the water and reduce stress on aquatic wildlife. Associated woody debris would further contribute organic material necessary to support the aquatic food web and improve stream structure by enhancing the substrate. As such, the implementation of Alternative 2 would be expected to result in an overall ***long-term, beneficial*** impact to aquatic wildlife, including EFH species, that utilize the Project Area for cover, spawning areas, foraging, and refuge.

Special Status Species

Similar to Alternative 1, physical disturbance and noise effects from construction of Alternative 2 would vary widely among species, but would be temporary and localized in nature. The terrestrial and aquatic habitats present within the proposed footprint of Alternative 2 are not critical for any special status species. Although 25 State-listed special status bird species were observed in the Project Area, comparable habitats are available for these species within and in the vicinity of the Project Area. Alternative 2 would not eliminate or jeopardize an existing or documented habitat for any special status species, and would not jeopardize the continued existence of local populations of any special status species. Any disturbances associated with construction activities would be temporary in nature, would be minimized by bird management activities, and would have no long-term impacts on special status species.

As detailed in the EFH Assessment Report (**Appendix Q**), Alternative 2 may affect, but would not have substantial adverse effects on, EFH due to construction-related disturbances. Alternative 2 would require less in-water construction work than Alternative 1. Additionally, proposed habitat creation/enhancement, which would result in long-term beneficial impacts to EFH and EFH species, would be greater than under Alternative 1. As such, Alternative 2 would be unlikely to adversely affect any specific EFH species.

Therefore, construction of Alternative 2 would result in ***short-term, less-than-significant adverse*** impacts to special status species.

Indirect Impacts

Terrestrial (Upland) Habitats

Similar to Alternative 1, Alternative 2 would remove vegetation from terrestrial habitats within the Project Area during construction activities. This could indirectly result in the spread or establishment of invasive species following ground disturbance associated with construction. BMPs during construction, such as thoroughly cleaning construction equipment prior to leaving an area of disturbance and reseeding/replanting with native species, would prevent or minimize the spread or establishment of invasive species. Regular equipment cleaning would also reduce the chance of igniting accumulating debris and reduce the risk of wildland fire. Therefore, construction and operation of Alternative 2 would not be anticipated to result in the introduction or proliferation of invasive species and would not induce further changes that would adversely or beneficially indirectly affect the terrestrial habitats in the Project Area.

Aquatic Habitats

Construction of Alternative 2 would include the installation of 41 green infrastructure systems (rain gardens, bioswales, storage/tree trenches), East Riser Ditch channel improvements, three pump stations within the East Riser Ditch and Losen Slote drainage areas, and an overall reduction of impervious surfaces (net decrease of 3.4 acres). These proposed stormwater drainage improvements would provide improved stormwater conveyance capacity, infiltration, and treatment within the Project Area, which would provide indirect effects to water quality, and a reduction in sedimentation, turbidity, and nutrient/contaminant inputs in downstream aquatic habitats within the Project Area. Therefore, Alternative 2 would be expected to result in ***long-term, beneficial*** effects to aquatic habitats, including EFH.

Similar to Alternative 1, implementation of construction BMPs would prevent or minimize the introduction or proliferation of invasive species, as well as reduce the risk of wildland fires started by construction equipment. As such, no indirect effects to onsite or downstream aquatic habitats are anticipated from construction and operation of Alternative 2.

Terrestrial Wildlife

Similar to Alternative 1, human disturbance would increase in the Project Area during the operational phase of Alternative 2, particularly within the proposed parks and improved open spaces. Indirect impacts would vary among species, but comparable habitat is available in the vicinity for species sensitive to human activity. Therefore, ***long-term, less-than-significant adverse*** impacts to terrestrial wildlife would be expected under Alternative 2.

Aquatic Wildlife

Similar to Alternative 1, human disturbance would increase in the Project Area during the operational phase of Alternative 2 (e.g., at Fluvial Park, Riverside Park, and DePeyster Creek Park). Indirect impacts would vary among species, but comparable habitat is available in the vicinity for species sensitive to human activity. Therefore, ***long-term, less-than-significant adverse*** impacts to aquatic wildlife would be expected under Alternative 2. As discussed above, improved water quality would provide an indirect effect on the overall quality of these habitats. As a result, the implementation of Alternative 2 would be expected to result in an overall ***long-term, beneficial*** impact to aquatic wildlife, including EFH species, that utilize the Project Area for cover, spawning areas, foraging, and refuge.

Special Status Species

As stated above, human disturbance would increase in the Project Area during the operational phase of Alternative 2. Specific indirect impacts would vary among species, as some are more urban-tolerant than others. Increased human disturbance may affect, but would be unlikely to adversely affect, EFH and EFH species. Therefore, the operation of Alternative 2 would be expected to result in ***long-term, less-than-significant adverse*** effects to special status species.

Mitigation Measures and BMPs

Potentially significant adverse impacts to biological resources have been identified from the proposed construction or operation of Alternative 2. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***potentially significant, adverse*** impacts under Alternative 2 (see **Section 4.14.4.2**). Construction would be conducted in accordance with Federal and State permits and any site-specific conditions specified therein.

4.14.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally similar to Alternative 2, but includes fewer stormwater improvements due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and its associated force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project would affect the biological resources in the Project Area, and thus would not change the impact analysis.

Because of the overall similarity in design between Alternative 2 and Alternative 3, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide an overview of the specific differences.

Direct Impacts

Direct impacts to terrestrial and aquatic habitats and wildlife are anticipated as part of implementation of Alternative 3 (see **Table 4.14-4**). Approximately 12.9 acres of terrestrial upland habitat and 4.0 acres of aquatic habitat would be impacted under Alternative 3, in comparison to 20.3 acres and 5.3 acres, respectively, under Alternative 2, and 6.3 acres and 7.4 acres, respectively, under Alternative 1.

Table 4.14-4: Summary of Anticipated Direct Impacts to Terrestrial and Aquatic Habitats under Alternative 3

Impact Type**	Area of Impact to Terrestrial and Aquatic Habitats (acres)*							Total Area of Impact
	Forested Upland	Shrub Uplands	Open Uplands	Forested Mineral Soil Wetlands	Shrub Mineral Soil Wetlands	Open Mineral Soil Wetlands	Waterbodies	
Permanent	0.5	0.0	0.1	<0.1	0.0	<0.1	0.1	0.7
Temporary	1.5	0.7	10.1	0.6	0.6	2.7	0.0	16.2
Total	**2.0**	**0.7**	**10.2**	**0.6**	**0.6**	**2.7**	**0.1**	**16.9**

* Aquatic habitats identified in this table and discussed in this section are based on field-mapped habitats and do not identify jurisdictional WOUS or wetlands. As such, impact acreages presented here do not directly correlate with acreages presented in Section 4.16 (Water Resources).
Habitats identified in this table do not include all land uses potentially affected by Alternative 3 (e.g., developed and disturbed), but do include those areas providing habitats for biological resources.
** Permanent impacts represent a long-term impact (e.g., permanent loss of habitat or function).
Temporary impacts represent a short-term impact (e.g., the habitat area and function can be restored fully upon completion of construction activities).

Direct impacts on biological resources under Alternative 3 would be the same as under Alternative 2, with the exception of the following impacts:

- Due to less vegetation removal and disturbance under Alternative 3, ***short-term, less-than significant, direct adverse*** impacts to terrestrial habitats in the Project Area from construction activities would be slightly less than Alternative 2.
- ***Short-term, less-than-significant adverse*** impacts to aquatic habitats, EFH, and aquatic wildlife during construction from limited habitat alteration and increased turbidity would be less than

under Alternative 2 due to less in-water work (i.e., exclusion of Fluvial Park and DePeyster Creek Park) under Alternative 3.

- Due to less ground-disturbing activities under Alternative 3, ***short-term, less-than-significant adverse*** impacts to aquatic and terrestrial wildlife, including EFH species and threatened and endangered species, from physical disturbance and noise/vibration during construction would be slightly less than Alternative 2, particularly along the Hackensack River waterfront due to the exclusion of Fluvial Park and DePeyster Park. Similar to Alternative 2, Alternative 3 may affect, but would be unlikely to have substantial effects on, EFH and EFH species (see **Appendix Q**).
- ***Long-term, beneficial*** impacts to terrestrial habitats and wildlife from proposed habitat enhancements in the Project Area would be less than Alternative 2 due to the exclusion of the proposed Fluvial Park and DePeyster Park. Alternative 3 would include the planting of approximately 770 new trees.
- ***Long-term, beneficial*** impacts to aquatic habitats and wildlife, including EFH and EFH species, in the study area through the creation and enhancement of wetlands would be less because only 3.5 acres of wetland would be created or enhanced under Alternative 3, in comparison to 7.2 acres under Alternative 2.

Indirect Impacts

Similar to Alternative 2, ***long-term, less-than-significant adverse*** impacts to terrestrial and aquatic wildlife, including EFH species and threatened and endangered species, would be expected due to increased human activity within the Project Area. However, potential impacts, particularly along the Hackensack River waterfront, would be expected to be less since Fluvial Park and DePeyster Creek Park would not be constructed. Increased human disturbance may affect, but would be unlikely to adversely affect, EFH and EFH species. Further, because Alternative 3 would include fewer stormwater improvements, it would be expected that the ***long-term, beneficial*** effects to aquatic habitats and wildlife from a reduction in sedimentation, turbidity, and nutrient/contaminant inputs in downstream aquatic habitats would be slightly less.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternatives 1 and 2 would be implemented to further reduce the identified ***potentially significant, adverse*** impacts under Alternative 3 (see **Section 4.14.4.2**).

4.15 Geology and Soils

This section analyzes the potential direct and indirect impacts of the three Build Alternatives and the No Action Alternative on the geology, topography, and soils in the Project Area. A direct impact would occur if the Proposed Project would directly alter soil stability during construction and cause property damage due to land subsidence. An indirect impact would occur if the Proposed Project would induce other changes that could affect geology, topography, or soils resources. For example, should the Proposed Project result in a long-term potential for ongoing soil erosion, an indirect impact would occur.

This analysis specifically addresses the potential for the Proposed Project’s considered alternatives to affect these resources during both construction and operational activities. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.15.1 Definition of Study Area

As described in **Section 3.15**, the study area for this resource area includes the Project Area, and specifically portions of the Project Area that would be directly altered or affected by the Proposed Project. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to geology and soils resources in accordance with 40 CFR 1508.27.

4.15.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives to geological and soils resources are shown in **Table 4.15-1**.

Additional criteria, not identified in the table, that were considered include whether the Proposed Project alternatives would substantially alter or impede access to a unique or valuable geologic feature, or substantially reduce access to important mineral resources. Because no unique or valuable geologic features or important mineral resources have been identified in the Project Area or immediate vicinity, these criteria are not applicable and are not discussed further in this analysis.

Table 4.15-1: Geology and Soils Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Geological/Soils Change	• Would not result in a change to, or increase risk to public safety or the built environment from geological or soil resources or hazards • Would not increase potential for land subsidence
	Indirect Geological/Soils Change	• Would not induce any further changes that would affect geological or soil resources • Would not induce any further changes that would increase risk from geological or soils conditions or hazards • Would not result in a downstream change in turbidity, sedimentation, or nutrient/contaminant inputs due to soil erosion
	Applies to All Effect Types	• Would result in no discernable changes to geological or soils resources in the Project Area • Would only alter geological or soils resources for an indiscernible or negligible period of time
Less-than-Significant	Direct Geological/Soils Change	• Would result in short-term, temporary changes to/from geological or soil resources that could be controlled through standard construction BMPs • Would result in soil disturbance and potential for erosion during construction that could be controlled through BMPs
	Indirect Geological/Soils Change	• Would induce further changes that would result in only minimal changes to/from geological or soil resources • Would result in a minimal downstream increase in turbidity, sedimentation, or nutrient/contaminant inputs due to soil erosion
	Applies to All Effect Types	• Geological or soil resources would only be altered/diminished for a short, finite period, and controlled through BMPs • Short-term impacts would be localized in specific areas and not substantially affect or diminish geological or soil resources, or alter associated hazards, throughout the Project Area

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Geological/Soils Change	• Would result in increased risk due to collapse of structures or damage to infrastructure because of ground failure, slope failure, land subsidence, and/or ground shaking • Would result in damage to foundations or other infrastructure due to liquefaction, differential settlement, lateral spreading, expansive soils, corrosive soils, or other adverse engineering properties of soils • Would result in moderate to substantial soil erosion • Construction could destabilize existing geologic conditions and/or accelerate adverse geologic processes
	Indirect Geological/Soils Change	• Would result in exposure of persons to elevated levels of radon • Would alter soil types if an area currently prone to daily tidal flooding would be drained • Would result in moderate/substantial downstream increase in turbidity, sedimentation, or nutrient/contaminant inputs • Would induce further changes that would result in moderate/substantial changes to/from geological or soil resources
	Applies to All Effect Types	• Geological or soil resources would be adversely altered for an extended or permanent period • Impacts would substantially affect geological or soils resources throughout the Project Area • Would result in increased risk to people or the built environment from geological or soils hazards
Beneficial	Direct Geological/Soils Change	• Would decrease risk due to geological or soils conditions, or would stabilize or protect geological or soil conditions • Would decrease soil erosion
	Indirect Geological/Soils Change	• Would result in a decrease in radon exposure • Would decrease downstream turbidity, sedimentation, or nutrient/contaminant inputs • Would induce further changes that would result in improvements to/from geological or soil resources or hazards
	Applies to All Effect Types	• Would result in geological or soil resources benefits, improvements, and/or risk reductions in the Project Area

4.15.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to geology and soils within the Project Area; these resources are described in **Section 3.15**. Evaluation of potential direct and indirect impacts to geologic and soils resources in the Project Area is based on published reports and maps from the NJDEP, New Jersey Geological Survey, USDA NRCS, and USGS. These agencies provide information concerning: geologic formations; soil types, characteristics, and limitations; and geologic setting. Relevant information was also derived from the site-specific geotechnical reports and data generated by the subsurface investigations performed for the Proposed Project.

The impacts of radon were also considered. Radon is a naturally occurring radioactive gas in New Jersey; it originates from a uranium-rich geologic province called the New Jersey Highlands. The NJDEP determined that radon is a state-wide issue (NJDEP 2016h). Major disturbances of soil in the Project Area could cause radon to migrate through the soil, through cracks in home foundations, and build up to unacceptable levels in indoor air.

Potential direct and indirect long-term impacts to surface water quality as a result of sediment re-suspension and transport were assessed by quantifying the relative potential for each alternative to disturb or scour sediments. The methodology and results of this analysis are addressed in **Section 4.16** and **Appendix I**.

To conduct this analysis, each considered alternative was overlaid onto the existing geology and soils environment, and relationships between project components and resources were identified. Using these data, potential direct short-term and long-term impacts to resources, and corresponding potential indirect impacts, at specific locations were identified. Where potential adverse effects were identified, mitigation measures were recommended, as appropriate.

4.15.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to geological and soils resources associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.15.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be implemented, and therefore no impacts attributable to the Proposed Project would occur to the existing geologic and soil resources within the Project Area. As such, there would be no direct impacts on geologic or soil resources from the Proposed Project.

However, continued and increased coastal storm surge, fluvial flooding, and SLR in the study area over time, as described in **Section 4.1.2.1**, could have ***indirect, less-than-significant adverse*** impacts on soil resources in the Project Area. Depending on the magnitude, severity, and frequency of future flooding events and SLR, these effects reasonably could increase to ***indirect, potentially significant adverse*** impacts by resulting in longer term, more permanent effects to soils resources. Per the significance criteria, the No Action Alternative, at a minimum:

- *Could induce an increase in the potential for land subsidence within the Project Area*

- *Could result in an increase in turbidity, sedimentation, nutrient input, and contaminant input due to soil erosion.*

Increased flooding within the Project Area could cause land subsidence. During excessive wetting of dry soils, soil can settle, resulting in land subsidence known as hydrocompaction. Hydrocompaction results when soil structure undergoes settlement due to the reduction of void space. Land subsidence (in the form of hydrocompaction) leads to a decline in the structural stability of soils, which results in reduced soil strength and issues with foundation support.

As storm and flood events become more frequent, moderate to substantial soil erosion could be expected within the Project Area. Increased erosion could further lead to an increase in the amounts of sediments, nutrients, and contaminants within waterbodies or a change in topography. Inadequate stormwater infrastructure in combination with increasing severity of storm events, poor soil drainage, and a large area of impervious surfaces could potentially result in increased levels of runoff entering waterbodies, which would adversely impact water quality by increasing turbidity and amounts of sediments, nutrients, and contaminants within waterbodies in the Project Area (see **Section 4.16** for further discussion of water quality). Under the No Action Alternative, these long-term adverse impacts could be potentially significant.

4.15.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to existing geologic conditions in the Project Area from activities such as excavation, filling, and pile driving during the construction phase of Alternative 1.
- ***Short-term, less-than-significant, adverse*** impacts to soils from soil erosion during the construction phase of Alternative 1 due to land-disturbing activities (e.g., excavation, filling, grading, pile driving, etc.).
- ***Long-term, beneficial*** impacts to soil resources due to a slight decrease in impervious surface area.

Alternative 1 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant, adverse*** impacts on the exposure of people to radon within the Project Area.
- ***Long-term, beneficial*** effects to soil resources from a decline in hydrocompaction and soil erosion, and in turn a reduction of both turbidity and sedimentation and nutrient and contaminant transport to adjacent waterbodies, due to a reduction in flooding.

Direct Impacts

<u>Existing Geologic and Soil Conditions</u>

Under Alternative 1, structural flood protection elements would reduce tidal flooding within the Project Area for approximately the next 50 years. No effects to the topography would be anticipated under Alternative 1. Further, construction and operation of Alternative 1 would not change the risk of geological or soil-related hazards, such as collapse of structures or infrastructure damage due to ground failure or damage to foundations from differential settlement of soils. While dewatering would be required during construction, temporary dewatering during construction is not expected to result in land subsidence because of the shallow depths of the dewatering operations.

Construction of Alternative 1 would require activities such as excavation, filling, grading, and pile driving along the alignment. These activities are not likely to destabilize existing geologic conditions or cause short-term settlement of adjacent loose soils based on the geologic composition of the Project Area. Proposed pile driving activities would occur along the Hackensack River where depths to bedrock range between 20 and 80 feet below grade (Widmer, 1959). No bedrock blasting is required for Alternative 1. Piles would be driven to the top of bedrock and not directly into the bedrock. As such, no fracturing of bedrock would be anticipated under Alternative 1. Therefore, no impacts to bedrock are anticipated.

Construction activities associated with building the LOP could also potentially generate over-sized materials (e.g., large rocks, stones, or boulders) that can cause differential settlement when subsequently used in engineered fills. In order to minimize these impacts, construction contractors would design and incorporate appropriate BMPs into the construction of Alternative 1. Impacts from construction on the underlying geology are expected to be ***short-term and less–than-significant***.

Soil Disturbance and Soil Erosion

During construction of Alternative 1, approximately 39 acres of land would be disturbed, and approximately 84,900 CY of soil removed from the Project Area. Of these 39 acres, approximately 9 acres of land would be permanently impacted as a result of Alternative 1, while approximately 30 acres of land would be temporarily disturbed during construction activities. Construction activities would include excavation, filling, pile driving, vegetation clearance, and the removal of impervious surfaces and existing infrastructure (e.g., parking lots and buildings). Upon completion of the construction phase, these areas would be regraded, restored, and revegetated. Soil erosion resulting from construction activities would also be temporary, and would be controlled through the implementation of a site-specific E&S Control Plan to ensure that appropriate BMPs, such as revegetation of disturbed soils and the installation of silt fences, are used to minimize impacts to soil resources. Therefore, under Alternative 1, ***short-term, less-than-significant adverse*** impacts to soil resources would occur during the construction phase of the Proposed Project that would be reduced with the implementation of BMPs.

Under Alternative 1, approximately 9.6 acres of impervious surface would be removed during construction activities, while approximately 8.8 acres of impervious surfaces would be developed within the Alternative 1 footprint. This represents a net decrease of approximately 0.8 acre of impervious surface within the Alternative 1 footprint from existing conditions. Therefore, ***long-term, beneficial*** effects to soils would occur under Alternative 1 due to a slight decrease in impervious surface area in the Project Area (see **Section 4.19** for further discussion on impervious surface impacts).

Indirect Impacts

Radon Exposure

As stated in **Section 4.15.3**, radon is a naturally occurring radioactive gas that has the potential to migrate through soil and into homes. The NJDEP and USEPA recommend mitigation action if radon levels in the air are greater than or equal to 4.0 pico-Curies per liter (pCi/L) (NJDEP 2007). Bergen County is in USEPA Radon Zone 2, which has an average indoor radon level of between 2 and 4 pCi/L (NJDEP 2016h). As such, construction and operation of Alternative 1 would not be expected to result in exposure of people within the Project Area to levels of radon that are greater than the acceptable levels, and no mitigation would be required. Therefore, Alternative 1 would have ***long-term, less-than-significant, adverse*** impacts on the exposure of people to radon within the Project Area.

Existing Geological and Soil Conditions and Resources

Construction and operation of Alternative 1 would not be expected to induce any changes that would impact the existing geological conditions within the Project Area. The construction and operation of Alternative 1 would not induce any further impacts that would result in increased risk to people or property from existing soil conditions or hazards such as liquefaction or differential settlement of soils.

The operation of Alternative 1 could lead to reduced potential for hydrocompaction and soil erosion, and in turn a reduction in turbidity and sedimentation within adjacent waterbodies due to less frequent flooding. This reduction in erosion could potentially result in less runoff entering waterbodies, which would ***beneficially*** impact water quality by reducing concentrations of sediment, nutrients, and contaminants within the Project Area (see **Section 4.16** for further discussion of water quality).

Mitigation Measures and BMPs

No potentially significant adverse effects to the geology or soils resulting from the construction or operation of Alternative 1 have been identified. Per established protocols, procedures, and requirements of the New Jersey Soil Erosion and Sediment Control Act of 1975 (NJSA 4:24-39 *et seq*.), the NJDEP would satisfy all applicable regulatory requirements in association with the Proposed Project. The NJDEP would prepare a detailed, site-specific E&S Control Plan to address land-disturbance aspects of Alternative 1 and to minimize potential impacts to soil resources during construction. The E&S Control Plan would include BMPs, such as specific guidelines and engineering controls, to address anticipated erosion and minimize release of sediments from constructing and operating the proposed facilities. Successful implementation of appropriate BMPs would ensure that Alternative 1 is in compliance with state and Federal water quality standards and that the resulting short-term and long-term soil impacts are maintained at less-than-significant levels. These measures could include the following:

- Install and monitor erosion-prevention measures, such as silt fences and water breaks, sedimentation basins, filter fences, sediment berms, interceptor ditches, straw bales, rip-rap, swales, and/or other sediment control structures; and re-spreading stockpiled topsoil.
- Seed and revegetate areas temporarily cleared of vegetation, and use native seed mixes and plants, whenever possible.
- Retain vegetation to the maximum extent possible.
- Install and maintain soil-stabilizing vegetation, mulch, or man-made materials to provide soil stabilization on disturbed areas.
- Minimize soil compaction by restricting vehicle travel, avoiding working on wet soils, and restoring soil conditions when necessary.

4.15.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to existing geologic conditions in the Project Area from activities such as excavation, filling, and pile driving during the construction phase of Alternative 2.

- ***Short-term, less-than-significant, adverse*** impacts to soils from soil erosion during the construction phase of Alternative 2 due to land-disturbing activities (e.g., excavation, filling, grading, pile driving, etc.).
- ***Long-term, beneficial*** impacts to soil resources due to a decrease in impervious surface area in the Project Area.

Alternative 2 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant, adverse*** impacts on the exposure of people to radon within the Project Area.
- ***Long-term, beneficial*** effects to soil resources from a decline in soil erosion, and in turn a reduction of both turbidity and sedimentation and nutrient and contaminant transport to adjacent waterbodies, due to a reduction in inland flooding.

Direct Impacts

Existing Geologic and Soil Conditions

Under Alternative 2, stormwater management would be improved through the installation of 41 green infrastructure systems (bioswales, storage/tree trenches, and rain gardens) along roadways, five new parks, improvements to five existing open spaces/public amenities, three new pump stations, two new force mains, and dredging of the lower reach of East Riser Ditch, as described in **Section 2.5.3.1**. Only minor localized effects to the topography would be anticipated under Alternative 2. Further, construction and operation of Alternative 2 would not change the risk of geological or soil-related hazards, such as the collapse of structures or infrastructure damage due to ground failure or damage to foundations from differential settlement of soils. While dewatering may be required during construction (if groundwater is encountered), temporary dewatering during construction is not expected to result in land subsidence because of the shallow depths of the dewatering operations.

Construction of Alternative 2 would require activities such as excavation, filling, grading, and pile driving within the Alternative 2 footprint. **Figure 4.8-6** through **Figure 4.8-10** show the potential pile driving and excavation locations. Similar to Alternative 1, these activities are not likely to destabilize existing geologic conditions or cause short-term settlement of adjacent loose soils based on the geologic composition of the Project Area. No bedrock blasting is required for Alternative 2. Piles would be driven to the top of bedrock and not directly into the bedrock. As such, no fracturing of bedrock would be anticipated under Alternative 2. Therefore, no impacts to bedrock are anticipated.

Construction activities associated with building the bioswales, rain gardens and storage trenches would potentially generate over-sized materials (e.g., large rocks, stones, or boulders) that could cause differential settlement when subsequently used in engineered fills. In order to minimize these impacts, construction contractors would design and incorporate appropriate BMPs into the construction of Alternative 2. Therefore, Alternative 2 is expected to result in ***short-term, less-than-significant, adverse*** impacts from construction activities on geologic and soil resources in the Project Area.

Soil Disturbance and Soil Erosion

During construction of Alternative 2, approximately 51 acres of land could be disturbed during construction activities. Approximately 32,300 CY of soils would be removed under Alternative 2 with the majority of these soils (20,200 CY) being dredged from East Riser Ditch. In comparison, approximately 39 acres of land would be disturbed under Alternative 1 and approximately 84,900 CY of soils removed.

Construction activities would include excavation, filling, pile driving, vegetation clearance, and the removal of impervious surfaces and existing infrastructure. Upon completion of the construction phase, these areas would be regraded, restored, and revegetated. Soil erosion resulting from construction activities would also be temporary, and would be controlled through the implementation of a site specific E&S Control Plan to ensure that appropriate BMPs, such as revegetation of disturbed soils and the installation of silt fences, are used to minimize impacts to soil resources. Therefore, under Alternative 2, ***short-term, less-than-significant adverse*** impacts to soil resources would occur during the construction phase of the Proposed Project that would be reduced with the implementation of BMPs.

Impervious surfaces would be removed during Alternative 2 construction activities. Under Alternative 2, a net decrease of approximately 3.4 acres of impervious surface would occur within the Proposed Project footprint from existing conditions. Therefore, ***long-term, beneficial*** effects to soils would occur under Alternative 2 due to a decrease in impervious surface area in the Project Area (see **Section 4.19** for further discussion on impervious surface impacts). In comparison, Alternative 1 would have only a net decrease of 0.8 acre of impervious surfaces.

Indirect Impacts

<u>Radon Exposure</u>

Similar to Alternative 1, Alternative 2 would have ***long-term, less-than-significant, adverse*** impacts on the exposure of people to radon within the Project Area. For more information on these impacts, refer to **Section 4.15.4.2**.

<u>Existing Geologic and Soil Conditions</u>

Construction and operation of Alternative 2 would not be expected to induce any changes that would impact the existing geological conditions within the Project Area. The construction of the proposed stormwater improvements would not induce any further impacts that would result in an increased risk to people or property from existing soil conditions or hazards such as liquefaction or differential settlement of soils.

The implementation of Alternative 2 would lead to reduced soil erosion, and in turn a reduction in turbidity and sedimentation within the Project Area due to less frequent flooding from stormwater events. This reduction in erosion could potentially result in less runoff entering waterbodies, which would ***beneficially*** impact water quality (see **Section 4.16.4.3** for further discussion of water quality). However, Alternative 2 would not address coastal flooding, and the potential for hydrocompaction following storm surge events would not be changed.

Mitigation Measures and BMPs

No potentially significant adverse impacts to geology and soil resources have been identified from the proposed construction or operation of Alternative 2. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2 (see **Section 4.7.4.2**).

4.15.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects geologic and soil resources, and thus would not change the impact analysis.

Direct and indirect impacts on geologic and soil resource under Alternative 3 would be the same with the exception of the following impacts.

- Due to less ground-disturbing activities under Alternative 3, ***short-term, less-than-significant, direct adverse*** impacts on existing geologic conditions and soils from soil erosion from construction activities would be slightly less than Alternative 2.
- Under Alternative 3, a net decrease of approximately 3.7 acres of impervious surface would occur within the Proposed Project footprint from existing conditions. Therefore, ***long-term, direct, beneficial*** effects to soils would be slightly greater than Alternative 1 (net decrease of 0.8 acre) and Alternative 2 (net decrease of 3.4 acres).
- Due to less ground-disturbing activities under Alternative 3, ***short-term, less-than-significant, indirect adverse*** impacts on the exposure of people to radon within the Project Area would be slightly less than Alternative 2.
- Under Alternative 3, the Losen Slote pump station C and force main C would not be constructed; therefore, ***long-term, indirect beneficial*** effects to soil resources from a decline in soil erosion, and in turn a reduction of both turbidity and sedimentation and nutrient and contaminant transport to adjacent waterbodies, due to a reduction in inland flooding would be slightly less than Alternative 2.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.7.4.3**).

4.16 Water Resources, Water Quality, and Waters of the US

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on water resources in the Project Area. As described in **Section 3.16**, water resources include the quality and quantity of surface water, groundwater, wetlands, and other regulated waters, including WOUS. Impacts to water resources can be either direct or indirect. A direct impact would occur if the Proposed Project would directly alter a water resource at the same time and place within the Project Area, such as filling a jurisdictional WOUS. An indirect impact would occur if the Proposed Project would alter an off-site water resource, such as reducing water quality downstream of the Proposed Project through increased turbidity, sedimentation, and/or pollutant loads.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to affect water resources during both construction and operation, either by affecting the areas directly or by causing indirect effects that alter their functionality. This analysis also identifies the location of impacts and, when possible, quantifies potential effects.

4.16.1 Definition of Study Area

As described in **Section 3.16**, the study area for this resource is defined as the Project Area. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to water resources.

4.16.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect water resources effects of the alternatives are provided in **Table 4.16-1**.

Table 4.16-1: Water Resources, Water Quality, and WOUS Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Water Resources Change	• Would not result in placement of fill, structures, or other discharge in a WOUS or State-regulated waterbody or wetland • Would not dredge or excavate in a WOUS or State-regulated waterbody or wetland • Would not mobilize contaminants or sediment into a WOUS or State-regulated waterbody or wetland within the immediate vicinity of Proposed Project components • Would not change the quality or quantity of surface water, groundwater, or regulated water • Would not divert surface water or disrupt groundwater flow • Would not result in temporary or long-term disturbance of freshwater or tidal wetlands
	Indirect Water Resources Change	• Would not mobilize contaminants into a WOUS or State-regulated waterbody or wetland • Would not disrupt hydrology to a WOUS or State-regulated waterbody or wetland • Would not induce activities that could diminish the quality or quantity of surface water, groundwater, or regulated waters • Would not increase tributary or river flows that would result in sediment scour • Would not increase stormwater runoff volume, as addressed in **Section 4.19**
	Applies to All Effect Types	• Would result in no discernable changes to water resources in the Project Area • Would only alter water resources for an indiscernible or negligible period of time
Less-than-Significant	Direct Water Resources Change	• Would result in temporary ground disturbance, placement of fill, structures, or other discharge in a WOUS or State-regulated waterbody or wetland • Would mobilize contaminants into a WOUS or State-regulated waterbody or wetland within the immediate vicinity of Proposed Project components, or would discharge stormwater that would not result in an exceedance of NJDEP surface water quality standards for a contaminant • Would result in a temporary decrease in the quality or alter the quantity of surface water, groundwater, or regulated water • Would result in temporary diversion of surface water or temporary disruption in groundwater flow • Would result in a temporary change to wetland functions and services
	Indirect Water Resources Change	• Would mobilize contaminants into a WOUS or State-regulated waterbody or wetland offsite from Proposed Project components; would discharge stormwater that would not result in an exceedance of NJDEP surface water quality standards for a contaminant • Would minimally disrupt hydrology to a WOUS or State-regulated waterbody or wetland • Would induce activities that could minimally diminish the quality or alter the quantity of surface water, groundwater, or regulated waters • Would increase tributary or river flows that would result in limited sediment scour • Would install new impervious surfaces, causing slightly increased stormwater runoff volume, as addressed in **Section 4.19**
	Applies to All Effect Types	• Water resources would only be altered/diminished for a short, finite period, but would recover • Temporary impacts would be localized in specific areas and not substantially affect or diminish water resources throughout the Project Area

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Water Resources Change	• Would result in placement of fill, structures, or other discharge in a WOUS or State-regulated waterbody or wetland • Would dredge or excavate in a WOUS or State-regulated waterbody or wetland, permanently altering the feature • Would mobilize contaminants into a WOUS or State-regulated waterbody or wetland within the immediate vicinity of Proposed Project components, or would discharge stormwater that could result in an exceedance of NJDEP surface water quality standards for a contaminant • Would permanently reduce the quality or alter the quantity of surface water, groundwater, or regulated water • Would permanently divert surface water or disrupt groundwater flow • Would permanently diminish wetland functions and services • Would result in substantial excavation below groundwater level
	Indirect Water Resources Change	• Would mobilize contaminants into a WOUS or State-regulated waterbody or wetland off-site from Proposed Project components, or would discharge stormwater that could result in an exceedance of NJDEP surface water quality standards for a contaminant • Would disrupt hydrology to a WOUS or State-regulated waterbody or wetland • Would induce activities that could moderately/substantially diminish the quality or alter the quantity of surface water, groundwater, or regulated waters • Would increase tributary or river flows that would result in substantial sediment scour • Would install new impervious surfaces, causing moderate/substantial increased stormwater runoff volume, as addressed in **Section 4.19**
	Applies to All Effect Types	• Water resources would be adversely altered/diminished for a long-term or permanent period • Impacts would substantially affect or diminish water resources in the Project Area
Beneficial	Direct Water Resources Change	• Would increase quality or quantity of WOUS or State-regulated waterbodies or wetlands • Would improve the quality or quantity of surface water, groundwater, or regulated water • Would improve surface water or groundwater flow • Would increase wetland functions and services • Would directly remove contaminated sediments from WOUS and State-regulated wetlands and waters
	Indirect Water Resources Change	• Would reduce contaminant mobilization into a WOUS or State-regulated waterbody or wetland • Would improve hydrology to a WOUS or State-regulated waterbody or wetland • Would induce activities that could improve the quality or quantity of surface water, groundwater, or regulated waters • Would decrease existing rate of sediment scour • Would reduce impervious surfaces, causing decreased stormwater runoff volume, as addressed in **Section 4.19**
	Applies to All Effect Types	• Would result in water resources benefits or improvements in the Project Area

4.16.3 Analysis Methodology

Each of the three Build Alternatives and the No Action Alternative was evaluated to determine the potential for changes to the existing conditions of water resources, in terms of quantity or quality, within the Project Area; these resources are described in **Section 3.16**.

To conduct this analysis, the areal extent of each considered alternative was overlaid in GIS onto the mapped water resources environment. Using the project footprints and NJDEP Land Use Land Cover (2015) data, potential short- and long-term direct and indirect impacts to water resources at specific locations were identified. Further refinement was performed through review of available collateral data sources to identify areas to be investigated in the field. The analysis focused on potential direct and indirect impacts to the quality and quantity of WOUS, State-regulated water resources, and groundwater. The methodologies for the analysis are further described in the subsections that follow. Where potential adverse effects were identified, mitigation measures were recommended, as appropriate.

4.16.3.1 Surface Waters

The potential construction-related and operational impacts on surface water were assessed both quantitatively and qualitatively for each alternative, as possible, including effects on surface water quantity, flow, and quality resulting from erosion, runoff, re-suspension of sediments, and changes in sediment quality and transport. The direct and indirect impacts of short-term and localized increases in turbidity and suspended sediment concentrations caused by proposed in-water construction activities (e.g., pile driving), as well as proposed land-based construction site and staging area disturbances, were addressed using the guidelines and standards set forth in **Section 3.16**, and the significance criteria presented in **Table 4.16-1**.

Potential direct and indirect long-term impacts to surface water quality as a result of sediment re-suspension and transport were assessed by quantifying the relative potential for each alternative to disturb sediments or create scour conditions. Sediment displacement due to stream velocity can return contaminants and solids to the water column and relocate contaminants to other areas of the waterbody. A sediment scour analysis was performed for the three Build Alternatives and the No Action Alternative. For Alternative 1, MIKE21 modeling of the 2-year, 10-year, 50-year, and 100-year return period storm events provided the necessary information for the analysis of the Hackensack River to the Oradell Dam and also Project Area tributaries (i.e., East and West Riser Ditches, Losen Slote, and DePeyster Creek) up to their respective tide gates. Effects of the Alternative 1 storm surge barrier and pump station on Berry's Creek were assessed using HEC-RAS model outputs for the 2-year, 10-year, 50-year, and 100-year return period storm events. For Alternatives 2 and 3, HEC-RAS and InfoWorks modeling of the 2-year, 10-year, 50-year, and 100-year return period storm events in East Riser Ditch and Losen Slote (and below the East Riser Ditch tide gate outlet) provided the necessary information to perform this evaluation. Models used for evaluations of Alternatives 1, 2, and 3 include inland and coastal flooding under normal tide conditions. For each storm scenario, the shear stress at the sediment bed was calculated and compared to critical shear stress, or the threshold at which erosion could begin to occur. For each of the selected storms, the existing condition was compared to each alternative to assess relative differences in shear stress and potential erosion that could lead to the release of contaminated sediment to the water column. Refer to **Appendix I** for more information on the sediment scour and deposition analysis.

In addition, the SVAP analysis (NRCS 1988) completed for non-tidal drainages within the Project Area (see **Section 3.14.3.2**) was also used to determine potential for effects to various surface waters. SVAP is a stream-specific functional assessment of hydrologic, habitat, and morphologic stream conditions.

Based on stream evaluations using SVAP, all but one of the watercourses received a poor rating. The lower reach of Losen Slote is the only watercourse evaluated that received a fair rating. Further discussion of the SVAP technique, preliminary results, and detailed scoring information are provided in **Appenidx L**.

4.16.3.2 Groundwater

A qualitative approach was used to assess impacts to groundwater quantity, quality, and flow from each alternative. Potential short- and long-term impacts were determined based on the likelihood and extent of impacts to the existing groundwater from each alternative during both construction and operation activities. The potential to exceed New Jersey Ground Water Quality Standards (NJAC 7:9C) was considered in conducting the impact assessment.[66]

4.16.3.3 Wetlands, Waters of the US, and State-regulated Waters

Based on Proposed Project plans and the location of mapped surface water features within and immediately adjacent to the proposed disturbance areas associated with each Build Alternative, wetland scientists quantified the potential area of short- and long-term impacts to WOUS and State-regulated wetlands, waters, adjacent buffer areas, and riparian zones based on CWA Sections 404 and 401, Rivers and Harbors Act Section 10, NJDEP Freshwater Wetlands Rules, NJDEP Coastal Zone Management Rules, and NJDEP FHACA Rules. Specifically, wetland scientists used the designed Proposed Project footprints, NJDEP and NWI data, aerial imagery (e.g., Google Earth, Bing, and NJDEP GIS), and 2016-2018 field surveys to determine the approximate boundaries of wetlands and waters within Build Alternative footprints, as well as the potential direct and indirect short- and long-term impacts to these water resources that could be reasonably anticpated from the Proposed Project. This desktop review and field investigation did not include a formal wetlands delineation, but rather provided a refinement of the wetland and stream data depicted on available mapping resources. **Appendix L** provides a detailed description of the methodology used to identify the approximate locations and types of wetlands and streams within the footprints of the Build Alternatives.

A functional assessment (i.e., EPW) was performed on each existing wetland within or near the proposed footprint of each Build Alternative to determine the functions and services of the wetland, to evaluate potential effects, and to support the future development of mitigation measures, as needed (see **Appendix L**). The EPW technique (Bartoldus et al. 1994) is a rapid assessment procedure based on the wetland's capacity to provide six functions: shoreline bank erosion control, sediment stabilization, water quality, wildlife, fish (tidal, non-tidal stream/river, and non-tidal pond/lake), and uniqueness/heritage. In the evaluation of mitigation for WOUS, State-regulated wetlands, wetland buffers, and riparian zone impacts, CWA Sections 404 and 401, Rivers and Harbors Act Section 10, NJDEP Freshwater Wetlands Rules, NJDEP Coastal Zone Management Rules, and NJDEP FHACA Rules were reviewed and applied.

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[66] Although groundwater in the Project Area is designated as Class II, it is not used as a source of potable water from either the surficial water table or the deeper Newark Group aquifer. It is not used due to the saline nature of the shallow groundwater, the identified impacts to water quality from the numerous landfills and other contaminated sites within the Project Area and region, and the existing water supply infrastructure that draws from other sources.

4.16.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to water resources associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operation activities.

4.16.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be constructed and no changes would occur to existing water resources from activities associated with the Proposed Project. As such, there would be no direct impacts to water resources from the Proposed Project.

However, continued and increased flooding in the Project Area over time, as summarized in **Section 4.1.2.1**, could have ***indirect, potentially significant adverse*** impacts on water resources by increasing the amount of stormwater discharging into the waterbodies, the depth of water, and the velocity of water that could lead to increased scour and sediment mobilization, and through overall changes in hydrology that would affect the quantity and quality of surface waters, including wetlands and other regulated water features. Relating to the significance criteria, the No Action Alternative, at a minimum, could:

- *Discharge stormwater that could result in an exceedance of NJDEP surface water quality standards for contaminants;*
- *Transport sediment, nutrients, and pollutants into a WOUS or State-regulated waterbody or wetland or mobilize those already present within these features;*
- *Disrupt hydrology to a WOUS or State-regulated waterbody or wetland with increased tidal flows and stormwater runoff;*
- *Increase Hackensack River flows downstream of the confluence with DePeyster Creek that could result in substantial scour and sediment transport; and/or*
- *Increase Berry's Creek flow downstream of Paterson Plank Road that could increase scour and sediment transport.*

Under the No Action Alternative, ongoing and increased flooding within the Project Area would be expected to continue to, and increasingly, impact water resources. Flood protection measures would generally be limited to the O&M of existing infrastructure, which is described in **Section 3.12**. The No Action Alternative would not assist in reducing flooding potential within the Project Area and as such, degradation of surface waters, groundwater, and wetland resources would occur.

<u>Surface Water</u>

As a result of the No Action Alternative, surface water quantity would be expected to increase in the Project Area due to anticipated impacts of SLR on the tidal regime. Surface water flow would also change as watercourses in the Project Area would receive more tidal flows and increased stormwater runoff from expected higher intensity, more frequent precipitation events.

The MIKE21 modeling results indicate that water depths would be expected to increase in the Hackensack River, with increased velocity downstream of the confluence with DePeyster Creek. The water depths and velocities would also be expected to increase downstream of the existing tide gates in West Riser Ditch, East Riser Ditch, Losen Slote, and DePeyster Creek. HEC-RAS modeling results indicate that water depths and velocities would be expected to increase in Berry's Creek downstream of Paterson Plank Road (see **Appendix I**). This would result in increased shear stress that has the potential to increase scour and sediment transport, including transport of contaminants and consequently adversely impact water quality. Surface water quality would permanently change from the baseline condition as the tidal influence extends farther inland and salinity levels increase, which would reduce the quantity/availability of freshwater. Water quality would also be adversely impacted over the long-term by increased coastal and inland flooding. The expected increased frequency of coastal flooding would impact water quality during storm events by increasing pollutant loading, contaminant transport, and sediment transport. The expected increase in stormwater runoff and inland flooding from heavy precipitation events, combined with an expected increase in impervious cover, would alter the timing and frequency of stormwater runoff, and further increase sediment transport, turbidity, nutrient loading, and pollutant loading to surface water resources in the Project Area.

Groundwater

As a result of the No Action Alternative, groundwater flow, quantity, and quality would permanently change in parts of the Project Area that are exposed to increased tidal inundation as a result of SLR. Groundwater in these areas could become more saline as the tidal regime influences flow within the shallow groundwater aquifer. The groundwater changes as a result of the No Action Alternative would not lead to a reduction in use as there are no potable wells within the Project Area, and the local Newark Group aquifers are not utilized for public water supply.

Wetlands and WOUS

Within the Project Area, there are currently 1,632.4 acres of NJDEP-mapped tidal and freshwater wetlands and 793.0 acres of open water (see **Table 3.16-6**). As a result of the No Action Alternative, the projected increase in sea level could cause long-term changes to the areal extent and types of wetlands in the Project Area. As sea level rises and the tidal influence extends farther inland, existing tidal wetlands could be converted to unvegetated tidal flats and open water, and existing freshwater wetlands would be converted to tidal wetlands if existing berms are overtopped.

Undeveloped uplands adjacent to tidal or freshwater wetlands could convert to wetland habitats, depending on topography. However, in developed urban areas, natural shorelines landward of coastal marshes are rare, and marshes are unable to retreat (Titus, et al. 2009). This phenomenon has been described previously as “coastal squeeze” and has been implicated in the loss of considerable acreage of salt marsh in the US and elsewhere (Yozzo et al. 2000; NWF 2011).

Consequently, net acreage changes to tidal and freshwater wetlands would likely be negative as tidal wetlands would convert to unvegetated tidal flats and open waters. These changes to wetland types would permanently alter the functions and services provided by these wetlands, including the quantity and quality of habitats. The wetland functions and services that would be impacted include: flood flow attenuation, fish/shellfish habitat, sediment/nutrient retention, wildlife habitat, shoreline protection, and recreation. Additionally, as a result of the increased frequency and intensity of coastal and inland flooding, wetland resources would be permanently impacted from increased shoreline erosion. Increased shoreline erosion would lead to potentially significant impacts to water resources as sediment containing contaminants and nutrients could be mobilized to surface waters and reduce water quality.

4.16.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Long-term, potentially significant adverse*** impacts to surface water quantity, flow, and quality from proposed installation of foundations (e.g., pilings), floodwalls, walkways, a tide gate, and the Berry's Creek storm surge barrier in surface waters.
- ***Long-term, potentially significant adverse*** impacts to wetlands, open waters, and wetland functions and services as well as riparian zones from placement of permanent fill or structures in wetlands or open waters to construct the proposed floodwall, elevated walkways, tide gate, and the Berry's Creek storm surge barrier.
- ***Short-term, less-than-significant adverse*** impacts to localized surface water flow and quality from dewatering, installation/removal of temporary sheet piling, and installation of stormwater drainage piping, a tide gate, and the surge barrier during construction of the proposed LOP and parks.
- ***Short- and long-term, less-than-significant adverse*** impacts to localized groundwater flow and quality from temporary dewatering of shallow groundwater during construction activities and the operation of the proposed floodwall.
- ***Short-term, less-than-significant adverse*** impacts to wetland areas, functions, and services as well as riparian zones from dewatering activities, temporary fill, installation/removal of temporary sheet piling, installation of stormwater drainage piping, and vegetation removal during construction of the proposed floodwall, tide gate, park improvements, and the Berry's Creek storm surge barrier.
- ***Long-term beneficial*** effects to wetland functions and services where wetlands would be enhanced or created.

Alternative 1 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant adverse*** impacts to surface water from installation/removal of temporary sheet piling and installation of stormwater drainage piping, a tide gate, and the surge barrier during construction of the proposed LOP.
- ***Long-term, less-than-significant adverse*** impacts to wetland area, functions, and services upstream of the proposed tide gate on the unnamed tributary to the Hackensack River.
- ***Long-term beneficial*** effects to surface water quantity, flow, quality, and sediment quality and transport by increasing flood protection against coastal storm surges and flooding during heavy storms, which would lead to a reduction in the frequency and magnitude of turbidity and pollutant-loading events.
- ***Long-term beneficial*** effects to localized surface water quality resulting from proposed parks and habitat enhancements that would reduce the velocity of stormwater runoff and trap solids before entering surface waters.
- ***Long-term beneficial*** effects to wetland functions and services by providing protection from the effects of SLR and increasing flood protection against coastal storm surges.

The following subsections provide greater detail.

Direct Impacts

The following subsections summarize the short-term and long-term direct impacts to surface waters, groundwater, and wetlands, based on the analysis methodology set forth in **Section 4.16.3**.

<u>Surface Water</u>

Although Alternative 1 has been designed to minimize work within surface waters to the extent feasible, construction and operation of this alternative have the potential to directly impact surface waters within the Project Area.

Construction of Alternative 1 would involve in-water work, such as dewatering, placement of temporary fill, installation and removal of temporary sheet piling, and installation of stormwater drainage piping, a tide gate, and the Berry's Creek storm surge barrier. Specific examples include the installation of the floodwall within the Hackensack River, at eight locations, to avoid existing buildings (i.e., required to maintain a 10-foot minimum offset from buildings); the installation of piles to support the proposed elevated walkway at Fluvial Park; and pier installation and construction of platforms at the proposed K-Town Park for the proposed boat dock and kayak launch. These activities would result in ***short-term, less-than-significant adverse*** impacts to surface water quantity, flow, and quality. Surface water flow would be altered during construction as water is diverted during dewatering activities and from installation of sheet piling. The installation of the gate structures would be phased so as to maintain flow during construction, but would still produce minor effects to water flow. Surface water quality would be temporarily impacted due to increases in suspended sediment during ground and waterbody disturbance activities. These construction impacts are expected to be ***less than significant adverse*** impacts as affected resources would recover within a short period of time, impacts would be localized, and impacts would not substantially affect the designated uses of surface water resources.

The installation of permanent pilings and elevated walkways within and over surface waters, the floodwall within the Hackensack River below the mean high water (MHW) line, a tide gate, and the Berry's Creek storm surge barrier would result in ***long-term, potentially significant adverse*** impacts to surface water quantity, flow, and quality by filling surface waters and reducing surface water area. Coordination would be conducted with the USACE, USCG, and NMFS regarding proposed fill or realignment of waters. Operation of the proposed tide gate would alter surface water flow and quality as the gate would permanently reduce the daily tidal flow and reduce salinity upstream of the gate. Although these impacts would be potentially significant, they would be localized and would not substantially diminish water resources throughout the Project Area. In addition, these effects would be partially offset through the proposed wetland creation measures included in Alternative 1 (see below).

<u>Groundwater</u>

No potable groundwater wells occur within the Project Area, and drinking water within the Project Area is not sourced from the local Newark Group aquifers. Rather, drinking water is supplied by reservoirs in northern New Jersey and Rockland County, New York. Therefore, no impact to groundwater wells or drinking sources would result from Alternative 1.

Alternative 1 construction activities would result in ***short-term, less-than-significant adverse*** impacts to localized groundwater flow and quality. Since shallow groundwater is prevalent throughout the Project Area, construction of Alternative 1 would likely require temporary dewatering of shallow groundwater. Temporary dewatering would likely alter groundwater flow toward the excavations in the short term; this water would be sampled, handled, and disposed of appropriately, in accordance with a NJPDES General Permit. In some areas, groundwater quality would be temporarily impacted due to re-suspension of sediments during ground-disturbing activities. These short-term impacts are expected to be less than significant as groundwater quality would recover within a short period of time, impacts would be localized, and impacts would not substantially affect the designated uses of groundwater resources throughout the Project Area. Alternative 1 would not be expected to result in impacts to groundwater quantity, as dewatering activities would be short term.

Under Alternative 1, approximately 20,600 LF of floodwalls and/or berms would be constructed along the Hackensack River. Although the final design for these floodwalls has not been completed, their foundations are expected to extend 20 feet or more below the ground surface. Due to the expansive scale of these foundations and their location immediately adjacent to the Hackensack River, they have the potential to disrupt localized groundwater flow. However, given the localized nature of this effect coupled with the retention of the pilings in place, ***long-term, less-than-significant adverse*** impacts would be expected from any disruption to groundwater flow.

Wetlands and WOUS

Permanent Impacts to Wetlands[67]

Implementation of Alternative 1 would result in ***long-term, potentially significant adverse*** impacts to wetlands, open waters, riparian zones, and wetland functions and services from placement of permanent fill or structures to construct the proposed floodwall, tide gate, and Berry's Creek storm surge barrier. As shown in **Table 4.16-2** and illustrated in **Figure 4.16-1** through **Figure 4.16-3**, a total of approximately 4.3 acres of wetlands and WOUS would be impacted. Of the approximately 4.3 acres, 2.2 acres would be permanently impacted; they include (from most to least): tidal open water (1.0 acre), freshwater emergent (0.6 acre), and tidal emergent (0.6 acre). These impacts are discussed further below. Additionally, permanent impacts to State-regulated riparian zones along open water would total approximately 8.8 acres.

Table 4.16-2: Anticipated Alternative 1 Wetland and WOUS Impacts

Classification	Total Impact (Acres)	Permanent* Impact (Acres)	Temporary** Impact (Acres)
Freshwater Emergent Wetlands	0.9	0.6	0.3
Freshwater Forested Wetlands	0.0	0.0	0.0
Tidal Emergent Wetlands	1.9	0.6	1.3
Tidal Open Water	1.5	1.0	0.5
Non-Tidal Open Water	0.0	0.0	0.0
Totals	**4.3**	**2.2**	**2.1**

* Permanent impacts represent a long-term impact (e.g., permanent loss of area or function).
** Temporary impacts represent a short-term impact (e.g., the total wetland area and function is restored fully upon completion of construction activities).

At the proposed K-Town Park, pier installation and the construction of platforms to develop the proposed boat dock and kayak launch would permanently impact intertidal wetlands through placement of pilings.

[67] Permanent wetland impacts are typically identified as any disturbance that affects the existing wetland soils, ultimately resulting in a loss of wetland area and function (i.e., permanent loss). This disturbance can include placement of fill material within the wetland or excavation of existing wetland soils.

These intertidal wetlands were observed to be sparsely vegetated and/or disturbed during the 2016 field investigation. The proposed elevated walkway at Fluvial Park would also require the installation of pilings to support the structure. These piles would directly displace NJDEP-mapped open water (included in the above calculations). As such, the displacement of intertidal wetlands and open water has the potential to result in ***long-term, potentially significant adverse*** impacts to wetlands and open waters by diminishing wetland quality permanently.

The proposed floodwall associated with Alternative 1 would generally be installed in upland areas that have been previously disturbed; however, areas of new, naturally sloping shorelines are proposed and would require excavation and filling of the riparian zone adjacent to the existing Hackensack River shoreline. Additionally, some minor areas of fill within the Hackensack River would occur adjacent to the existing hardened shoreline where vegetation is minimal and buildings are in close proximity to the riverbank. Therefore, construction of Alternative 1 has the potential to result in ***long-term, potentially significant adverse*** impacts to wetland resources and the riparian zone from dredge and fill activities, primarily in the Central Segment and at the proposed location of the Berry's Creek storm surge barrier.

Construction of the proposed Berry's Creek storm surge barrier near Paterson Plank Road and a tide gate at an unnamed tributary to the Hackensack River, north of Losen Slote and beneath an access road leading to the BCUA, would result in permanent impacts to wetland resources. The proposed surge barrier and tide gate would require in-water work during construction and would result in limited alteration to wetland resources permanently. Therefore, Alternative 1 has the potential to result in ***long-term, potentially significant adverse*** impacts to wetland resources in these locations.

While approximately 2.2 acres of wetland and open water would be permanently impacted by the construction of Alternative 1, the wetland functions and services of the impacted wetlands are already somewhat diminished as they are located in previously disturbed habitats and in an urban setting. Many of the wetland areas that would be permanently impacted are located adjacent to roads, man-made berms, and other structures that diminish their quality. Also, several impacts to specific wetland areas represent very small portions of substantially larger wetland complexes (e.g., wetland system located south of Commerce Boulevard). In addition, an approximately 1.1-acre tidal wetland would be created as part of the proposed Fluvial Park under Alternative 1; it is estimated that the creation of this wetland would partially replace wetland functions and services lost during the construction of Alternative 1. Created wetlands would naturally filter the water by storing nutrients and contaminants in the soil and vegetation, thereby improving water quality. As such, creation of wetlands associated with Alternative 1 has the potential to result in ***long-term benefits*** to wetland functions and services in the Project Area.

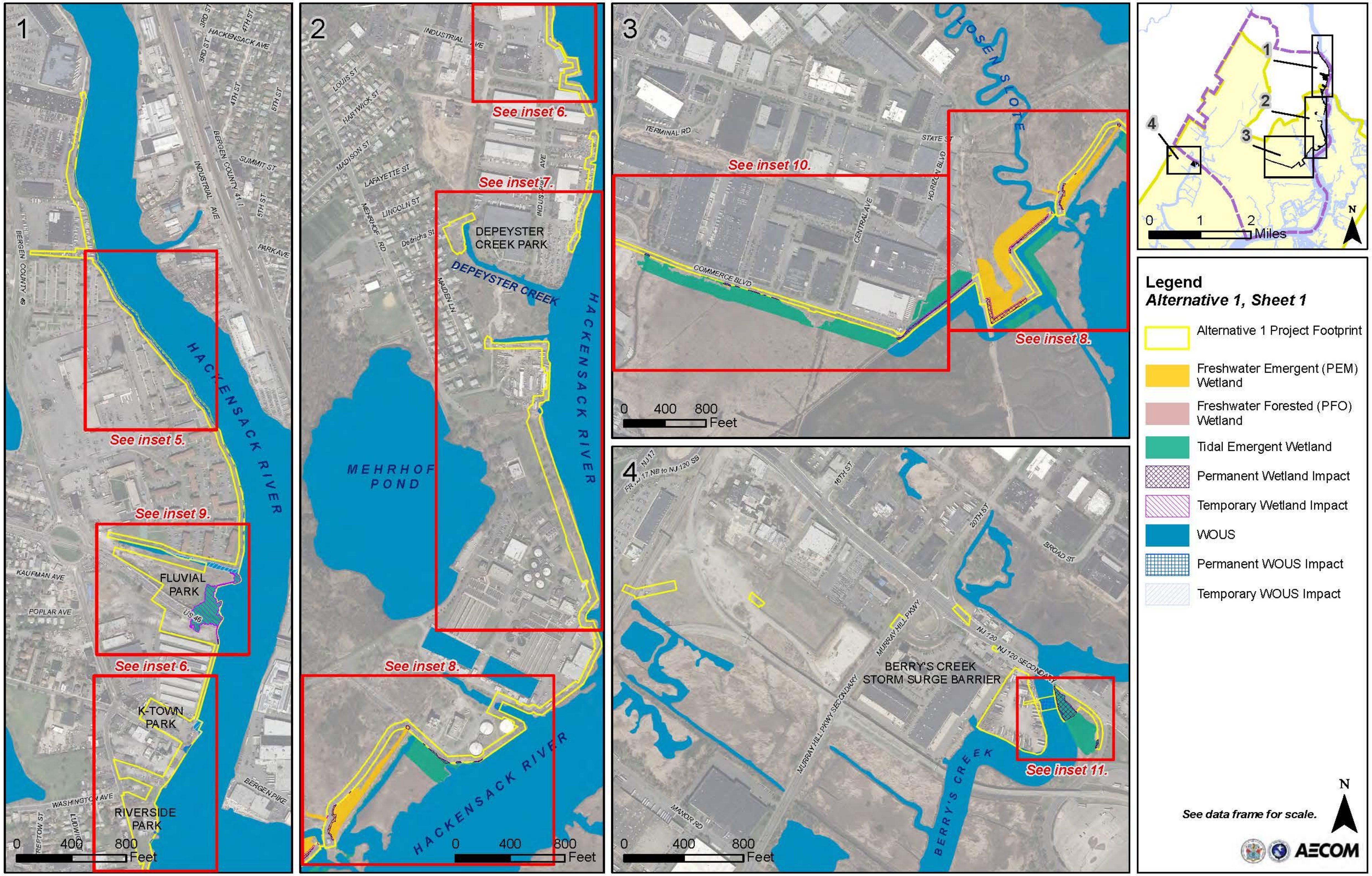

Figure 4.16-1: Anticipated Alternative 1 Wetland and WOUS Impacts (Sheet 1)

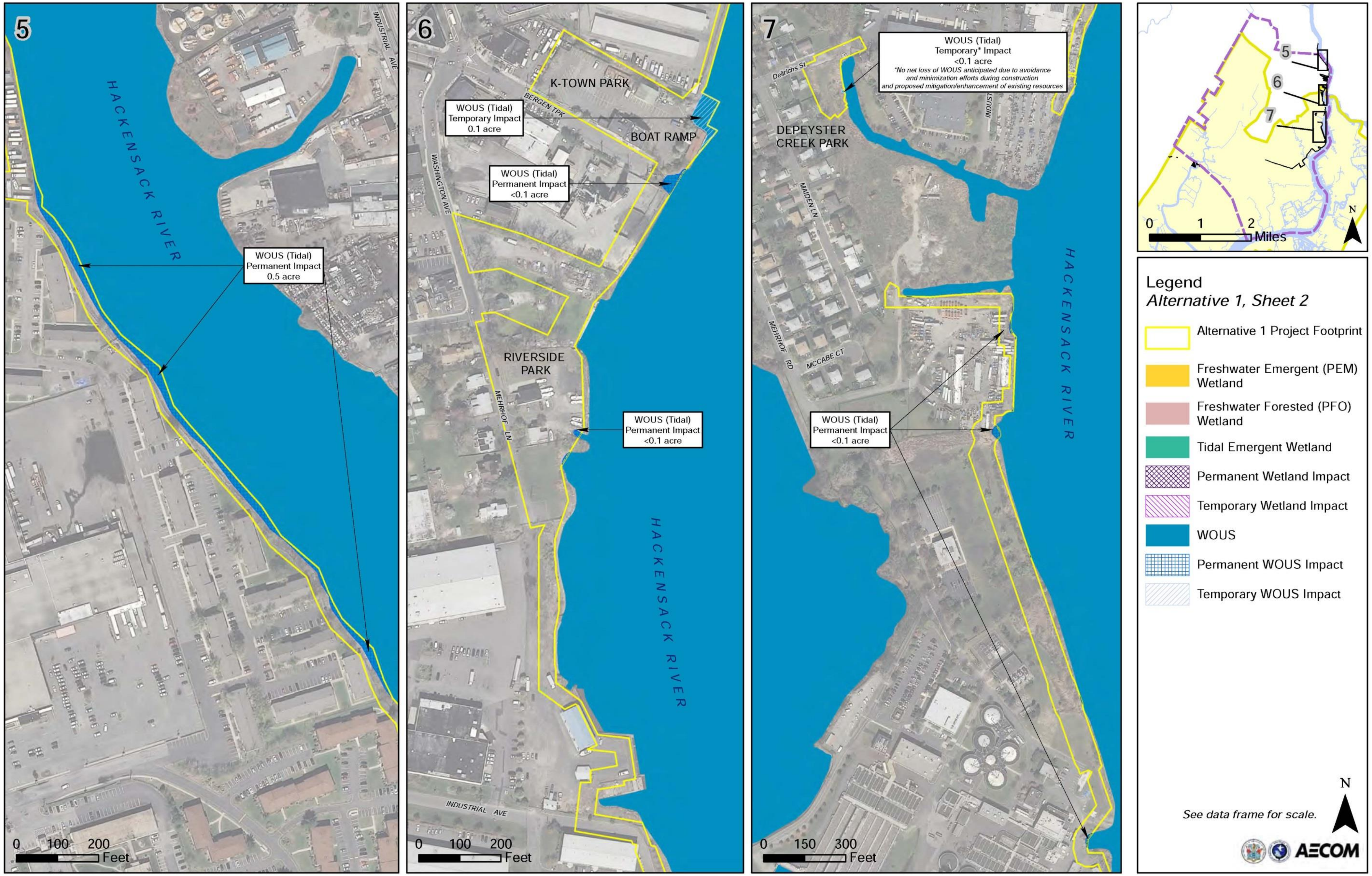

Figure 4.16-2: Anticipated Alternative 1 Wetland and WOUS Impacts (Sheet 2)

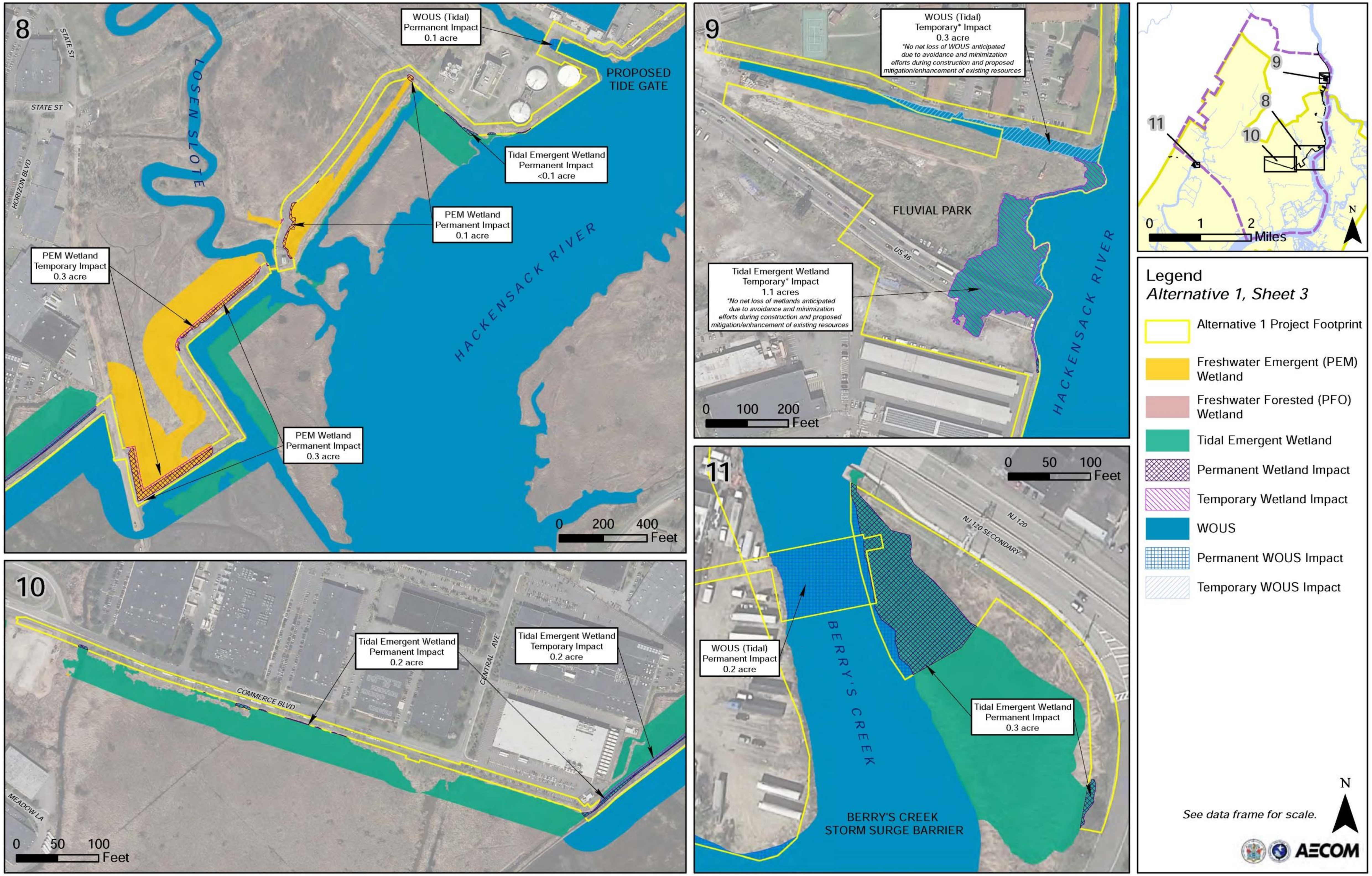

Figure 4.16-3: Anticipated Alternative 1 Wetland and WOUS Impacts (Sheet 3)

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Temporary Impacts to Wetlands[68]

Implementation of Alternative 1 would also result in ***short-term, less-than-significant adverse*** impacts to additional wetland areas, functions, and services. These impacts would occur from dewatering activities, placement of temporary fill, installation and removal of temporary sheet piling, installation of stormwater drainage piping, and vegetation removal during construction of the proposed floodwall, tide gate, park improvements, and the Berry's Creek storm surge barrier. As shown in **Table 4.16-2** and illustrated in **Figure 4.16-1** through **Figure 4.16-3**, a total of approximately 4.3 acres of wetlands and WOUS would be impacted under Alternative 1. Of these approximately 4.3 acres of wetlands, 2.1 acres would be temporarily impacted during construction activities; they include (from most to least): tidal emergent wetlands (1.3 acres), tidal open water (0.5 acre), and freshwater emergent wetlands (0.3 acre). Additionally, temporary impacts to State-regulated riparian zones along open water would total approximately 2.3 acres. Proposed wetlands, open water, and riparian zone impacts may be further avoided or minimized through design and construction techniques (e.g., clearly marking limits of construction on plans to avoid wetlands where possible, and clearly marking wetlands and buffers with high-visibility construction fencing in the field and maintaining them for the life of the construction project).

Construction of Alternative 1 would require in-water work for the emplacement of proposed structures, such as the floodwall along the Hackensack River, the Berry's Creek storm surge barrier, the tide gate near BCUA, and the elevated walkway. These activities would result in removal of wetland/riparian vegetation and increases in turbidity for the duration of construction in and adjacent to watercourses and wetlands in the Project Area. Therefore, Alternative 1 has the potential to result in ***short-term, less-than-significant adverse*** impacts to the quality of wetland/riparian resources. Immediately following construction, these localized areas of impact (i.e., 2.1 acres of wetlands and open water and 2.3 acres of riparian zones) would be restored to pre-construction conditions and would recover within a short period of time.

Indirect Impacts

<u>Surface Water</u>

Construction of Alternative 1 would result in ***short-term, less-than-significant adverse*** impacts to surface water from installation and removal of temporary sheet piling and installation of stormwater drainage piping, a tide gate, and the surge barrier during construction of the proposed LOP. These construction activities have the potential to temporarily mobilize sediment and associated contaminants to off-site locations; however, construction BMPs associated with NPDES permitting requirements for erosion and sediment control (e.g., turbidity curtains, silt fences, etc.) would minimize these potential impacts.

Operation of Alternative 1 would be expected, however, to result in ***long-term beneficial*** effects to off-site surface water quantity, flow, quality, and sediment quality and transport by increasing flood protection against coastal storm surges and flooding during heavy storms, which would lead to a reduction in the frequency and magnitude of turbidity and pollutant-loading events at the Berry's Creek storm surge barrier. The HEC-RAS modeling results indicate that within Berry's Creek, water velocities and hence shear stress would be lower with the storm surge barrier than under the No Action Alternative. This would result in a

[68] Temporary wetland impacts are typically identified as any disturbance that affects the existing wetland soils that are restored when construction activities are complete, ultimately resulting in retention of wetland area and function (i.e., no loss). This disturbance can include stockpile material or temporary excavation of existing wetland soils.

beneficial reduction of scour and sediment transport, including transport of contaminants, within surface waters. The detailed evaluation of potential project impacts from tributary scour and sediment transport are included in **Appendix I**. Similarly, the LOP would reduce coastal flooding throughout the Project Area, thereby leading to an overall reduction in sediment transported into the Project Area, and a reduction in sediment disrupted by floodwaters due to erosion (see **Section 4.15.4.2**). No indirect effects to sediment transport are anticipated downstream of the existing tide gates in West Riser Ditch, East Riser Ditch, Losen Slote, and DePeyster Creek. In addition, localized surface water quality improvements would result from proposed parks and native plantings associated with Alternative 1; these would reduce the velocity of stormwater runoff and trap solids before entering surface waters in affected locations.

The conversion of impervious surfaces to pervious surfaces (net decrease of 0.8 acre), improved stormwater management, and wetland creation would provide localized indirect water quality and flow benefits by decreasing stormwater and pollutant loading (see **Section 4.19**). The establishment of the proposed Fluvial Park would provide indirect beneficial effects to surface water quality and flow, as the created wetlands, native riparian and upland plantings, and pervious surfaces would serve to enhance treatment of stormwater before discharge to the Hackensack River. Similar benefits would be expected at the other parks, depending on site use and landscaping. Overall, Alternative 1 would be expected to reduce annual stormwater runoff in the Project Area by approximately 3.2 million gallons. Additionally, new trees, which would have varying rates of water uptake over time due to growth, would further reduce stormwater runoff by approximatley 10,000 gallons over the next 50 years. These stormwater runoff reductions would improve surface water quality through removal of suspended sediment, nutrients, and contaminants during precipitation and coastal flooding events. Changes to surface water hydrology and hydraulics are further discussed in **Section 4.18**, and potential impacts from sediment quality documented at hazardous waste sites are further discussed in **Section 4.20.4.4**.

Groundwater

No indirect short- or long-term impacts to groundwater are anticipated from implementation of Alternative 1. However, some Alternative 1 components (i.e., landscaping at new parks) would be designed to increase local stormwater infiltration. Increased infiltration could mobilize subsurface soil contaminants and have the potential to mobilize a contaminant plume. These potential impacts are further described in **Section 4.20.4.2**.

Wetlands and WOUS

No indirect short-term impacts to wetlands are anticipated as a result of Alternative 1. However, operation of Alternative 1 could result in ***long-term, less-than-significant adverse*** impacts to wetland area, functions, and services upstream of the proposed tide gate on the unnamed tributary to the Hackensack River. The tidal regime within this area would be impacted by the installation of the proposed new tide gate. The new tide gate would influence the transport of water, nutrients, and sediment to the upstream wetlands, which would alter the wetland area, type, functions, and services. However, as the tributary consists of a short length of open channel prior to transitioning to a subsurface piped conveyance, the associated wetland area upstream of the proposed structure is small. In addition, the tributary is adjacent to the BCUA wastewater treatment facility and filled lands; there is no direct connection to estuarine wetlands. Therefore, the existing functions and services of this wetland are diminished.

Long-term beneficial effects to wetland functions and services throughout the Project Area would be anticipated under Alternative 1 through: (1) increased protection of wetlands from the effects of SLR; and (2) increased flood protection against coastal storm surges. Specifically, operation of Alternative 1 would reduce the anticipated areal extent of wetlands potentially impacted by SLR in future conditions.[69] Moreover, the placement of the floodwall would protect the ecologically valuable and wooded wetland complexes around Losen Slote.

Operation of Alternative 1 also would result in ***long-term beneficial*** effects to wetlands in the watershed upstream of the proposed Berry's Creek storm surge barrier. As discussed in **Section 4.17**, increased flood protection under Alternative 1 would be most concentrated in the Berry's Creek watershed, including along Peach Island Creek and the lower portions of East and West Riser Ditches, and along the Hackensack River in the Losen Slote watershed. These areas include industrial and residential properties, as well as existing natural areas including wetland resources. During coastal flood events, the storm surge barrier would influence the transport of water, nutrients, and sediment to the upstream wetlands that are hydrologically connected to Berry's Creek, the East Riser Ditch, West Riser Ditch, and Peach Island Creek.

Mitigation Measures and BMPs

Potentially significant adverse impacts to water resources have been identified from the proposed construction and operation of Alternative 1. These include potential adverse effects to wetlands and open waters due to dredge and fill activities, alteration of habitat, and placement of new infrastructure. Proposed mitigation measures to minimize impacts to surface water, groundwater, wetlands, and other regulated waters during construction have been identified in **Sections 4.14** (Biological Resources), **4.15** (Geology and Soils), and **4.18** (Coastal Zone Management). Implementation of these resource-specific measures would concurrently reduce related effects to water resources. The following mitigation measures and BMPs would be implemented to reduce the identified potentially significant adverse impacts.

- During the design process, impacts to riparian zones, wetlands, and transition areas (i.e., wetland buffers) would be avoided and minimized to the extent practicable. Temporarily impacted wetlands and buffers would be restored immediately following construction. As part of the project permitting process, a compensatory mitigation plan would be developed and implemented to compensate for long-term unavoidable impacts to regulated wetlands and other WOUS associated with dredging, filling, or other permanent alteration. The plan would be developed in cooperation with the MIMAC (the Interagency Review Team). The plan would consist of purchasing mitigation credits; onsite or offsite creation, restoration, or enhancement of wetlands; or a combination of mitigation methods, in accordance with the Compensatory Mitigation for Losses of Aquatic Resources Final Rule (33 CFR Parts 325 and 332). Wetland and waterbody impacts from construction dredge and fill activities would be coordinated with the NJDEP, USACE, and other applicable regulatory agencies during project permitting. It is anticipated the proposed construction would require a USACE individual permit for proposed impacts to WOUS, including wetlands, and a NJDEP permit for regulated activities in channels and riparian zones.
- In order to minimize the spatial extent and duration of construction impacts to surface water flow, water quality, and sediment transport, BMPs such as silt curtains and turbidity barriers would be implemented during construction, and construction would be conducted in accordance with Federal and State permits, and any conditions specified therein. To reduce the risk of erosion, sedimentation, and associated water quality impacts, a project-specific SWPPP in

[69] As sea level rises and the tidal influence extends farther inland, existing tidal wetlands could be converted to unvegetated tidal flats and open water, and existing freshwater wetlands could be converted to tidal wetlands.

accordance with NJ Stormwater Management Act NJAC 7:8 would be prepared and implemented. The Bergen County Soil Conservation District would review and certify the Soil Erosion and Sediment Control Plans as mandated by the Soil Erosion and Sediment Control Act, Chapter 251, Public Law 1975. Silt fences and stabilized entrances to construction sites would be deployed in accordance with the SWPPP. Mulch or other suitable ground cover would be placed on all slopes following grading. Slopes would be seeded with plant materials approved by the Bergen County Soil Conservation District.

- In order to minimize the spatial extent and duration of construction impacts to groundwater flow and groundwater quality during temporary dewatering, BMPs, such as silt fencing and hay bales, would be implemented during construction, and construction would be conducted in accordance with Federal and State permits, and any conditions specified therein.
- In order to minimize the spatial extent and duration of construction impacts to wetland area, functions, and services, BMPs such as silt curtains and turbidity barriers would be implemented during the construction phase, and construction would be conducted in accordance with Federal and State permits, and any conditions specified therein. In addition, wetland and open water areas would be restored to pre-construction or enhanced condition at the completion of construction.
- Coordination with the NJDEP, USACE, USCG, NMFS, NJSEA, and other applicable regulatory agencies would be conducted and all necessary permits obtained prior to construction, in accordance with CWA Sections 404 and 401, Rivers and Harbors Act Section 10, NJDEP Freshwater Wetlands Rules, and NJDEP Coastal Zone Management Rules.
- Coordination with the USEPA and BCSA Cooperating Potentially Responsible Parties (PRP) Group would be conducted during the final design process to ensure the Proposed Project does not adversely impact the ongoing BCSA PRP Group remediation project.

4.16.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding in the Project Area, but continued and increased flooding from coastal storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following **direct** impacts:

- ***Long-term, potentially significant adverse*** impacts to surface water quantity, flow, and quality from proposed installation of the permanent pilings and elevated walkways over the Hackensack River at Fluvial Park.
- ***Long-term, potentially significant adverse*** impacts to localized sediment and contaminant transport by increasing the depth and velocity of water within the immediate vicinity of the Losen Slote and East Riser Ditch pump station discharge locations.
- ***Long-term, potentially significant adverse*** impacts to wetlands, open waters, and wetland functions and services as well as riparian zones from placement of permanent fill or structures in wetlands or open waters.
- ***Short-term, less-than-significant adverse*** impacts to localized surface water flow and quality from dredging, dewatering, placement of temporary fill, and grading activities during construction of the waterfront parks (Fluvial Park, DePeyster Creek Park, and Riverside Park), East Riser ditch dredging and culvert/bridge replacements, and installation of pump station discharge locations.

- ***Short-term, less-than-significant adverse*** impacts to groundwater flow and quality from dewatering and grading activities during construction.
- ***Short-term, less-than-significant adverse*** impacts to wetland areas, functions, and services as well as riparian zones from dewatering, temporary fill, vegetation removal, and grading activities during construction activities.
- ***Long-term, less-than-significant adverse*** impacts to groundwater quality from the localized accumulation of contaminants where stormwater runoff infiltrates to the shallow groundwater aquifer during the operation of green infrastructure systems.
- ***Long-term beneficial*** effects to wetland functions and services where wetlands would be created or enhanced.

Alternative 2 would result in the following **indirect** impacts:

- ***Short-term, less-than-significant adverse*** impacts to surface water from vegetation removal and grading activities during construction.
- ***Long-term, less-than-significant adverse*** impacts to surface water flow, water quality, and sediment and contaminant transport at off-site locations downstream of the proposed outlets from the Losen Slote pump stations following flooding events.
- ***Long-term, less-than-significant adverse*** impacts to surface water flow, water quality, and sediment and contaminant transport upstream of the proposed construction of the pump station, culvert/bridge replacements, and dredging within the East Riser Ditch.
- ***Long-term beneficial*** effects to surface water quantity, flow, and quality, as well as sediment and contaminant transport downstream from proposed green infrastructure systems, wetland enhancements and creation, conversion of impervious surfaces to pervious surfaces (net decrease of 3.4 acres), the pump stations, and East Riser Ditch improvements.
- ***Long-term beneficial*** effects to off-site wetland functions and services from the construction of the proposed stormwater improvements.

The following subsections provide greater detail.

Direct Impacts

<u>Surface Water</u>

Construction of Alternative 2 would involve some in-water work, such as dredging, dewatering, placement of temporary fill, and grading activities during development of Fluvial Park, Riverside Park, and DePeyster Creek Park near the Hackensack River; construction of the Losen Slote pump station discharge locations and removal of the defunct tide gate; and culvert/bridge replacements and dredging within the East Riser Ditch. These activities would result in ***short-term, less-than-significant adverse*** impacts to surface water quantity, flow, and quality. Surface water flow would be altered during construction as water is diverted during dewatering, specifically during dredging activities in East Riser Ditch. The installation of the pump stations at East Riser Ditch and Losen Slote would be phased to maintain flow during construction, but would still produce minor effects to water flow. At all sites, surface water quality would be temporarily impacted due to increases in suspended sediment during ground and waterbody disturbance activities. These construction impacts are expected to be less than significant as affected resources would recover within a short period of time, impacts would be localized, and impacts would not substantially affect the designated uses of surface water resources. Additionally, based on preliminary SVAP analysis, all surface waters in which construction activities would occur are all considered to be in poor condition. No short-term impacts to surface waters are anticipated during construction of the green infrastructure components, including bioswales, rain gardens, storage trenches, and permeable surfaces, as these would be located in upland urbanized areas.

Similar to Alternative 1, the installation of permanent pilings and elevated walkways within and over the Hackensack River below the MHW line at Fluvial Park would result in ***long-term, potentially significant adverse*** impacts to surface water quantity, flow, and quality by filling surface waters and reducing surface water area. Although these impacts would be potentially significant, they would be localized and would not substantially diminish water resources throughout the Project Area. In addition, these effects would be partially offset through the proposed wetland creation measures included in Alternative 2 (see below).

The operation of the Losen Slote and East Riser Ditch pump stations would result in ***long-term, potentially significant adverse*** impacts to localized sediment and contaminant transport by increasing the depth and velocity of water within the immediate vicinity of the pump station discharge locations. The HEC-RAS model results indicate that the shear stress would be slightly higher than the No Action Alternative, critical shear stress would be exceeded within the immediate vicinity of the discharge point, and critical shear stress would not be exceeded downstream. Although these impacts would be potentially significant, they would be localized and would not substantially diminish water resources throughout the Project Area. Energy dissipation features would be included in the final design to avoid and minimize these impacts. The detailed evaluation of potential project impacts from tributary scour and sediment transport are included in **Appendix I**.

<u>Groundwater</u>

Alternative 2 would result in no impacts to groundwater used as a drinking water source.

Alternative 2 construction activities would result in ***short-term, less-than-significant adverse*** impacts to groundwater flow and quality. Since shallow groundwater is prevalent throughout the Project Area, construction of Alternative 2 would likely require temporary dewatering. The type of impact to groundwater quality and quantity would be similar to Alternative 1; however, the locations, extents, and depths of construction activities would be less under Alternative 2. These short-term impacts are expected to be less than significant as groundwater quality would recover within a short period of time, impacts would be localized, and impacts would not substantially affect the designated uses of groundwater resources throughout the Project Area. Alternative 2 would not be expected to result in impacts to groundwater quantity, as dewatering activities would be short-term.

The operation of the green infrastructure features, including bioswales, rain gardens, storage trenches, and permeable surfaces, would result in ***long-term, less-than-significant adverse*** impacts to groundwater quality from the localized accumulation of contaminants where stormwater runoff infiltrates to the shallow groundwater aquifer. These green infrastructure features would capture stormwater runoff near the source of runoff generation, and allow for infiltration and seepage of contaminants to the shallow groundwater aquifer where runoff does not directly discharge to the storm sewer system. This impact would be localized and would not substantially diminish groundwater quality throughout the Project Area.

Wetlands and WOUS

Permanent Impacts to Wetlands

Implementation of Alternative 2 would result in ***long-term, potentially significant adverse*** impacts to wetlands, open waters, riparian zones, and wetland functions and services from placement of permanent fill or structures to construct the East Riser Ditch pump station and the proposed elevated walkways at Fluvial Park. As shown in **Table 4.16-3** and illustrated in **Figure 4.16-4** and **Figure 4.16-5**, a total of approximately 9.9 acres of wetlands and WOUS would be impacted. Of the approximately 9.9 acres, 0.6 acre would be permanently impacted; they include (from most to least): freshwater emergent wetlands (0.3 acre), tidal open water (0.2 acre), and non-tidal open water (0.1 acre). Additionally, permanent impacts to State-regulated riparian zones along open water would total 1.4 acres.

In comparison, Alternative 1 would permanently impact approximately 2.2 acres of wetlands and open water and approximately 8.8 acres of State-regulated riparian zones. Therefore, permanent impacts to wetlands, open waters, and riparian zones would be less under Alternative 2.

Table 4.16-3: Anticipated Alternative 2 Wetland and WOUS Impacts

Classification	Total Impact (Acres)	Permanent* Impact (Acres)	Temporary** Impact (Acres)
Freshwater Emergent Wetlands	3.3	0.3	3.0
Freshwater Forested Wetlands	0.1	0.0	0.1
Tidal Emergent Wetlands	1.1	0.0	1.1
Tidal Open Water	1.9	0.2	1.7
Non-Tidal Open Water	3.5	0.1	3.4
Totals	**9.9**	**0.6**	**9.3**

* Permanent impacts represent a long-term impact (e.g., permanent loss of area or function).
** Temporary impacts represent a short-term impact (e.g., the total wetland area and function is restored fully upon completion of construction activities).

While 0.6 acre of wetlands and open water would be permanently impacted by the construction and operation of Alternative 2, much of these wetlands are degraded due to their location in an urban environment where they have been subject to previous impacts, and are located near roads or other structures that diminish their quality. Also, several impacts to specific wetland areas represent very small portions of substantially larger wetland complexes. In addition, approximately 7.2 acres of wetlands would be created and/or enhanced within the proposed Fluvial Park, Riverside Park, DePeyster Creek Park, Caesar Place Park, and Avanti Park under Alternative 2. These enhanced or created wetlands would partially replace wetland functions and services lost during the construction and operation of Alternative 2, which has the potential to result in ***long-term beneficial*** effects to wetland functions and services in the Project Area.

Temporary Impacts to Wetlands

Similar to Alternative 1, implementation of Alternative 2 would also result in temporary impacts to wetlands during construction, resulting in ***short-term, less-than-significant adverse*** impacts to wetland area, functions, and services. These impacts would occur from dewatering, temporary fill, vegetation removal, and grading activities during construction. As shown in **Table 4.16-3**, a total of approximately 9.9 acres of wetlands and WOUS would be impacted. Of the approximately 9.9 acres, 9.3 acres would be temporarily impacted; they include (from most to least): non-tidal open water (3.4 acres), freshwater emergent wetlands (3.0 acres), tidal open water (1.7 acres), tidal emergent wetlands (1.1 acres), and freshwater forested wetlands (0.1 acre). Additionally, construction and operation of Alternative 2 would temporarily impact 7.3 acres of State-regulated riparian zone.

In comparison, Alternative 1 would temporarily impact approximately 2.1 acres of wetlands and open water and approximately 2.3 acres of State-regulated riparian zones. Therefore, temporary impacts to wetlands, open waters, and riparian zones would be greater under Alternative 2.

Construction of Alternative 2 would require in-water work for the placement of proposed structures, such as the construction of the pump station, culvert/bridge replacements, and dredging within the East Riser Ditch; construction of the pump station discharge locations along Losen Slote; and removal of the defunct Losen Slote tide gate. These activities would result in removal of wetland and riparian vegetation and increases in turbidity for the duration of in-water construction activities adjacent to watercourses and wetlands in the Project Area. Therefore, Alternative 2 has the potential to result in ***short-term, less-than-significant adverse*** impacts to the quality of wetland/riparian resources. Following construction, these localized areas of impact (i.e., 9.3 acres of wetlands and open water and 7.3 acres of riparian zones) would be restored to pre-construction conditions and would recover within a short period of time.

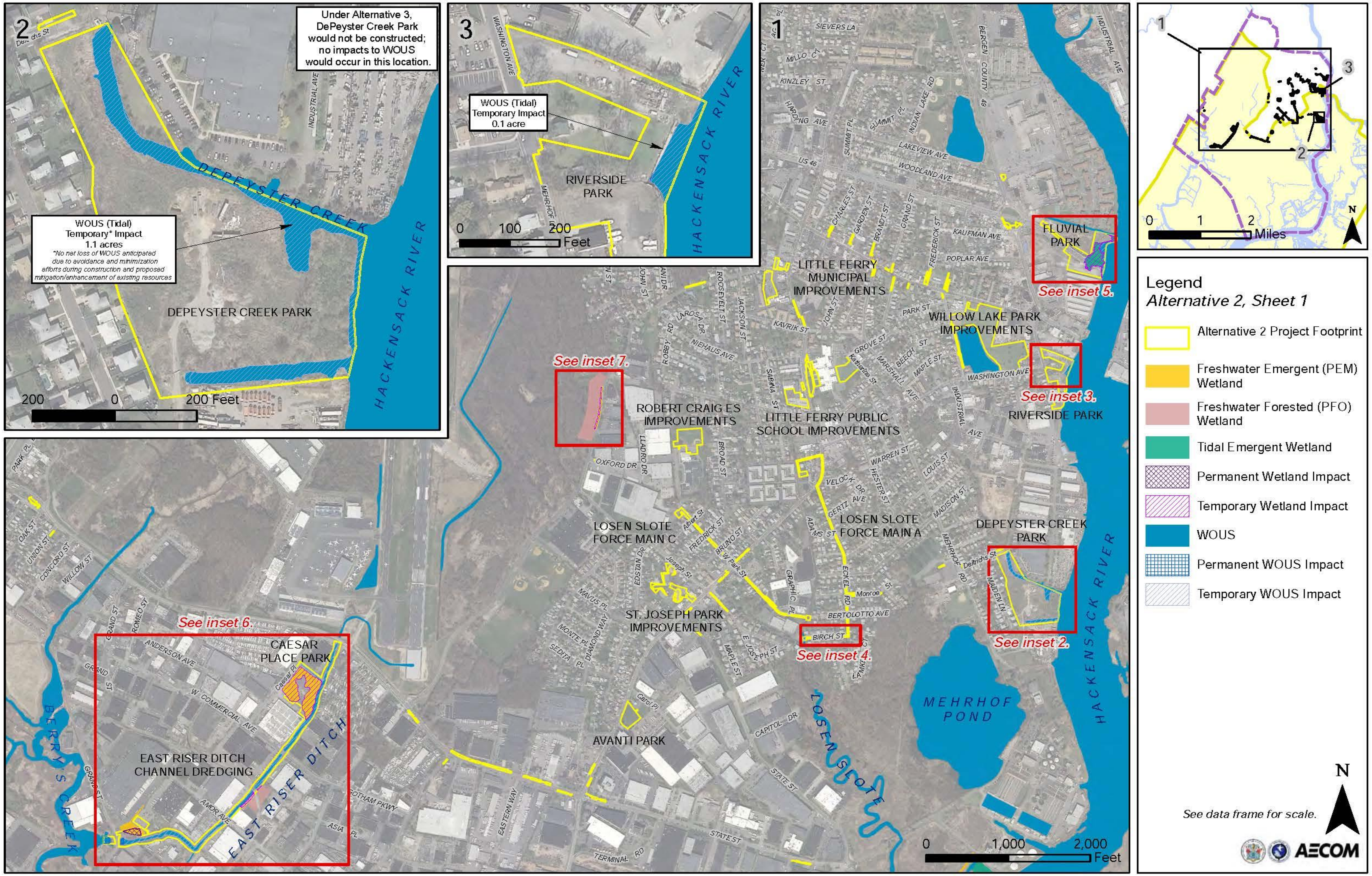


Figure 4.16-4: Anticipated Alternative 2 and Alternative 3 Wetland and WOUS Impacts (Sheet 1)

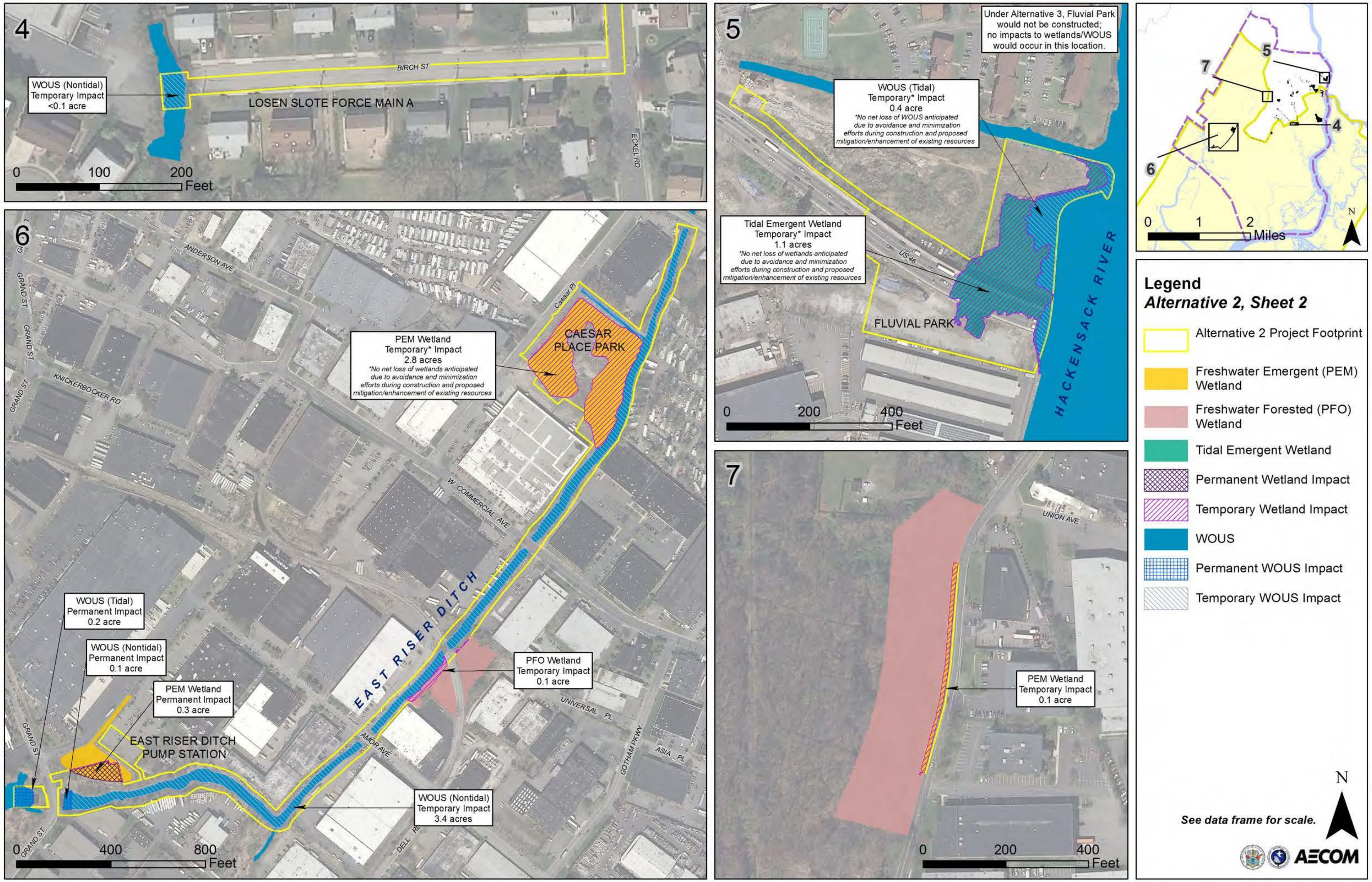


Figure 4.16-5: Anticipated Alternative 2 and Alternative 3 Wetland and WOUS Impacts (Sheet 2)

Indirect Impacts

Surface Water

Construction of Alternative 2 would result in ***short-term, less-than-significant adverse*** impacts to surface water from vegetation removal and grading activities near waters and wetlands. These construction activities have the potential to temporarily mobilize sediment and associated contaminants to off-site locations; however, construction BMPs associated with NPDES permitting requirements for erosion and sediment control (e.g., turbidity curtains, silt fences, etc.) would minimize these potential impacts.

Operation of Alternative 2 would result in ***long-term, less-than-significant adverse*** impacts to surface water flow, water quality, and sediment and contaminant transport at off-site locations downstream of the proposed outlets from the Losen Slote pump stations following flooding events. During these events, the timing of the additional surface water discharged to the channel would alter the volume and frequency of channel-forming stream flows, which would increase water depth and stream velocity and transport available sediment and associated contaminants downstream. Although these impacts would be potentially significant, the HEC-RAS model results indicate that the critical shear stress would not be exceeded substantially downstream of the discharge point, and as such, impacts would be localized and would not substantially diminish water resources throughout the Project Area.

Operation of Alternative 2 would result in ***long-term, less-than-significant adverse*** impacts to surface water flow, water quality, and sediment and contaminant transport at locations upstream of the proposed pump station, culvert/bridge replacements, and dredging within the East Riser Ditch. Within the East Riser Ditch system the new larger culverts, bridge, channel cross section, and pump station would increase the capacity of the system to move more surface water and sediment downstream during a flood event. This would result in decreased water depth and increased water velocity upstream of the proposed work, which would increase the localized shear stress and likelihood of sediment and contaminant transport. The HEC-RAS model results indicate that the critical shear stress would be exceeded for 10 to 20 hours longer than the No Action Alternative upstream of Moonachie Avenue for the 2-year, 10-year, 50-year, and 100-year return interval storms. Downstream of Moonachie Avenue the critical shear stress would not be exceeded for these storm events, and so the impacts would be localized to the reach immediately upstream of Moonachie Avenue. These impacts would be localized and would not substantially diminish water resources throughout the Project Area. The detailed evaluation of potential project impacts from tributary scour and sediment transport are included in **Appendix I.**

Operation of Alternative 2 would be expected to result in ***long-term beneficial*** effects to surface water quantity, flow, quality, and sediment and contaminant transport downstream from proposed green infrastructure systems, wetland enhancements and creation, conversion of impervious surfaces to pervious surfaces (net decrease of 3.4 acres), the pump stations, and East Riser Ditch improvements. Similar to Alternative 1, these components would provide downstream and off-site water quality and flow benefits by decreasing stormwater and pollutant loading (see **Section 4.19**). The green infrastructure systems and wetlands would capture stormwater runoff near the source of runoff generation, and allow for infiltration and seepage to the shallow groundwater aquifer, or direct discharge to the storm sewer system. These green infrastructure features would reduce the volume and delay the timing of stormwater surface runoff, and serve to improve downstream water quality by reducing sediment and contaminant transport through capture and treatment near the source. Alternative 2 would be anticipated to reduce annual stormwater runoff in the Project Area by approximately 24.9 million gallons. Additionally, new trees would further reduce stormwater runoff by approximatley 56,000 gallons over the next 50 years. For stormwater runoff that is not infiltrated into the soil or taken up vegetation, the green infrastructure systems would be designed to remove approximately 80 percent of total suspended solids, approximately 60 percent of total phosphorus, and approximately 30 percent of total nitrogen from the runoff, thereby reducing pollutant loading in the Project Area's surface waterbodies.

The East Riser Ditch improvements and three pump stations with the East Riser and Losen Slote drainage areas would increase the stormwater conveyance capacity, thereby reducing the frequency of flooding events upstream.

<u>Groundwater</u>

No indirect short- or long-term impacts to groundwater are anticipated from implementation of Alternative 2. Similar to Alternative 1, the proposed green infrastructure systems under Alternative 2 that induce groundwater recharge could mobilize a contaminant plume if located over or near existing contaminated soils and groundwater. These impacts are further described in **Section 4.20.4.2**.

<u>Wetlands and WOUS</u>

No indirect short- or long-term adverse impacts to existing wetlands are anticipated as a result of Alternative 2. However, ***long-term beneficial*** effects to off-site wetland functions and services throughout the Project Area would be anticipated from the proposed construction of stormwater conveyance capacity, infiltration, and treatment improvements under Alternative 2.

Mitigation Measures and BMPs

Potentially significant adverse impacts to water resources have been identified from the proposed construction and operation of Alternative 2. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***potentially significant, adverse*** impacts under Alternative 2 (see **Section 4.16.4.2**). In addition, the following measure would be implemented to address potentially significant adverse effects to sediment and contaminant transport at the three East Riser Ditch and Losen Slote pump station discharge locations.

- In order to minimize the spatial extent and duration of scour and sediment transport as a result of storm events, energy dissipation structures would be installed at the Losen Slote and East Riser Ditch pump station discharge locations. These structures would be designed to minimize the frequency and duration of localized scour, and minimize downstream transport of sediment and contaminants.

4.16.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer stormwater improvements due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects water resources, and thus would not change the impact analysis.

Because of the overall similarity in design between Alternative 2 and Alternative 3, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the specific differences between the alternatives.

Direct Impacts

Surface Water

Construction of Alternative 3 would require less ground-disturbing activities and in-water work than both Alternatives 1 and 2. Therefore, ***short-term, less-than-significant adverse*** impacts to surface water quantity, flow, water quality, as well as sediment and contaminant transport from dredging, dewatering, placement of temporary fill, and grading activities would be expected to be less under Alternative 3. However, no impact would occur from the installation of permanent pilings and elevated walkways within and over the Hackensack River because Fluvial Park would not be constructed.

Long-term, potentially significant adverse impacts to localized sediment and contaminant transport by increasing the depth and velocity of water within the immediate vicinity of the Losen Slote and East Riser Ditch pump station discharge locations would also occur under Alternative 3. However, these impacts would be slightly less within the Losen Slote drainage area because only one pump station would be constructed.

Groundwater

Under Alternative 3, ***short-term, less-than-significant adverse*** impacts to groundwater flow and quality would be slightly less than Alternatives 1 and 2 because construction footprints would be smaller.

Wetlands and WOUS

Permanent Impacts to Wetlands

As shown in **Table 4.16-4**, approximately 0.6 acre of permanent impacts to wetlands and open water would occur under Alternative 3. Additionally, construction and operation of Alternative 3 would permanently impact 0.8 acre of State-regulated riparian zone along open water.

In comparison, Alternative 1 would permanently impact approximately 2.2 acres of wetlands and open water and approximately 8.8 acres of State-regulated riparian zones, and Alternative 2 would impact 0.6 acre of wetlands and open waters and 1.4 acres of State-regulated riparian zone. Therefore, under Alternative 3, permanent impacts to wetlands and open waters would be the same as Alternative 2 and less than Alternative 1, while impacts to State-regulated riparian zones would be less than both Alternatives 1 and 2.

Table 4.16-4: Anticipated Alternative 3 Wetland and WOUS Impacts

Classification	Total Impact (Acres)	Permanent* Impact (Acres)	Temporary** Impact (Acres)
Freshwater Emergent Wetlands	3.3	0.3	3.0
Freshwater Forested Wetlands	0.1	0.0	0.1
Tidal Emergent Wetlands	0.0	0.0	0.0
Tidal Open Water	0.3	0.2	0.1
Non-Tidal Open Water	3.5	0.1	3.4
Totals	**7.2**	**0.6**	**6.6**

* Permanent impacts represent a long-term impact (e.g., permanent loss of area or function)

** Temporary impacts represent a short-term impact (e.g., the total wetland area and function is restored fully upon completion of construction activities).

Similar to Alternative 2, approximately 0.6 acre of wetland and open water would be permanently impacted by the construction and operation of Alternative 3. In general, these wetlands are currently degraded. Also, several impacts to specific wetland areas represent very small portions of substantially larger wetland complexes. However, only approximately 3.5 acres of wetlands would be enhanced or created under Alternative 3 due the exclusion of Fluvial Park and DePeyster Creek Park. These enhanced or created wetlands would partially replace wetland functions and services lost during the construction and operation of Alternative 3. Therefore, Alternative 3 has the potential to result in ***long-term beneficial*** effects to wetland functions and services in the Project Area, but to a lesser extent than Alternative 2.

Temporary Impacts to Wetlands

As shown in **Table 4.16-4**, approximately 6.6 acres of temporary impacts to wetlands and open water would occur under Alternative 3. Additionally, construction and operation of Alternative 3 would temporarily impact approximately 4.1 acres of State-regulated riparian zone.

In comparison, Alternative 1 would temporarily impact approximately 2.1 acres of wetlands and open water and approximately 2.3 acres of State-regulated riparian zones, and Alternative 2 would impact 9.3 acres of wetlands and open waters and 7.3 acres of State-regulated riparian zone. Therefore, under Alternative 3, temporary impacts to wetlands and open waters would be less than Alternative 2, but greater than Alternative 1.

Indirect Impacts

Because Alternative 3 would include less ground-disturbing activities, fewer stormwater improvements, and only approximately 3.5 acres of wetland creation and enhancement, the following indirect impacts would be expected to be less than under Alternatives 1 and 2.

- ***Short-term, less-than-significant adverse*** impacts to surface water from vegetation removal and grading activities during construction.
- ***Long-term, less-than-significant adverse*** impacts to surface water flow, water quality, and sediment and contaminant transport at off-site locations downstream of the proposed Losen Slote pump station outlet following flooding events.
- ***Long-term beneficial*** effects to surface water quantity, flow, and quality, as well as sediment and contaminant transport downstream, due to proposed green infrastructure systems, wetland enhancements and creation, conversion of impervious surfaces to pervious surfaces (net decrease of 3.7 acres), the pump stations, and East Riser Ditch improvements. Alternative 3 would be anticpated to reduce annual stormwater runoff in the Project Area by approximately 19.0 million gallons, and new trees would be expected to take up an additional approximately 35,000 gallons over the next 50 years.
- ***Long-term beneficial*** effects to off-site wetland functions and services from the construction of the proposed stormwater improvements.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to further reduce the identified ***potentially significant, adverse*** impacts under Alternative 3 (see **Section 4.16.4.3**).

4.17 Hydrology and Flooding

The Project Area is an urbanized watershed that continues to be impacted by historic and ongoing development. The low-lying topography of the Project Area, coupled with a relatively high groundwater level, play major roles in the local hydrology and inland flooding due to run-off, lack of water storage, and restricted conveyance. This section analyzes the potential impacts of the Build Alternatives and the No Action Alternative on the hydrology and flooding in and around the Project Area. As described in **Section 3.17**, there are two causes of flooding in the Project Area: (1) flooding from coastal storm surge and (2) from excessive stormwater runoff. These two sources of flooding may be independent or coincidental to one another depending on the type of storm event or tidal conditions that occur in the Project Area at the specific time of the event.

This analysis considers potential impacts to and from coastal (storm surge-related) flooding, stormwater management and flooding, and coincidental events that include both coastal and stormwater components. Impacts to hydrology and flooding can be either direct or indirect. An example of a direct impact would be if the Proposed Project would alter the water table in the Project Area due to changes in surface water runoff. An indirect impact would occur if the Proposed Project would induce flooding in areas outside of the Project Area.

This analysis specifically addresses the potential for the Proposed Project’s considered alternatives to affect hydrology and flooding during both construction and operation, either by direct effects or by causing indirect effects that alter these conditions in the future. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.17.1 Definition of Study Area

As described in **Section 3.17**, the study area for this analysis includes the Project Area and areas adjacent to (downstream of) and across the Hackensack River. This study area was defined based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to hydrology and flooding in and around the Project Area in accordance with 40 CFR 1508.27.

4.17.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect hydrology and flooding effects of the alternatives are shown in **Table 4.17-1**.

Table 4.17-1: Hydyology and Flooding Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Hydrology and Flooding Change	• Would not alter inland flooding due to stormwater runoff • Would not alter flooding due to a coastal storm surge • Would not change hydrology in the study area
	Indirect Hydrology and Flooding Change	• Would not induce flooding outside of the Project Area • Would not change hydrology outside of the Project Area
	Applies to All Effect Types	• Would result in no discernable changes to hydrology or flooding in the study area • Would only alter flooding or hydrology for an indiscernible or negligible period of time
Less-than-Significant	Direct Hydrology and Flooding Change	• Would temporarily disrupt the water table due to changes in surface water runoff • Would temporarily alter hydrology, flooding, or flood elevations during construction • Would temporarily increase normal water or flood levels in open channels
	Indirect Hydrology and Flooding Change	• Would result in minor induced flooding outside of the Project Area in environmental areas or areas unlikely to be further developed • Would temporarily induce flooding or change hydrology outside of the Project Area during construction
	Applies to All Effect Types	• Hydrology or flooding would only be altered for a short, finite period, and would return to its original conditions • Short-term impacts would be localized in specific areas and not substantially affect hydrology or flooding
Potentially Significant	Direct Hydrology and Flooding Change	• Would adversely and permanently alter hydrology, flooding, or flood elevations • Would substantially and/or permanently increase normal water or flood levels in open channels • Would result in substantial alteration of local open channel hydrology
	Indirect Hydrology and Flooding Change	• Would result in significant induced flooding outside of the Project Area
	Applies to All Effect Types	• Hydrology or flooding would be adversely altered for an extended period or permanently • Impacts would substantially adversely affect hydrology or flooding

<table>
<tr><th>Impact Level</th><th>Type of Effect</th><th>Impact Description</th></tr>
<tr><td rowspan="3">Beneficial</td><td>Direct Hydrology and Flooding Change</td><td>• Would reduce flooding during coastal storm events
• Wood reduce flooding during rainfall events
• Would beneficially change normal water or flood levels in open channels
• Would improve stormwater management and drainage networks in developed portions of the Project Area</td></tr>
<tr><td>Indirect Hydrology and Flooding Change</td><td>• Would reduce flooding and/or improve hydrology outside of the Project Area
• Would induce future activities or development that would improve hydrology or reduce flooding</td></tr>
<tr><td>Applies to All Effect Types</td><td>• Would result in hydrology or flooding benefits, improvements, and/or reductions</td></tr>
</table>

4.17.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to hydrology and flooding within the study area. To conduct this analysis, each considered alternative was evaluated by comparing existing flooding conditions under various event frequencies with the proposed improved or changed flooding condition. Where appropriate, this analysis included evaluating downstream and adjacent areas for any potentially induced flooding impacts. In addition, the potential for Proposed Project features to induce flooding beyond that which currently occurs within the Project Area was evaluated, as were potential changes in stormwater runoff during coastal surge events.

The methodologies for the analysis are described in the subsections that follow. Where potential adverse effects were identified, mitigation measures were recommended, as appropriate. Alternatives were also assessed for compliance with the FHACA (NJSA 58:16A:-50 *et seq.*) and the New Jersey Storm Water Management Rules (NJAC 7:8).

4.17.3.1 Coastal Flooding

As proposed under Alternatives 1 and 3 (see **Sections 2.5.2** and **2.5.4**), coastal flood protection components would reduce storm surge-induced flooding within the Project Area, but could increase flooding opposite the LOP on the other side of the Hackensack River or in downstream areas. To determine and quantify such potential impacts, detailed modeling of the storm surge scenarios was undertaken (NJDEP 2018). Three coastal hydrodynamic models were used for the surge analysis, as well as two wave models that served different purposes. A high-resolution MIKE21 model (0.7 million elements) was developed and, in conjunction with a regional ADCIRC model, was used to evaluate effects on water levels. The MIKE21 model domain included both the Hackensack River (to the Oradell Dam) and Passaic River (to the Dundee Dam) and extended south to Bergen Point, New Jersey. Sensitivity testing confirmed that this domain was sufficiently large to capture any effects from proposed coastline modification. These models were run under various storm conditions with and without the Proposed Project components in order to evaluate the potential for induced flooding in adjacent areas, as well as to calculate the level of protection afforded to the Project Area.

Based on Proposed Project plans, analyses of site-specific flood elevations, and the resulting delineation of the multiple frequency storm events, engineers determined the potential changes in flood stages within the study area, including the Project Area and areas potentially affected by the Proposed Project. Changes in water surface elevations at various frequency events were evaluated and quantified to the extent possible.

4.17.3.2 Stormwater Improvements

As proposed under Alternatives 2 and 3 (see **Sections 2.5.3** and **2.5.4**), improved conveyance as a result of channel and pipe improvements would facilitate better drainage and reduce interior stormwater flooding in the Project Area. Likewise, a decrease in impervious surfaces or an increase in pervious surfaces (e.g., open green spaces) may have a positive impact on drainage of stormwater from the study area by reducing runoff.

To conduct this analysis, drainage models were developed to simulate the flow of water through the existing main channels, overbank areas, and, in some cases, through existing storm drain pipe and ditch networks within the Project Area (NJDEP 2018). Two-dimensional hydraulic models were developed for the East and West Riser Ditches, Losen Slote, DePeyster Creek, and Peach Island Creek to evaluate how improvements to these conveyances would improve drainage from adjacent residential, commercial, and industrial areas. Existing channel, floodplain, and storm drain network data were combined with newly collected data to construct the model geometries. Runoff flows for the 2-, 5-, 10-, 25-, 50-, and 100-year rainfall events obtained from the HEC-HMS modeling effort were routed through the models for both with and without Proposed Project conditions. In addition, storm drainpipe and ditch network models were developed using InfoWorks® ICM (Integrated Catchment Modeling); network models were developed for six sub-drainage areas within the Project Area. The proposed components evaluated in this modeling effort included conventional drainage improvements, conveyance increases due to channel widening and deepening, and pipe and culvert size upgrades. Off-channel storage and pump station upgrades, as well as the proposed installation of new off-channel storage areas and pump stations, as proposed, were also evaluated. Each alternative was evaluated against typical tidal, SLR, and coincident coastal surge downstream conditions, and was analyzed to determine potential changes in flood depths and hydrology, including stormwater movement through and downstream of the Project Area to determine and quantify potential effects.

4.17.3.3 Coincidental Impacts

Coincidental impacts, or the combined effects of coastal and stormwater flooding occurring simultaneously, were also analyzed (NJDEP 2018). This included an analysis of interior drainage flooding behind a structural LOP, as well as an analysis of coastal storm surge effects on proposed stormwater drainage improvements. These potential coincidental effects were taken into consideration during the modeling, including a determination of the most likely coincidental flooding scenarios and are discussed below.

4.17.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to hydrology and flooding associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.17.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be built, and, as such, the coastal zone-regulated areas and coastal resources of the Project Area would not be altered by construction or operation activities associated with the Proposed Project. However, SLR and more intense rainfall over time from climate change (see **Section 3.10**) could have ***direct, potentially significant adverse*** impacts on hydrology and flooding in the Project Area. Per the significance criteria, the No Action Alternative:

- *Could adversely and permanently alter hydrology, flooding, or flood elevations.*
- *Could substantially and/or permanently disrupt the water table due to changes in surface water runoff*
- *Could substantially and/or permanently increase normal water or flood levels in open channels*

<u>Coastal Storm Surge Flooding</u>

As noted in **Section 4.10**, storm surge flooding is expected to worsen as a result of SLR. Increased coastal flooding in the Project Area would result in significant adverse impacts on the municipalities in the Project Area. Currently, approximately 17 percent of the Project Area is at risk of flooding during the normal tide (see **Table 4.17-2**) [70]. Under the 1.2-foot and 2.4-foot SLR scenarios, respectively, approximately 19 to 42 percent of the Project Area would be at risk of flooding. On a municipal level, flooding during the normal tide would be anticipated to impact an additional 30 percent of Little Ferry, 25 percent of Moonachie, 30 percent of Carlstadt,[71] 3 percent of Teterboro, and 27 percent of South Hackensack under the 2.4-foot SLR scenario as compared to existing conditions. Under the 1.2-foot SLR scenario, increases in flooding of 4 percent or less would be expected in Little Ferry, Carlstadt, and South Hackensack; flooding would not be expected to increase under this scenario for Moonachie or Teterboro.

Table 4.17-2: Extent of Flooding During Normal Tide Under No Action Alternative

Community	Flooded Acres Within Project Area		
	Existing	SLR = 1.2 feet	SLR = 2.4 feet
Borough of Little Ferry	97	103	408
Borough of Moonachie	<1	<1	257
Borough of Carlstadt	816	910	1,534
Borough of Teterboro	0	0	20
Township of South Hackensack	23	28	75
Project Area	**936**	**1,042**	**2,293**

Mathematical inconsistencies due to rounding.

During a 10-year storm (see **Table 4.17-3**), approximately 28 percent of the Project Area is currently at risk of flooding under existing conditions; approximately 36 to 51 percent of the Project Area would be at risk of flooding under the 1.2-foot and 2.4-foot SLR scenarios, respectively. On a municipal level, increased flooding during the 10-year storm would be anticipated to impact an additional 13 percent of Little Ferry, 13 percent of Moonachie, 9 percent of Carlstadt, and 5 percent of South Hackensack under the 1.2-foot SLR scenario. Under the 2.4-foot SLR scenario, increased flooding during a 10-year storm would be anticipated to impact an additional 39 percent of Little Ferry, 35 percent of Moonachie, 19 percent of Carlstadt, 2 percent of Teterboro, and 9 percent of South Hackensack as compared to existing conditions.

[70] Please note the "area at risk of flooding" (i.e., area with the potential to flood) described in this EIS was determined based on the total acreage within the Project Area for the No Action Alternative and Alternative 1. As shown in **Figure 4.17-1**, the majority of the area "at risk of flooding" under existing normal tide conditions occurs within the southern and eastern portions of the Project Area that are largely dominated by tidal wetlands/waters (e.g., Hackensack River, MRI Wetland Mitigation Bank, the Richard P. Kane Natural Areas and Wetland Mitigation Bank, and Berry's Creek).

[71] In this section, flooded area is calculated as a percentage of the portion of each municipality that is located within the Project Area. For example, approximately 2,415 acres of Carlstadt are located within the Project Area. Approximately 1,534 acres would be flooded by the normal tide in 50 years under the 2.4-foot SLR scenario, whereas 816 acres are currently flooded by the normal tide under existing conditions. The difference between these acreages (i.e., 718 acres) represents approximately 29.7 percent of the portion of Carlstadt located within the Project Area.

Table 4.17-3: Extent of Flooding During 10-year Storm Surge Event Under No Action Alternative

Community	Flooded Acres Within Project Area		
	Existing	SLR = 1.2 feet	SLR=2.4 feet
Borough of Little Ferry	243	380	649
Borough of Moonachie	34	168	397
Borough of Carlstadt	1,143	1,344	1,597
Borough of Teterboro	0	0	11
Township of South Hackensack	66	75	84
Project Area	**1,486**	**1,967**	**2,739**

Mathematical inconsistencies due to rounding.

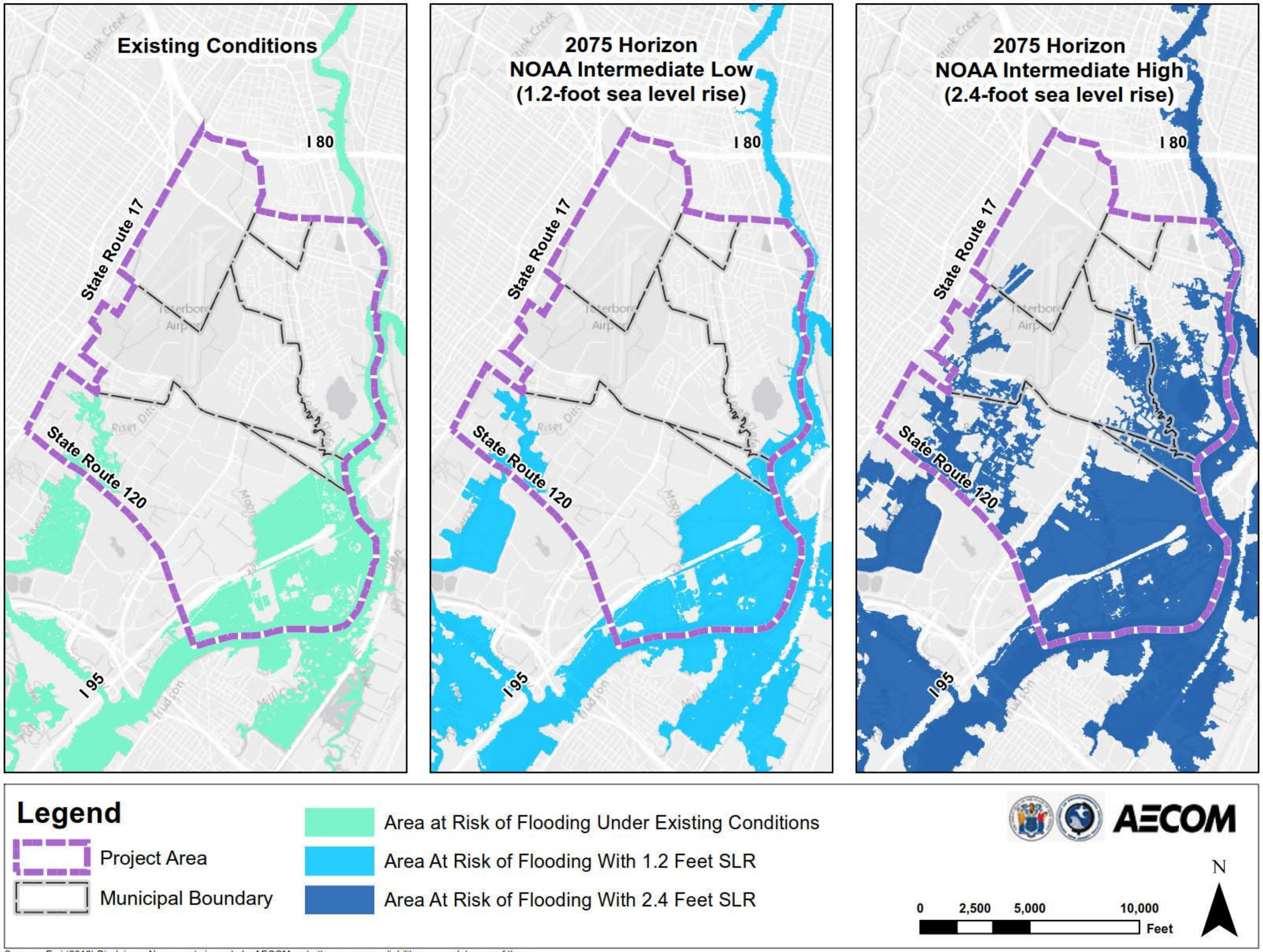
During a 50-year storm (see **Table 4.17-4**), approximately 36 percent of the Project Area is currently at risk of flooding; approximately 47 to 62 percent of the Project Area would be at risk of flooding during this event under the 1.2-foot and 2.4-foot SLR scenarios, respectively. On a municipal level, increased flooding during the 50-year storm would be anticipated to impact an additional 23 percent of Little Ferry, 16 percent of Moonachie, 8 percent of Carlstadt, and 4 percent of South Hackensack under the 1.2-foot SLR scenario as compared to existing conditions. Under the 2.4-foot SLR scenario, increased flooding during the 50-year storm would be anticipated to impact an additional 39 percent of Little Ferry, 43 percent of Moonachie, 20 percent of Carlstadt, 7 percent of Teterboro, and 6 percent of South Hackensack as compared to existing conditions.

Table 4.17-4: Extent of Flooding During 50-year Storm Surge Event Under No Action Alternative

Community	Flooded Acres Within Project Area		
	Existing	SLR = 1.2 feet	SLR=2.4 feet
Borough of Little Ferry	352	584	757
Borough of Moonachie	136	296	580
Borough of Carlstadt	1,383	1,571	1,866
Borough of Teterboro	0	0	55
Township of South Hackensack	74	82	86
Project Area	**1,946**	**2,534**	**3,344**

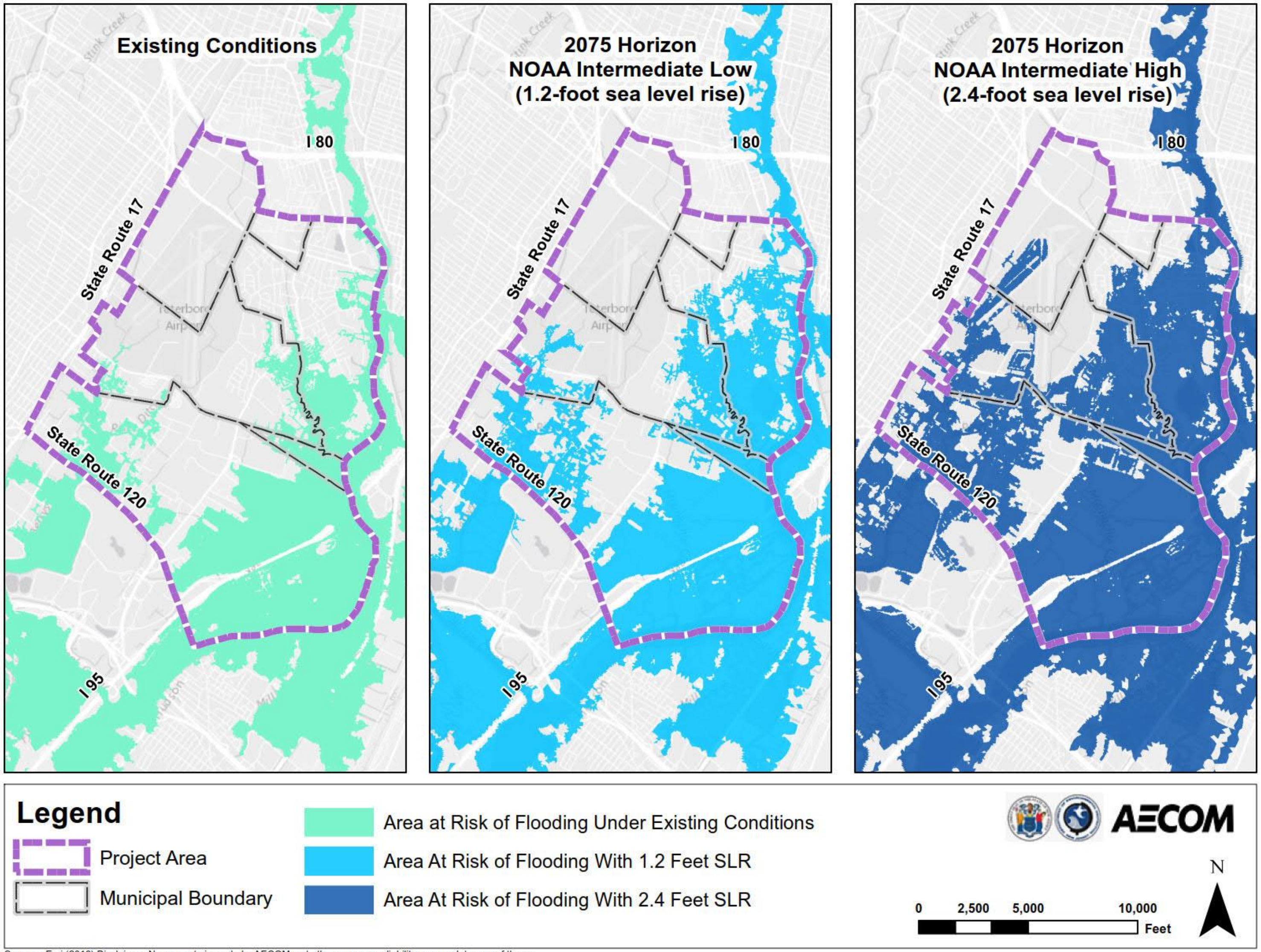
Mathematical inconsistencies due to rounding.

As none of the Proposed Project's Build Alternatives would be designed to protect against the 100-year storm, that return frequency is not discussed in this section. The approximately 50-year storm is the highest return frequency that the Proposed Project would be designed to address (i.e., a LOP at 7 feet [NAVD 88] under Alternative 1). The anticipated extent of flooding under the No Action Alternative for both the normal tide and 50-year storm are displayed in **Figure 4.17-1** and **Figure 4.17-2**, respectively.



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-1: Area at Risk of Flooding During Normal Tide Under the No Action Alternative



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-2: Area at Risk of Flooding During a 50-year Flood Under the No Action Alternative

As described in **Section 3.17,** the Project Area currently contains a series of flood protection berms that provide limited flood protection to an elevation of approximately 4 to 5 feet (NAVD 88). Annually, these berms currently have an approximately 20 percent chance of being overtopped; however, with expected SLR , the annual chance of being overtopped could rise to between 50 and 100 percent. With 2.4 feet of SLR, the normal high tide would likely overtop the existing berms, effectively removing any flood protection they currently provide. **Table 4.17-5** below displays the expected storm surge elevations for floods of various return frequencies in the Project Area under both the 1.2-foot and 2.4-foot SLR scenarios, and depicts the anticipated reduction in flood protection provided by the existing berms.

Table 4.17-5: Change in the Flood Protection Level Under the No Action Alternative

Coastal Storm Surge Return Frequency	Surge Elevation (feet NAVD 88)		
	Existing Conditions	SLR = 1.2 feet	SLR = 2.4 feet
Normal Tide	3.7	4.7	5.7
2-Year	4.2	5.2	6.1
5-Year	5.0	5.8	6.7
10-Year	5.6	6.4	7.2
25-Year	6.3	7.0	7.8
50-Year	6.5	7.1	7.9
100-Year	7.6	8.4	9.0

Note: Surge elevations outlined in red represent floods that would overtop the existing flood protection berms.
Source: (FEMA 2014b)

Additionally, the condition of the existing berms in the Project Area would be adversely affected by increased flooding. When they were originally constructed, they were typically not engineered, with the exception of portions adjacent to flood gates and pump stations. Consequently, many of the berms were constructed unsystematically, and have either settled or slumped over time. Furthermore, many of the berms are not maintained regularly. As a result, they are at risk of further deterioration and possible failure during surge events, as the expected increase in the frequency and intensity of coastal storms would likely cause accelerated erosion of the berms. This would result in the provision of less flood protection than they currently do, and further exacerbate the risk of storm surge flooding within the Project Area.

Inland Flooding

Under the No Action Alternative, changes in precipitation patterns would also be expected to have ***potentially significant adverse*** impacts on the study area. **Table 4.17-6** shows projected changes to peak discharges of select waterways within the Project Area. These changes were projected for 2-year through 100-year precipitation events, and were coupled with the MIKE21 model for both the 1.2-foot and 2.4-foot SLR scenarios during normal tide conditions.

Table 4.17-6: Percent Change to Peak Discharges for Precipitation Events of Various Frequencies Under Normal Tide Conditions

Location	2-year		5-year		10-year		25-year		50-year		100-year	
	1.2 feet SLR	2.4 feet SLR	1.2 feet SLR	2.4 feet SLR	1.2 feet SLR	2.4 feet SLR	1.2 feet SLR	2.4 feet SLR	1.2 feet SLR	2.4 feet SLR	1.2 feet SLR	2.4 feet SLR
East Riser Ditch @ tide gate	45%	75%	35%	79%	38%	87%	39%	85%	49%	84%	54%	77%
Peach Island Creek	22%	51%	15%	42%	18%	43%	33%	56%	48%	68%	80%	101%
West Riser Ditch @ Moonachie Avenue	12%	12%	17%	17%	27%	27%	30%	30%	41%	41%	65%	65%
West Riser Ditch @ tide gate	3%	5%	3%	4%	8%	13%	26%	33%	39%	45%	53%	58%
Berry's Creek @ Paterson Plank Bridge	47%	64%	34%	49%	28%	45%	22%	57%	27%	68%	35%	80%
DePeyster Creek @ tide gate	19%	29%	6%	7%	3%	4%	6%	3%	6%	3%	7%	3%
Losen Slote @ tide gate	2%	-7%	9%	-1%	6%	2%	6%	6%	9%	9%	12%	12%
Main Street stormwater system	0%	0%	-23%	-23%	-2%	-37%	2%	-1%	5%	3%	5%	5%
Moonachie Creek @ tide gate	10%	13%	7%	9%	9%	12%	13%	18%	18%	24%	26%	33%
Willow Lake	23%	39%	11%	22%	9%	14%	9%	13%	15%	24%	28%	41%

Overall, peak discharges of precipitation events are expected to increase for each return frequency at each location, with two exceptions at Losen Slote Creek and Main Street due to factors associated with stormwater management infrastructure. Further, peak discharge increases are consistently greater for the 2.4-foot SLR scenario than for the 1.2-foot SLR scenario at most locations, as higher normal tides in the Hackensack River or Berry's Creek would slow, and consequently prolong, discharge.

Peak discharges vary greatly by location and return frequency. For example, during a 5-year precipitation event, peak discharges of waterways within the Project Area could increase between 3 percent and 35 percent for the 1.2-foot SLR scenario, or between 1 percent and 79 percent for the 2.4-foot SLR scenario. During a 50-year precipitation event, peak discharges could increase between 4 percent and 49 percent or between 3 percent and 84 percent for the 1.2-foot and 2.4-foot SLR scenarios, respectively. **Figure 4.17-3** through **Figure 4.17-6** further illustrate projected changes to the discharge rates of various channels in the Project Area. These figures depict a 5-year precipitation event under the No Action Alternative over a 48-hour time period. In each case, there are substantial projected increases in the peak and overall discharge volumes due to changes in future precipitation.

In the interior of the Project Area, flooding problems associated with inadequate stormwater drainage systems would continue and likely become worse as the intensity and frequency of rainfall events increase over time. Inland flooding would also be worsened by increases in impervious surfaces in the Project Area. Increases to peak discharge rates in the Project Area's waterways could further result in various hazards, including increased water levels and velocity in channels that can impact other resources in the Project Area from increased risks of flooding and erosion to adjacent areas.

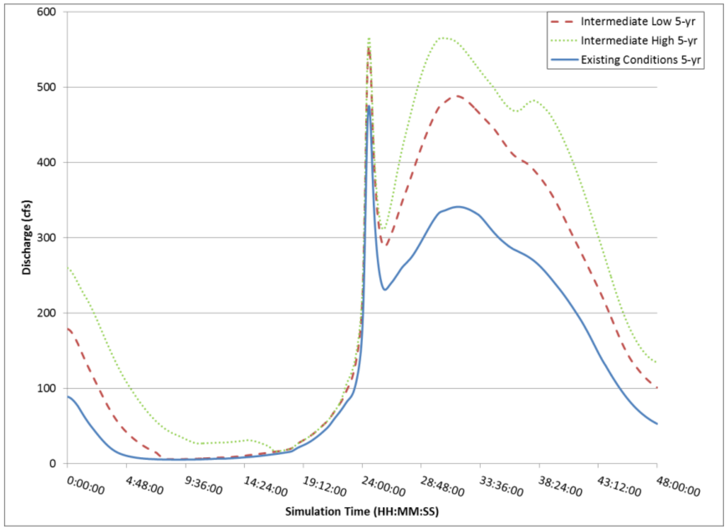


Figure 4.17-3: East Riser Ditch (at tide gate)

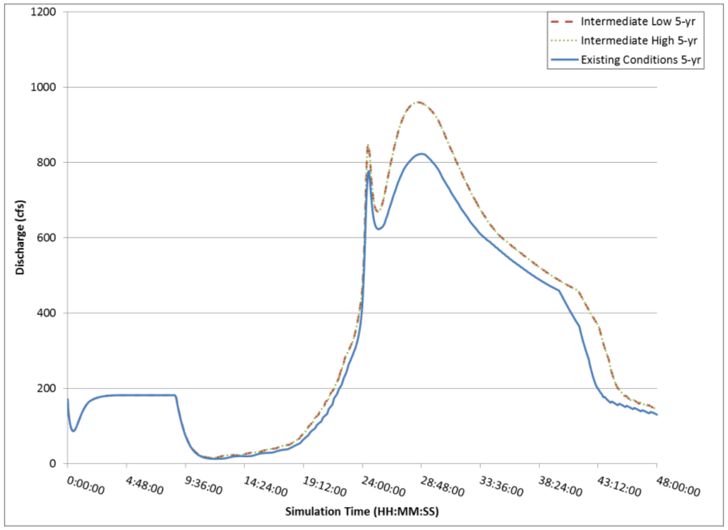


Figure 4.17-4: West Riser Ditch (at tide gate)

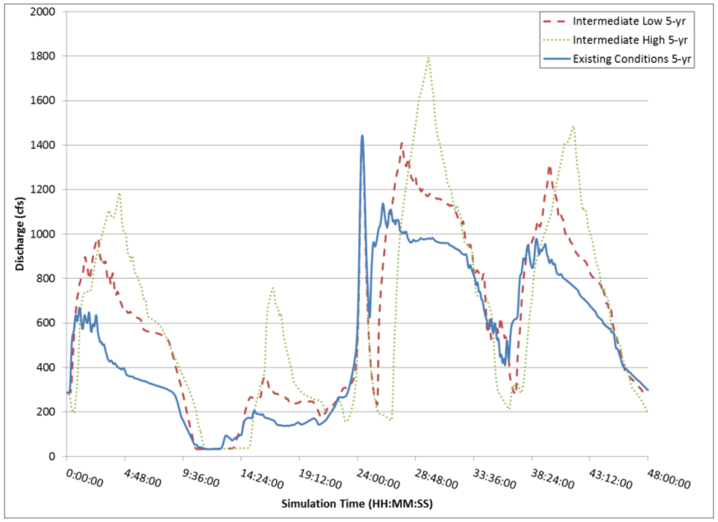


Figure 4.17-5: Berry's Creek (at Paterson Plank Bridge)

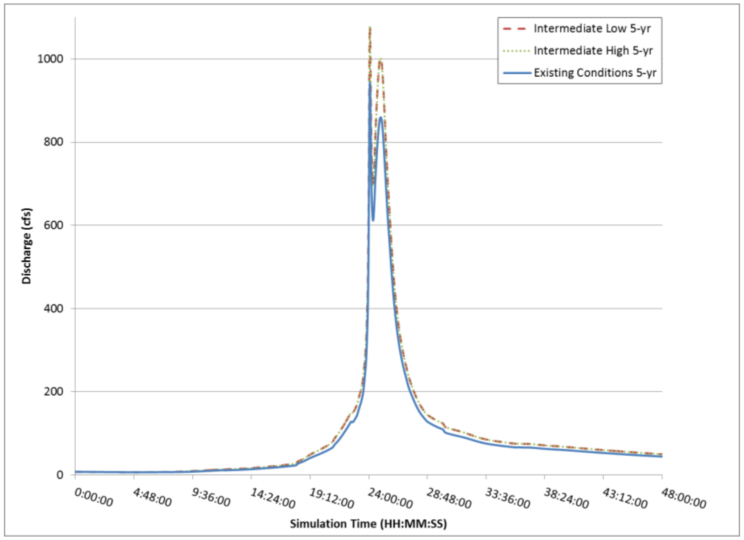


Figure 4.17-6: Losen Slote

The extent of inland flooding in the Project Area under the No Action Alternative was modeled for East Riser Ditch[72] and Losen Slote to support the Alternative 2 impact analysis. By 2075 (i.e., the future condition) flooding extent in both of these drainage basins would be expected to increase (see **Table 4.17-7**). Flooding extent for East Riser Ditch would increase by approximately 88 acres over existing conditions during a 2-year storm, 84 acres during a 10-year storm, 122 acres during a 25-year storm, and 221 acres during a 100-year storm. Flooding extent in Losen Slote would increase by approximately 18 acres over existing conditions during a 2-year storm, 22 acres during a 10-year storm, 28 acres during a 25-year storm, and 50 acres during a 100-year storm.

Table 4.17-7: Area at Risk of Flooding in the Losen Slote and East Riser Ditch Floodplains Under the No Action Alternative

Storm Event Frequency	Approximate Flood Extent (acres)					
	East Riser Ditch			Losen Slote		
	Existing Conditions (2023)	Future Conditions (2075)	Net Change	Existing Conditions (2023)	Future Conditions (2075)	Net Change
2-year	360	448	+88	302	320	+18
10-year	676	760	+84	356	379	+22
25-year	755	877	+122	381	409	+28
50-year	818	973	+155	397	434	+37
100-year	871	1092	+221	414	464	+50

Mathematical inconsistencies due to rounding.

As noted in **Section 3.17**, existing stormwater flood protection features in the Project Area include tide gates and pump stations along the existing berms. These facilities are expected to continue to provide their current level of stormwater flood reduction under the No Action Alternative, but would likely be required to operate more often due to increases in the frequency and intensity of interior rainfall events.

Finally, SLR could further adversely impact stormwater drainage in the Project Area. Although there is no correlation between tidal surges and rainfall events in the Project Area, increased sea levels could increase the frequency and duration that stormwater outfalls are blocked (i.e., submerged) during high tide and tidal surges. If stormwater outfalls are submerged during an intense precipitation event, those existing drainage systems would be unable to drain stormwater, which could potentially lead to increased flooding in those respective drainage basins within the Project Area.

4.17.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would adversely affect the Project Area (see **Section 4.1.2.2**).

[72] As discussed under the Alternative 2 impact analysis below, modeling for East Riser Ditch also included West Riser Ditch due to their hydrologic interconnectivity.

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to the Project Area through increased risk of coastal flooding while construction of the LOP is occurring along existing flood protection berms.
- ***Long-term, less-than-significant, adverse*** impacts to the normal water surface elevations of waterways in the Project Area due to disrupted groundwater movement resulting from the LOP.
- ***Long-term, beneficial*** effects to the Project Area due to reduced coastal flooding behind the LOP.
- ***Long-term, beneficial*** effects to stormwater drainage in the Project Area through reduced impervious surfaces and improved stormwater management at the proposed parks.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, potentially significant, adverse*** impacts to developed areas outside the Project Area resulting from induced coastal flooding.

The following subsections provide greater detail.

Direct Impacts

Coastal Storm Surge Flooding

During construction, Alternative 1 could temporarily increase the risk of coastal storm surge flooding in portions of the Project Area. This could occur while the LOP is being constructed along the existing berms, as the berms would be damaged by the construction process. Currently, berms are located along the LOP alignment on either side of the Losen Slote tide gate, and in the northern portion of the BCUA property (see **Figure 3.17-5**). However, the time period in which risk could be increased would be temporary (i.e., during construction), so this would be a ***short-term, less-than-significant adverse*** impact. This increased risk would be mitigated through appropriate construction planning and, if necessary, emergency actions at the construction site during the approach of a forecasted storm surge.

Alternative 1 would have ***long-term, beneficial*** impacts on the Project Area by reducing the extent of coastal flooding. The Alternative 1 LOP would raise the level of flood protection to an elevation of 7 feet (NAVD 88) from the existing 4 to 5 feet (NAVD 88) of flood protection provided by the existing berms. This level of protection would be sufficient to protect against the present-day approximately 50-year flood, or against approximately the 10-year flood in 50 years due to SLR projections. Stated differently, Alternative 1 would reduce the annual chance of the flood protection being overtopped to approximately 2 percent, as compared to the existing approximately 20 percent annual chance of the berms being overtopped. Further, the new LOP would be uniform in its flood protection level, and fully engineered and maintained to prevent deterioration over time.

The approximate flood protection provided by Alternative 1 is shown numerically in **Table 4.17-8** using projected storm surge elevations for various return event frequencies under both the 1.2-foot and 2.4-foot SLR scenarios. SLR would be expected to increase the frequency with which the LOP is overtopped over time: under existing conditions, there would be an approximately 2 percent annual chance of the LOP being overtopped; under the 1.2-foot SLR scenario, there would be an approximately 4 percent annual chance of the LOP being overtopped; and under the 2.4-foot SLR scenario, there would be an approximately 10 percent annual chance of the LOP being overtopped. For comparison, the existing berms have an approximately 20 percent annual chance of being overtopped under existing conditions.

Table 4.17-8: Change in the Flood Protection Level under Alternative 1

Coastal Storm Surge Return Frequency	Surge Elevation (feet NAVD 88)		
	Existing Conditions	SLR = 1.2 feet	SLR = 2.4 feet
Normal Tide	3.7	4.7	5.7
2-Year	4.2	5.2	6.1
5-Year	5.0	5.8	6.7
10-Year	5.6	6.4	7.2
25-Year	6.3	7.0	7.8
50-Year	6.5	7.1	7.9
100-Year	7.6	8.4	9.0

Note: Surge elevations outlined in red represent floods that would overtop the Alternative 1 LOP.
Source: (FEMA 2014b)

As shown in **Table 4.17-9**, the portions of the Project Area at risk of flooding during the normal tide and the 50-year storm would be substantially reduced under Alternative 1 as compared to the No Action Alternative. The full extent of increased flood protection will be addressed in the Feasibility Study (NJDEP 2018) as the design and modeling of Alternative 1 are further refined; however, current modeling results are provided herein.

During the normal tide, there would be minor decreases in the area at risk of flooding under existing conditions and the 1.2-foot SLR scenario. However, under the 2.4-foot SLR scenario, the area at risk of flooding in the Project Area would decrease from approximately 2,293 acres under the No Action Alternative to approximately 980 acres under Alternative 1. That would represent increased flood protection to approximately 24 percent of the Project Area.[73] On a municipal level, under the 2.4-foot SLR scenario, Alternative 1 would provide increased flood protection to approximately 29 percent of Little Ferry, 25 percent of Moonachie, 29 percent of Carlstadt, 3 percent of Teterboro, and 24 percent of South Hackensack during the normal tide.

[73] This value was determined by dividing the difference in flooded area by the total acreage of the Project Area. In other words, 2,293 acres (area at risk of flooding during normal tide with 2.4 feet of SLR under the No Action Alternative) minus 980 acres (area at risk of flooding under the same circumstances with Alternative 1) is equal to 1,313 acres receiving flood protection. 1,313 acres receiving flood protection divided by 5,405 acres (total Project Area) is equal to 24.3 percent.

Table 4.17-9: Comparison of Flooding Risk Under Alternative 1 and No Action Alternative

Community	Flooded Acres Within Project Area					
	Existing Conditions		SLR=1.2 feet		SLR=2.4 feet	
	No Action Alternative	Alternative 1	No Action Alternative	Alternative 1	No Action Alternative	Alternative 1
Normal Tide						
Borough of Little Ferry	97	96	103	101	408	110
Borough of Moonachie	<1	0	<1	0	257	0
Borough of Carlstadt	816	735	910	806	1,534	842
Borough of Teterboro	0	0	0	0	20	0
Township of South Hackensack	23	23	28	28	75	29
Project Area	**936**	**854**	**1,042**	**936**	**2,293**	**980**
10-Year Storm						
Borough of Little Ferry	243	109	380	111	649	423
Borough of Moonachie	34	0	168	0	397	24
Borough of Carlstadt	1,143	836	1,344	858	1,597	1159
Borough of Teterboro	0	0	0	0	11	0
Township of South Hackensack	66	29	75	29	84	56
Project Area	**1,486**	**974**	**1,967**	**998**	**2,739**	**1,662**
50-Year Storm						
Borough of Little Ferry	352	111	584	310	757	668
Borough of Moonachie	136	0	296	12	580	166
Borough of Carlstadt	1,383	1,151	1,571	1,194	1,866	1,310
Borough of Teterboro	0	0	0	0	55	0
Township of South Hackensack	74	29	82	46	86	76
Project Area	**1,946**	**1,291**	**2,534**	**1,562**	**3,344**	**2,220**

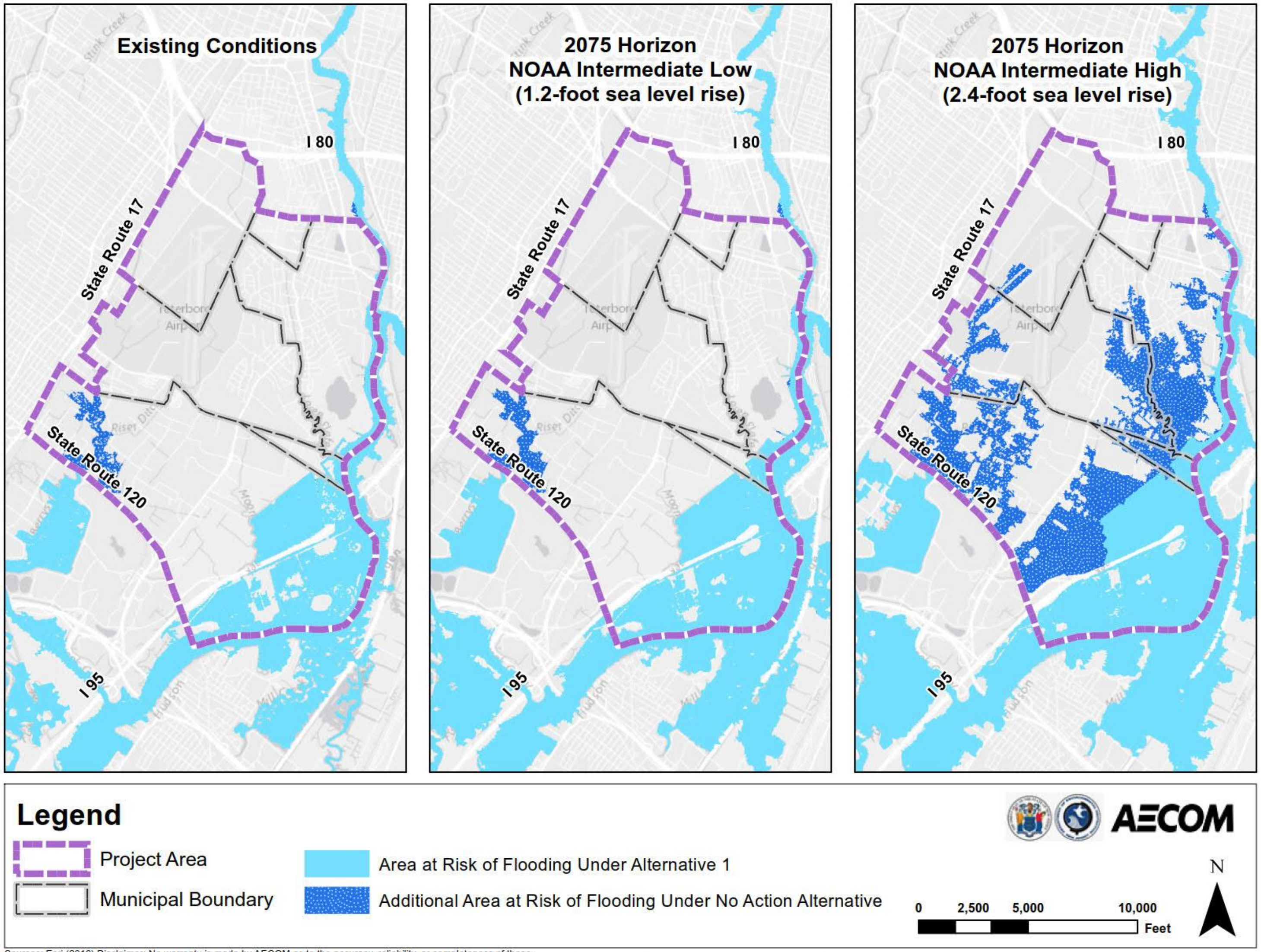
Mathematical inconsistencies due to rounding.

During the 10-year storm, increased flood protection would be provided to approximately 10 percent of the Project Area under existing conditions, approximately 18 percent of the Project Area under the 1.2-

foot SLR scenario, and approximately 20 percent of the Project Area under the 2.4-foot SLR scenario. On a municipal level, Alternative 1 would provide increased flood protection to approximately 26 percent of Little Ferry, 16 percent of Moonachie, 20 percent of Carlstadt, and 25 percent of South Hackensack under the 1.2-foot SLR scenario. Under the 2.4-foot SLR scenario, Alternative 1 would provide increased flood protection to approximately 22 percent of Little Ferry, 36 percent of Moonachie, 18 percent of Carlstadt, 2 percent of Teterboro, and 14 percent of South Hackensack.

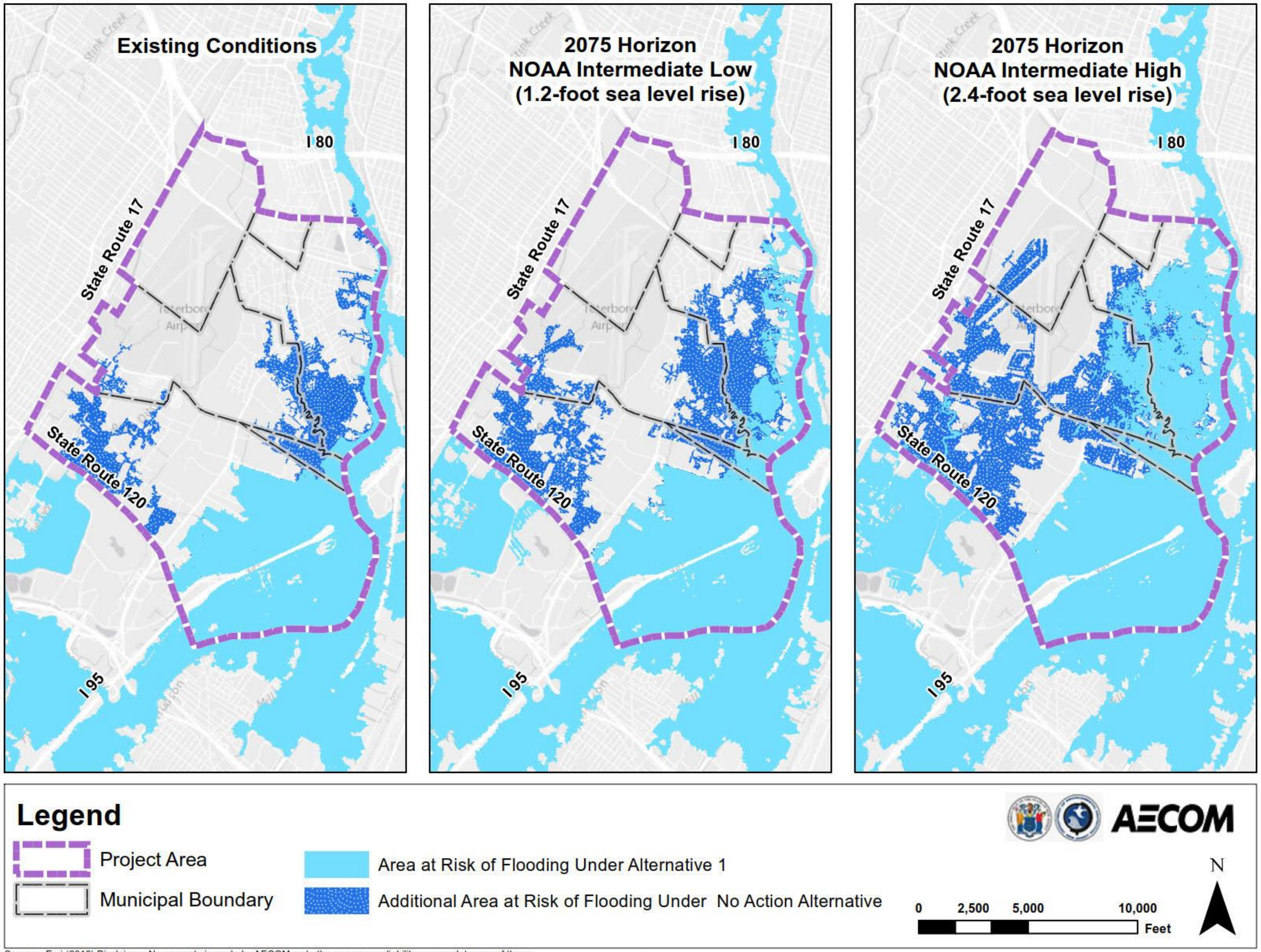
During the 50-year storm, increased flood protection would be provided to approximately 12 percent of the Project Area under existing conditions, approximately 18 percent of the Project Area under the 1.2-foot SLR scenario, and approximately 21 percent of the Project Area under the 2.4-foot SLR scenario. On a municipal level, Alternative 1 would provide increased flood protection to approximately 11 percent of Little Ferry, 27 percent of Moonachie, 16 percent of Carlstadt, and 19 percent of South Hackensack during the 50-year storm under the 1.2-foot SLR scenario. Under the 2.4-foot SLR scenario for the 50-year flood, Alternative 1 would provide increased flood protection to approximately 9 percent of Little Ferry, 40 percent of Moonachie, 23 percent of Carlstadt, 7 percent of Teterboro, and 5 percent of South Hackensack.

As shown in **Figure 4.17-7** and **Figure 4.17-8**, increased flood protection under Alternative 1 would be most concentrated in the Berry's Creek watershed, including along Peach Island Creek and the lower portions of East and West Riser Ditches, and along the Hackensack River in the Losen Slote watershed. These areas encompass primarily industrial and residential properties, as well as existing natural areas. The potential impacts to resources in these areas resulting from increased flood protection are discussed under each respective Technical Resource Area throughout **Section 4.0**.



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-7: Comparison of Flooding During Normal Tide Under Alternative 1 and the No Action Alternative



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-8: Comparison of Flooding During 50-year Storm Under Alternative 1 and the No Action Alternative

Inland Flooding

As discussed in **Section 4.16**, Alternative 1 also has the potential to impede/alter existing groundwater movement, and possibly raise the water table to a higher elevation. By altering existing groundwater patterns (i.e., by redirecting groundwater that currently flows toward the Hackensack River), Alternative 1 could result in increased normal water surface elevations in proximal surface water features (i.e., the various creeks in the Project Area). In turn, this could potentially influence their flooding patterns. However, these impacts would be dependent on various other factors within each drainage sub-basin, and the relative impact of Alternative 1 would be expected to be a ***less-than-significant adverse*** impact.

Under Alternative 1, there would be a minor ***long-term, beneficial*** impact to stormwater drainage in the Project Area. As noted in **Section 4.15**, there would be a net decrease of approximately 0.8 acre of impervious surfaces along the LOP, which would increase stormwater infiltration capacity. Further, although pervious surfaces already comprise much of the land proposed to be converted into parks, the open space improvements proposed for these new parks would be specifically designed with on-site stormwater management as a goal, which would be likely to improve existing drainage in those localized areas. As noted in **Section 4.16.4.2**, Alternative 1 would reduce annual stormwater runoff in the Project Area by approximately 3.2 million gallons; however, these stormwater drainage improvements would not address any specific existing stormwater flooding problem areas. Therefore, overall changes in the Project Area from increased precipitation would be similar to those discussed under the No Action Alternative.

Indirect Impacts

Current preliminary modeling indicates that Alternative 1 could potentially induce increased flooding outside the Project Area during storm surge events. Specifically, this increased flooding appears in the portion of the Berry's Creek watershed downstream of the proposed surge barrier, and encompasses both environmental areas (i.e., wetlands) and industrial areas that border Berry's Creek. While environmental areas would not likely be impacted by occasional increased flooding, increased coastal flooding of industrial properties could result in ***long-term, potentially significant adverse*** impacts. Therefore, the potential for induced flooding would be further evaluated as final design of Alternative 1 continues, and the modeling becomes more refined, in order to eliminate these potential impacts, or reduce them to less-than-significant levels.

Mitigation Measures and BMPs

Mitigation measures and BMPs related to Hydrology and Flooding would generally be the same as those listed in **Section 4.16.4.2**. To mitigate the indirect potentially significant adverse impacts related to hydrology and flooding that could occur if Alternative 1 induces increased flooding outside of the Project Area, such as in the Berry's Creek watershed downstream of the proposed surge barrier, the following additional mitigation measures and/or BMPs would be implemented to reduce potentially significant adverse impacts to less-than-significant levels.

- The potential for impacts would be addressed throughout the final stages of the design and modeling processes in order to either eliminate them (i.e., through more refined modeling data) or reduce them to less-than-significant levels (i.e., induced flooding only in existing environmental areas in accordance with regulatory requirements).

- Adequate construction planning, including identification of potential emergency measures, would be implemented to avoid potential increased storm surge flooding in the Project Area while construction of the LOP is occurring along existing berms.

4.17.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding from continued and increased precipitation events, but coastal flooding from storm surges would continue to adversely affect the Project Area. Coastal flooding under Alternative 2 would be as described under the No Action Alternative. While future SLR[74] and precipitation data were incorporated into the inland flooding models as parameters, the Alternative 2 analysis does not specifically assess coastal flooding.

Alternative 2 would result in the following **direct** impacts:

- ***Long-term, less-than-significant, adverse*** impacts to the Project Area by potentially raising the groundwater table in localized areas near the installation of proposed green infrastructure systems and new pervious surfaces.
- ***Long-term, beneficial*** effects to the Project Area due to reduced inland flooding resulting from increased stormwater infiltration, and increased stormwater conveyance capacity in East Riser Ditch and Losen Slote.

Alternative 2 would not result in any **indirect** impacts. The following subsections provide greater detail.

Direct Impacts

Alternative 2 would have ***long-term, beneficial*** impacts on stormwater drainage in the Project Area by increasing stormwater infiltration during low intensity rainfall events, and increasing the conveyance capacity of both East Riser Ditch and Losen Slote.

Alternative 2 would incorporate dedicated stormwater management features (i.e., green infrastructure systems, landscape design, etc.) along streets and at the proposed new parks and open space improvements in the Project Area. These components would be designed to accommodate the NJ Stormwater Quality Design Storm, which is 1.25 inches of precipitation in a 2-hour span (NJDEP 2004a). In addition to these specific stormwater management features, there would be a reduction in impervious surfaces within the Alternative 2 footprint. Alternative 2 would convert approximately 3.4 acres (see **Section 4.15**) of impervious surfaces to pervious surfaces. By both constructing stormwater management features and reducing impervious surfaces, Alternative 2 would increase the rate and capacity of stormwater infiltration. In turn, this would reduce annual stormwater runoff by approximately 24.9 million gallons (see **Section 4.16.4.3**), and thus potentially reduce stormwater flooding, both on-site and in the general vicinity of the Alternative 2 footprint during routine rainfall events. However, stormwater infiltration during substantially larger rainfall events would likely remain unchanged from existing conditions, as greater precipitation amounts would exceed the design capacity of the green infrastructure and stormwater management features.

[74] Inland flooding models were constructed using the 1.2-foot SLR scenario, as the stormwater drainage improvements proposed under Alternatives 2 and 3 would likely be of limited value during the substantially increased coastal flooding anticipated during normal tide under the 2.4-foot SLR scenario (see **Figure 4.17-1**).

Increased stormwater infiltration could also result in ***long-term, less-than-significant adverse*** impacts to the Project Area by raising the water table. However, because the green infrastructure systems, proposed new parks, and proposed open space improvements are discontinuous and address relatively small drainage areas, these potential impacts would be highly localized to the specific location of each feature, and would be unlikely to impact the overall groundwater level within the Project Area. Alternative 2 would also require dewatering of East Riser Ditch during construction. As groundwater refills the ditches, it would be pumped downstream. This would result in a negligible reduction in groundwater adjacent to the ditches during construction.

Furthermore, Alternative 2 would have beneficial impacts on the Project Area by reducing the depth and, to a lesser degree, extent of inland flooding from East Riser Ditch and Losen Slote, as well as reducing the number of buildings expected to be impacted by inland flooding in these watersheds. The following subsections provide greater detail.

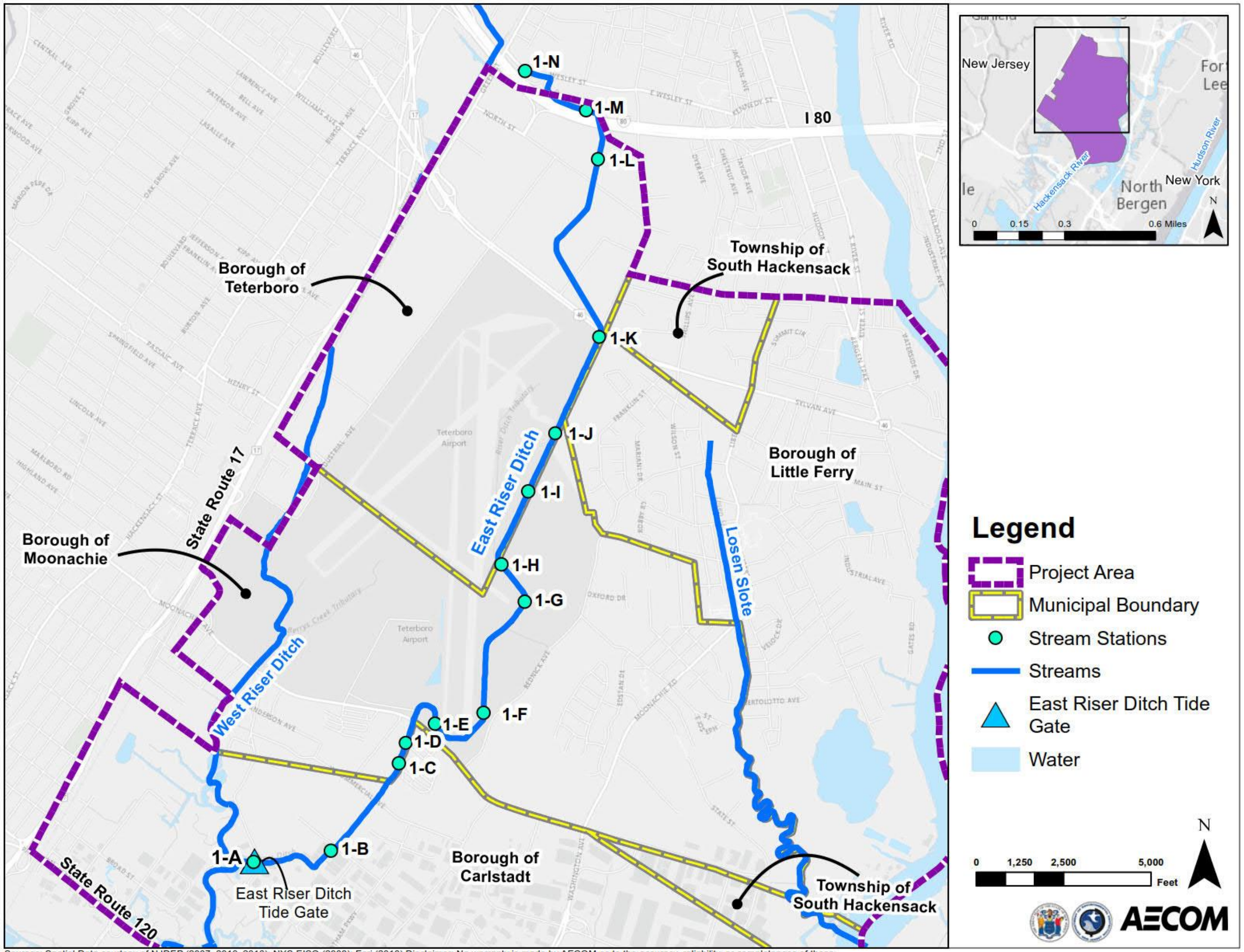
<u>East Riser Ditch</u>

Under Alternative 2, East Riser Ditch would be improved from the existing tide gate to Moonachie Avenue. While no improvements would be made to West Riser Ditch, it should be noted that the hydrology of East Riser Ditch is largely connected to West Riser Ditch due to their proximity and the generally flat topography between them. For example, when flood depths in East Riser Ditch overflow the channel berm, the excess floodwaters spill into Teterboro Airport, where drainage flows west to West Riser Ditch. When flooding occurs in both East Riser Ditch and West Riser Ditch, the area around the airport is inundated. Because of the high hydrologic interconnectivity of these ditches, modeling of proposed improvements to East Riser Ditch also incorporated projected flood conditions for West Riser Ditch. However, changes to flood depths in West Riser Ditch resulting from Alternative 2 would be minimal; as such, they are not specifically discussed in this analysis.

As described in **Section 2.5.3.1**, improvements to East Riser Ditch under Alternative 2 would include channel dredging, replacement of culverts and the railroad bridge, and construction of an East Riser Ditch pump station at the existing tide gate. These improvements would be designed to 1) increase the capacity of the ditch to convey stormwater, thereby transferring runoff from adjacent developed areas to Berry's Creek more quickly, and 2) enable stormwater drainage to continue (i.e., through pumping) even when Berry's Creek is flowing higher than the existing outfalls at the tide gate. These improvements would reduce the depths and extent of flooding in East Riser Ditch.

Reduction in flood depth (i.e., the water level in the ditch) in East Riser Ditch under Alternative 2 is shown below in **Table 4.17-10**. Flood depths were modeled at numerous locations (i.e., stations; see **Figure 4.17-9**) along East Riser Ditch. The results show that flood reduction would be greatest between the existing tide gate and Moonachie Avenue, as this is the reach that would receive the improvements. Specifically, flood depths at the tide gate (station 1-A) would be reduced by approximately 2.9 feet during a 2-year storm, 2.7 feet during a 10-year storm, 2.5 feet during a 25-year storm, and 2.2 feet during a 100-year storm. Near Moonachie Avenue (station 1-D), the flood depth would be reduced by approximately 2.5 feet during a 2-year storm, 2.1 feet during a 10 year storm, 1.9 feet during a 25-year storm, and 1.6 feet during a 100-year storm.

Although improvements would only be made to East Riser Ditch south of Moonachie Avenue, the improved conveyance would result in residual flood reduction benefits upstream of Moonachie Avenue. At station 1-H (Teterboro Airport), flood depths would be reduced by approximately 1.3 feet during a 2-year storm, 0.9 feet during a 10-year storm, 0.5 feet during a 25-year storm, and 0.4 feet during a 100-year storm. Further flood reduction would occur north to US Route 46; no change to flooding would be expected in East Riser Ditch north of US Route 46.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-9: Representative Stream Stations Modeled Along East Riser Ditch

Table 4.17-10: Change in Flooding Depths in East Riser Ditch Under Alternative 2

Stream Station	Distance Upstream of Tide Gate (feet)	Approximate Location	Change in Flooding Depth (feet)											
			2-year Storm		5-year Storm		10-year Storm		25-year Storm		50-year Storm		100-year Storm	
			2023	2075	2023	2075	2023	2075	2023	2075	2023	2075	2023	2075
1-A	4	East Riser Ditch tide gate	-2.9	3.1	-2.7	-2.9	-2.7	-2.7	-2.5	-2.4	-2.2	-2.3	-2.2	-1.5
1-B	1,566		-2.9	-3.1	-2.6	-2.9	-2.6	-2.6	-2.4	-2.3	-2.1	-2.2	-2.1	-1.2
1-C	3,519		-2.5	-2.8	-2.2	-2.4	-2.1	-2.1	-1.9	-1.7	-1.6	-1.5	-1.6	-0.6
1-D	3,897	Downstream of Moonachie Avenue	-2.5	-2.7	-2.2	-2.4	-2.1	-2.1	-1.9	-1.7	-1.6	-1.5	-1.6	-0.6
1-E	5,112	Upstream of Moonachie Ave	-2.1	-2.2	-1.7	-1.8	-1.6	-1.6	-1.4	-1.3	-1.2	-1.1	-1.2	-0.4
1-F	6,320		-1.7	-1.9	-1.3	-1.4	-1.1	-0.9	-0.7	-0.6	-0.5	-0.4	-0.5	-0.1
1-G	8,531		-1.3	-1.5	-1.1	-1.1	-0.9	-0.7	-0.6	-0.5	-0.4	-0.3	-0.4	-0.1
1-H	9,320	Teterboro Airport	-1.3	-1.5	-1.0	-1.1	-0.9	-0.7	-0.5	-0.5	-0.4	-0.3	-0.4	-0.1
1-I	10,739		-1.2	-1.4	-0.9	-1.0	-0.8	-0.6	-0.5	-0.4	-0.4	-0.3	-0.4	-0.1
1-J	11,849		-1.1	-1.3	-0.9	-0.9	-0.8	-0.6	-0.5	-0.4	-0.4	-0.1	-0.4	-0.1
1-K	13,703	Downstream of US Route 46	-0.2	-0.3	-0.2	-0.3	-0.2	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	0.0
1-L	17,607		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-M	18,615	Upstream of I-80	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-N	20,107	Adjacent to Wesley Street	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Highlighted cells represent flood reductions.

Future condition flood depths were also projected for the year 2075. These projections show that flood depth reduction in the lower reach of East Riser Ditch would generally increase by 0.2 feet during a 2-year storm, remain the same or decrease slightly (i.e., 0.2 feet or less) during a 10-year or 25-year storm, and decrease between 0.7 and 1.0 feet during a 100-year storm, compared to the flood depth reduction anticipated under existing conditions.

The expected spatial extents of stormwater-induced flooding during various rainfall events are provided in **Table 4.17-11**. Reductions in flooding extent would be concentrated near the lower reach of the East Riser Ditch floodplain (i.e., Carlstadt; see **Figure 4.17-10**), as this is where stormwater conveyance would be most improved. Under existing conditions, flooding extent would be reduced by approximately 14 acres during a 2-year storm, 19 acres during a 10-year storm, 22 acres during a 25-year storm, and 33 acres during a 100-year storm. Under future conditions, flooding extent reduction would be greater than under existing conditions; however, even with Alternative 2, the area at risk of flooding from East Riser Ditch under future conditions for each storm event would still be larger than it is under existing conditions due to the anticipated effects of climate change.

Table 4.17-11: Area at Risk of Flooding Under Alternative 2 in the East Riser Ditch Floodplain

Storm Event Frequency	Approximate Flood Extent (acres)					
	Existing Conditions (2016)	Under Alternative 2	Net Change	Future Conditions (2075)	Under Alternative 2	Net Change
2-year	360	346	-14	448	425	-23
10-year	676	657	-19	760	729	-31
25-year	755	733	-22	877	832	-45
50-year	818	788	-30	973	920	-52
100-year	871	837	-33	1,092	1,046	-46

Mathematical inconsistencies due to rounding.

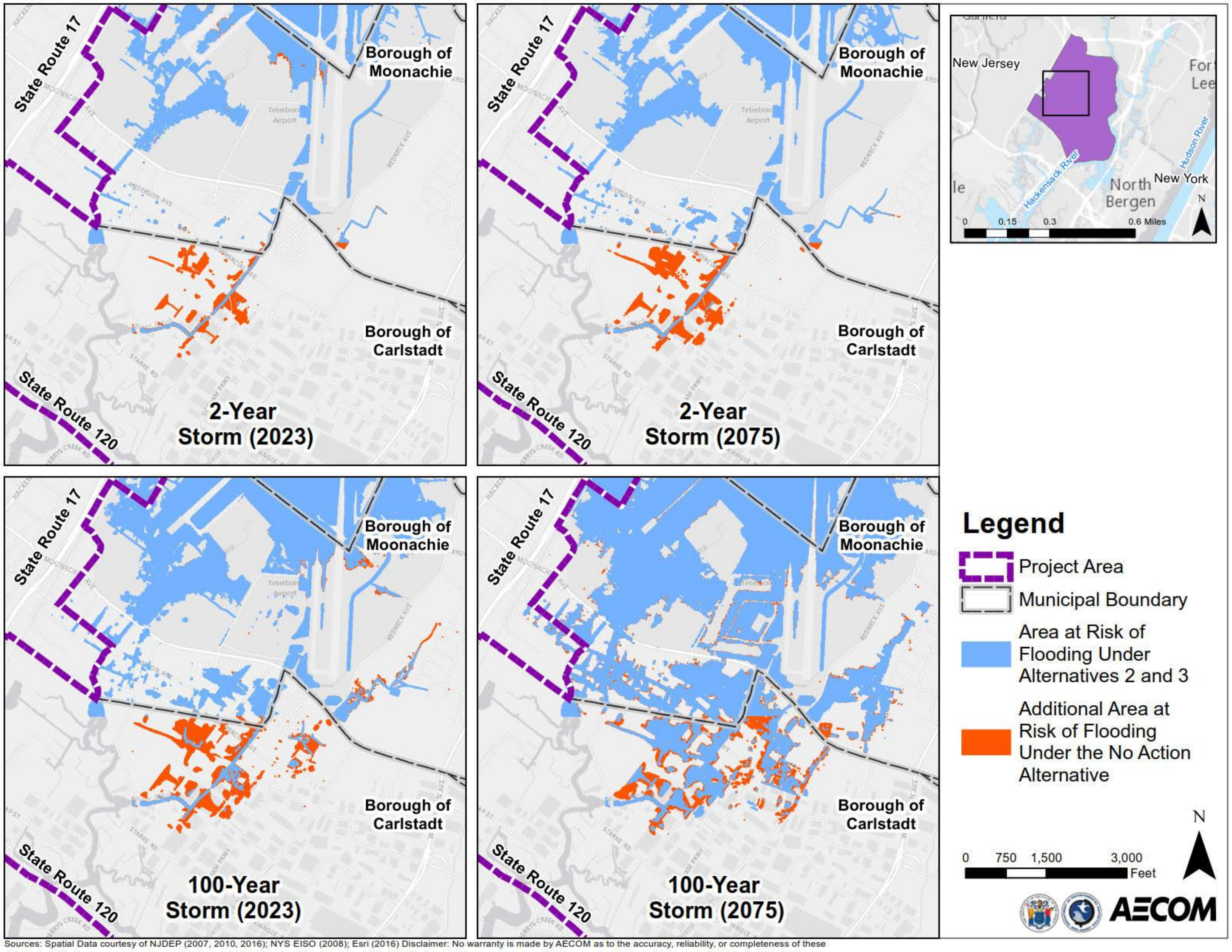


Figure 4.17-10: Comparison of East Riser Ditch Flooding Under Alternative 2 and the No Action Alternative

Estimated reductions in buildings impacted and damages under Alternative 2 in the East Riser Ditch watershed are provided for existing conditions in **Table 4.17-12**. Alternative 2 would provide increased flood protection for up to approximately 182 additional buildings (i.e., during a 100-year storm) in this watershed above ground level, and increased flood protection for up to 12 additional buildings above the main floor level. Monetary savings for avoided stormwater flooding damage would be approximately $381,000 during a 2-year storm, $1.8 million during a 10-year storm, $3.4 million during a 25-year storm, and $7.8 million during a 100-year storm.

Table 4.17-12: Reductions in Buildings Impacted By Inland (Stormwater) Flooding of East Riser Ditch Under Alternative 2

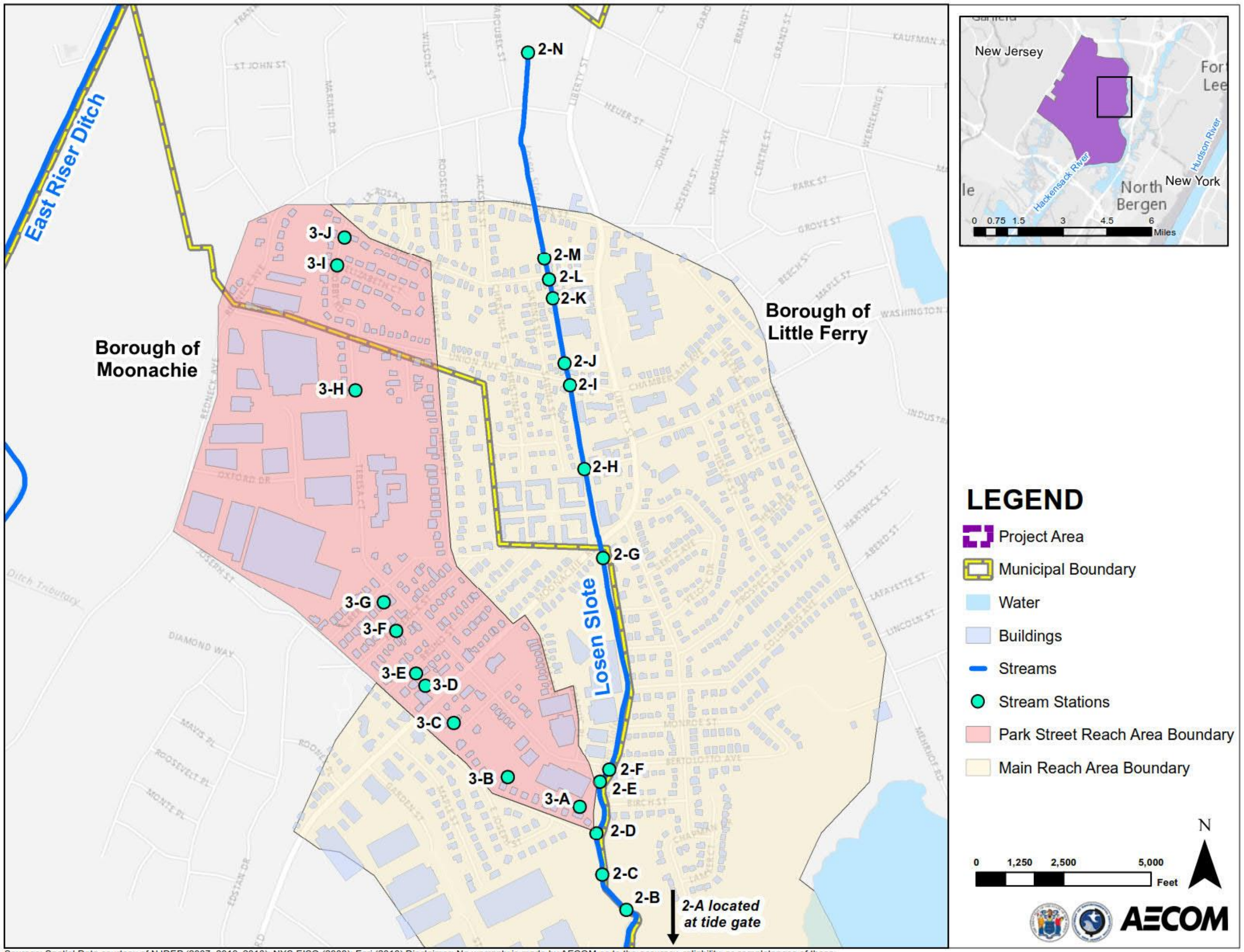
Flood Event Frequency	Reductions in Impacted Buildings		Estimated Damages Avoided ($,000)
	Flooding Above Ground Level	Flooding Above Main Floor Level	
2-year Storm	47	0	381
5-year Storm	70	1	697
10-year Storm	93	4	1,793
25-year Storm	125	7	3,357
50-year Storm	155	6	5,747
100-year Storm	182	12	7,847

Monetary flood damage reduction benefits for the three watersheds were calculated using the US Army Corps of Engineers' Flood Damage Reduction Analysis software (HEC-FDA, ver. 1.4.1).

Losen Slote

The Losen Slote drainage basin was divided into two reaches for analysis based on the two proposed pump stations under Alternative 2. The Main Reach, which would be improved by Losen Slote pump station A, was analyzed from the existing Losen Slote tide gate to approximately the point where it flows beneath Redneck Avenue. The Park Street Reach, which is a fully piped tributary that would be improved by Losen Slote pump station C, was analyzed between its confluence with the Main Reach just north of East Joseph Street and approximately the intersection of Niehaus Avenue with Robby Road. These two reaches, as well as the model stations for each, are shown in **Figure 4.17-11**.

Under existing conditions with Alternative 2, flood depths in the Main Reach (see **Table 4.17-13**) would be reduced between approximately Bertolotto Avenue and Niehaus Avenue. At Bertolotto Avenue (station 2-F), flood depths would increase slightly by approximately 0.2 feet during a 2-year storm, and would not change during a 10-year or 25-year storm. However, they would be reduced by approximately 0.2 feet during a 100-year storm. At Moonachie Road (station 2-G), flood depths would be reduced by approximately 0.2 feet during a 2-year storm, 0.1 feet during a 10-year or 25-year storm, and 0.2 feet during a 100-year storm. The largest flood depth reduction in this reach would occur between approximately the proposed pump station (station 2-H) and Union Avenue (station 2-I); at Union Avenue, flood depths would be reduced by approximately 0.6 feet during a 2-year storm, 0.4 feet during a 10-year storm, 0.3 feet during a 25-year storm, and 0.7 feet during a 100-year storm. Finally, at Niehaus Avenue (2-L), flood depths would be reduced by approximately 0.2 feet or less during each storm event.



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-11: Representative Stream Stations Modeled Along Losen Slote

Table 4.17-13: Change in Flooding Depths in Losen Slote Main Reach Under Alternative 2

Stream Station	Distance Upstream of Tide Gate (feet)	Approximate Location	Change in Flooding Depth (feet)											
			2-year Storm		5-year Storm		10-year Storm		25-year Storm		50-year Storm		100-year Storm	
			2023	2075	2023	2075	2023	2075	2023	2075	2023	2075	2023	2075
2-A	75	Losen Slote tide gate	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0
2-B	6,291		0.3	0.2	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.0
2-C	6,575		0.3	0.2	0.3	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.0
2-D	6,844	East Joseph Street	0.2	0.2	0.2	0.1	0.1	0.1	0.1	-0.1	0.0	-0.1	-0.1	-0.2
2-E	7,197		0.2	0.1	0.1	0.0	0.1	0.0	0.0	-0.1	-0.1	-0.3	-0.2	-0.4
2-F	7,295	Bertolotto Avenue	0.2	0.1	0.1	0.0	0.0	0.0	0.0	-0.2	-0.1	-0.3	-0.2	-0.4
2-G	8,692	Moonachie Road	-0.2	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.2	-0.3
2-H	9,274	North of proposed Losen Slote pump station A	-0.6	-0.7	-0.8	-0.6	-0.5	-0.4	-0.4	-0.3	-0.4	-0.1	-0.3	-0.2
2-I	9,828	Union Ave	-0.6	-0.7	-0.7	-0.6	-0.4	-0.4	-0.3	-0.3	-0.9	-0.1	-0.7	-0.2
2-J	9,970		-0.2	-0.8	-0.2	-0.5	-0.2	-0.3	-0.2	-0.8	-0.2	0.0	-0.2	-0.2
2-K	10,396		-0.2	-0.2	-0.1	-0.2	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.2
2-L	10,518	Niehaus Avenue	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.2
2-M	10,657		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
2-N	12,002	North of Redneck Avenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Highlighted cells represent flood reductions.

Table 4.17-14: Change in Flooding Depths in Losen Slote Park Street Reach Under Alternative 2

Stream Station	Distance Upstream of Main Reach (feet)	Approximate Location	Change in Flooding Depth (feet)											
			2-year Storm		5-year Storm		10-year Storm		25-year Storm		50-year Storm		100-year Storm	
			2023	2075	2023	2075	2023	2075	2023	2075	2023	2075	2023	2075
3-A	94		-0.4	-0.1	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4
3-B	594		-0.3	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
3-C	1,094	Northwest of Molinart Street	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.3
3-D	1,394	Northwest of Moonachie Road	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.3
3-E	1,494	Bruno Street	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.5	-0.3
3-F	1,794	Frederick Street	-0.4	-0.4	-0.5	-0.5	-0.6	-0.6	-0.6	-0.4	-0.5	-0.3	-0.4	-0.3
3-G	1,994	Southeast of Albert Street	-0.5	-0.5	-0.5	-0.6	-0.5	-0.6	-0.6	-0.4	-0.5	-0.4	-0.4	-0.3
3-H	3,394	South end of Teresa Court	-0.3	-0.2	-0.3	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3
3-I	4,294	Elizabeth Court	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.1	-0.1	0.0	-0.1	0.0
3-J	4,494	Niehaus Ave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Highlighted cells represent flood reductions.

Flood depths in the Park Street Reach (see **Table 4.17-14**) would be reduced between its confluence with the Main Reach and approximately the south end of Teresa Court. Near the confluence (station 3-A), flood depths would be reduced by approximately 0.4 feet during a 2-year event, 0.3 feet during a 10-year storm, 0.2 feet during a 25-year storm, and 0.3 feet during a 100-year storm. At Moonachie Road (station 3-D), flood depths would be reduced by approximately 0.1 feet during a 2-year event, 0.3 feet during a 10-year or 25-year storm, and 0.4 feet during a 100-year storm. Flood depths in the Park Street Reach would be most reduced near Frederick Street (station 3-F) and Albert Street (station 3-G); flood depth reduction at Frederick Street would be approximately 0.4 feet during a 2-year event, 0.6 feet during a 10-year storm or 25-year storm, and 0.4 feet during a 100-year storm. North of Teresa Court, flood depth reduction would be approximately 0.3 feet or less.

Due to the increased discharge of Losen Slote from the two proposed pump stations, flood depths would be expected to increase slightly in the portion of the ditch downstream of Bertolotto Avenue, as shown in **Table 4.17-13**. Between stations 2-D and 2-F (i.e., between East Joseph Street and Bertolotto Avenue), flood depths could increase up to 0.2 feet during 2-year, 10-year, or 25-year storms, but would decrease slightly during a 100-year storm. South of East Joseph Street, where Losen Slote meanders through existing wetlands, flood depths could increase up to 0.3 feet, depending on the storm. These minor increases in flood depths would not be expected to adversely impact residences, businesses, or environmental resources.

Flood depth reduction in Losen Slote under future conditions would not substantially differ from flood depth reduction under existing conditions in either reach. Generally, projected flood depth reduction values under future conditions are within 0.2 feet or less of existing conditions.

As shown in **Table 4.17-15**, the spatial extent of flooding in Losen Slote would decrease slightly under Alternative 2. Under existing conditions, flooding extent would be reduced by approximately 13 acres during a 2-year or 10-year storm, 14 acres during a 25-year storm, and 15 acres during a 100-year storm. These reductions are not substantially different from projected flood extent reductions under future conditions. Further, as compared to the relatively concentrated flood extent reductions for East Riser Ditch, the Losen Slote flood extent reductions would be more distributed throughout the Main Reach and Park Street Reach floodplains. Anticipated flooding along Losen Slote is depicted for the 2-year and 100-year storms under existing and future conditions in **Figure 4.17-12** and **Figure 4.17-13**.

Table 4.17-15: Area at Risk of Flooding Under Alternative 2 in the Losen Slote Floodplain

Storm Event Frequency	Approximate Flood Extent (acres)					
	Existing Conditions (2016)	Under Alternative 2	Net Change	Future Conditions (2075)	Under Alternative 2	Net Change
2-year	302	289	-13	320	307	-13
10-year	356	344	-13	379	365	-14
25-year	381	367	-14	409	395	-14
50-year	397	383	-14	434	422	-13
100-year	414	399	-15	464	452	-12

Mathematical inconsistencies due to rounding.

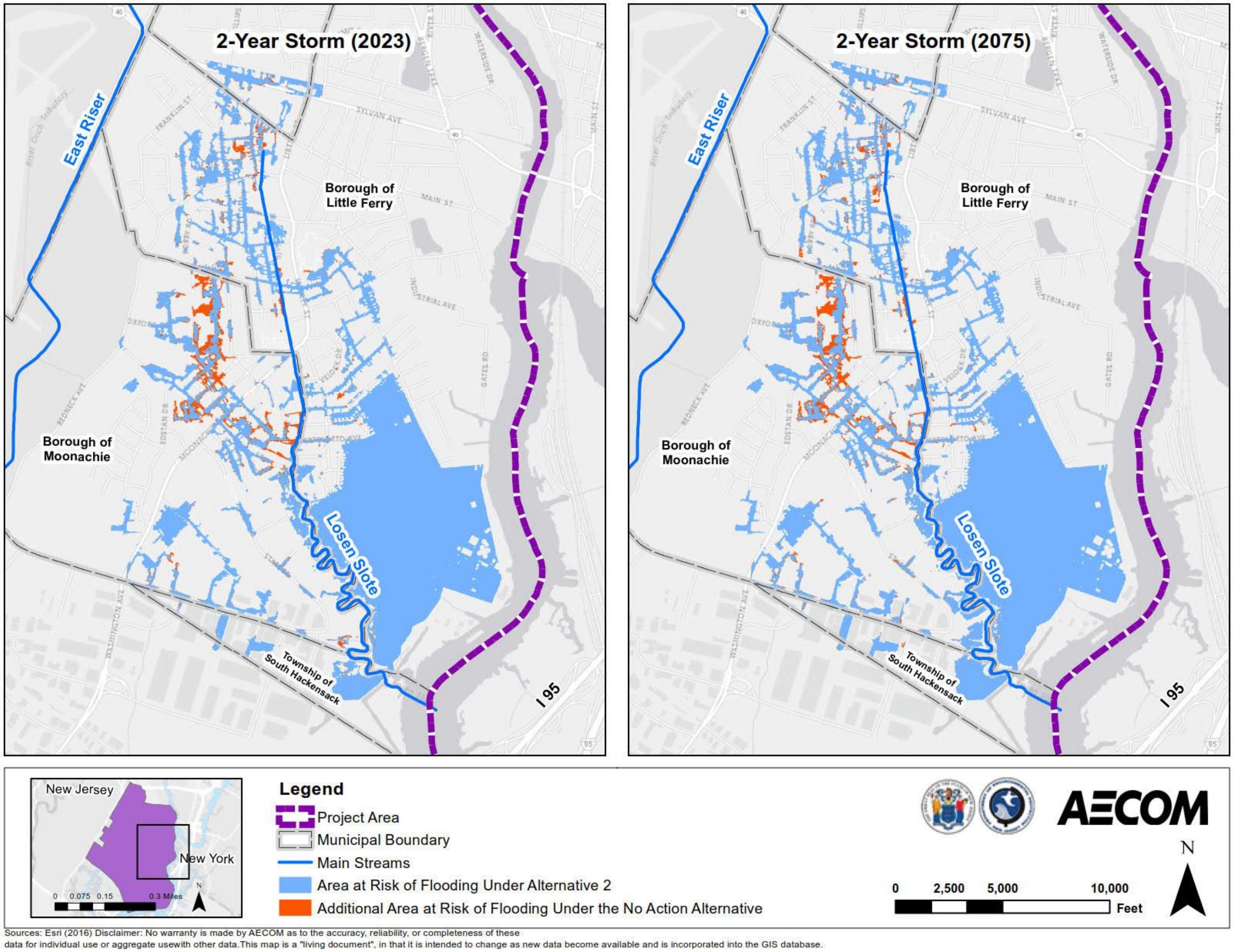
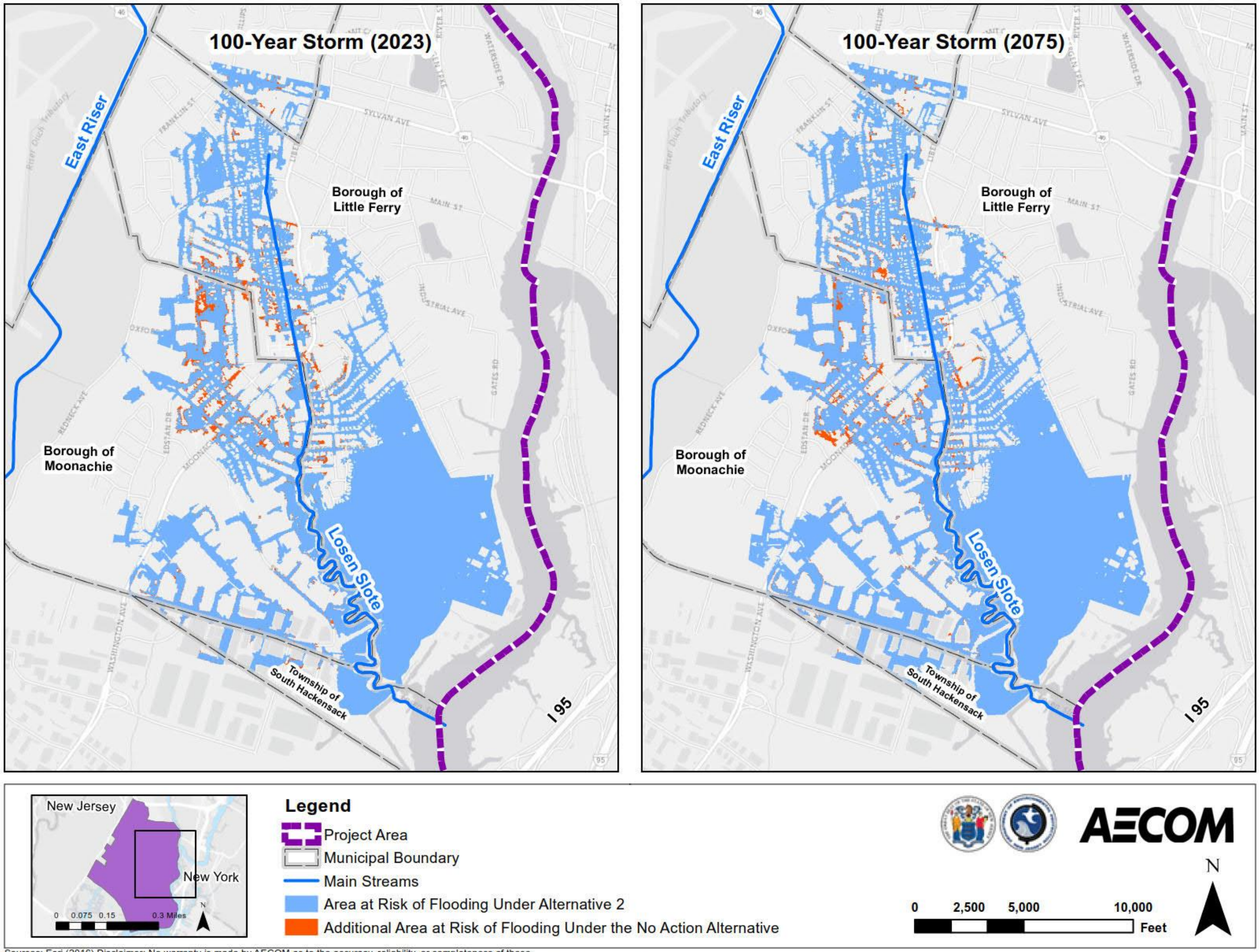


Figure 4.17-12: Comparison of Losen Slote Flooding Under Alternative 2 and the No Action Alternative for the 2-Year Storm



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-13: Comparison of Losen Slote Flooding Under Alternative 2 and the No Action Alternative for the 100-Year Storm

Estimated reductions in buildings impacted and damages under Alternative 2 in the Losen Slote watershed are provided in **Table 4.17-16**. Alternative 2 would provide increased flood protection above ground level for up to approximately 60 additional buildings (i.e., during a 100-year storm), and increased flood protection for up to 12 additional buildings above the level of the main floor. Monetary savings for avoided stormwater flooding damage would be approximately $110,000 during a 2-year storm, $419,000 during a 10-year storm, $790,000 during a 25-year storm, and $1.1 million during a 100-year storm.

Table 4.17-16: Reductions in Buildings Impacted By Inland (Stormwater) Flooding of Losen Slote Under Alternative 2

Flood Event Frequency	Reductions in Impacted Buildings		Estimated Damages Avoided ($,000)
	Flooding Above Ground Level	Flooding Above Main Floor Level	
2-year Storm	9	2	110
5-year Storm	35	7	404
10-year Storm	35	6	419
25-year Storm	32	8	790
50-year Storm	55	11	724
100-year Storm	60	12	1,052

Monetary flood damage reduction benefits for the three watersheds were calculated using the US Army Corps of Engineers' Flood Damage Reduction Analysis software (HEC-FDA, ver. 1.4.1).

Indirect Impacts

Alternative 2 would not be expected to induce flooding or alter hydrology outside of the Project Area. No potential indirect impacts of Alternative 2 have been identified.

Mitigation Measures and BMPs

Mitigation Measures and BMPs related to Hydrology and Flooding would generally be the same as those listed in **Section 4.16.4.3**.

4.17.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, except that it excludes Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and force main C. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not noticeably change how the Proposed Project would affect existing hydrology and flooding in the Project Area, and thus would not change the impact analysis.

Direct Impacts

Similar to Alternative 2, Alternative 3 would have ***long-term, beneficial*** impacts on stormwater drainage in the Project Area by increasing stormwater infiltration during low intensity rainfall events, and increasing the conveyance capacity of both East Riser Ditch and Losen Slote.

Alternative 3 would include all the roadway green infrastructure systems and open space improvements included under Alternative 2, as well as all but two of the proposed new parks. Additionally, the net reduction in impervious surfaces within the Alternative 3 footprint would be approximately 3.7 acres (see **Section 4.15**), which is approximately the same as under Alternative 2. As described previously, the combination of new stormwater management features and reductions in the amount of impervious surfaces would likely increase the rate and capacity of stormwater infiltration, and reduce annual stormwater runoff in the Project Area by approximately 19.0 million gallons (see **Section 4.16.4.4**), during routine rainfall events. However, stormwater flooding associated with rainfall events larger than the NJ Water Quality Design Storm would not be addressed by green infrastructure or other stormwater management features.

Impacts to groundwater under Alternative 3 would be as described under Alternative 2, as the increased stormwater infiltration associated with the green infrastructure systems/stormwater management features could lead to highly localized raises in the water table. Therefore, Alternative 3 could result in ***long-term, less-than-significant adverse*** impacts to the Project Area.

Similar to Alternative 2, Alternative 3 would benefit the Project Area by reducing the depth and, to a lesser degree, extent of inland flooding from East Riser Ditch and Losen Slote, as well as reducing the number of buildings expected to be impacted by inland flooding in these watersheds.

East Riser Ditch

Impacts to flooding of East Riser Ditch under Alternative 3 would be as described under Alternative 2.

Losen Slote

Alternative 3 would provide less flood reduction in the Losen Slote watershed than Alternative 2. In the Main Reach of Losen Slote, flood depth reduction would be similar to that described under Alternative 2; the flood reduction values in this reach for Alternative 3 (see **Table 4.17-17**) predominantly differ from Alternative 2 by 0.1 feet or less. However, there would be very little flood depth reduction in the Park Street Reach due to the elimination of Losen Slote pump station C and force main C. Minor flood depth reductions of 0.1 feet or less could occur within several hundred feet of its confluence with the Main Reach as residual benefits to increased conveyance in that reach.

Additionally, as compared to Alternative 2, Alternative 3 would have a lower chance of increasing flooding downstream of the force main discharge location due to the reduced overall discharge (i.e., one pump station and force main instead of two). Between Bertolotto Avenue and East Joseph Street, Alternative 3 would provide minor flood depth reduction during all storm events, whereas Alternative 2 could lead to minor flooding increases for low-intensity storms up to a 25-year frequency. Similarly, Alternative 3 would have a lower risk of increasing flood depths between East Joseph Street and the tide gate than Alternative 2.

Table 4.17-17: Change in Flooding Depths in Losen Slote Main Reach Under Alternative 3

Stream Station	Distance Upstream of Tide Gate (feet)	Approximate Location	Change in Flooding Depth (feet)											
			2-year Storm		5-year Storm		10-year Storm		25-year Storm		50-year Storm		100-year Storm	
			2023	2075	2023	2075	2023	2075	2023	2075	2023	2075	2023	2075
2-A	75	Losen Slote tide gate	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
2-B	6,291		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
2-C	6,575		0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0
2-D	6,844	East Joseph Street	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
2-E	7,197		-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2
2-F	7,295	Bertolotto Avenue	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2
2-G	8,692	Moonachie Road	-0.2	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
2-H	9,274	North of proposed Losen Slote pump station A	-0.6	-0.7	-0.9	-0.6	-0.6	-0.4	-0.4	-0.2	-0.4	-0.1	-0.3	-0.2
2-I	9,828	Union Ave	-0.6	-0.8	-0.7	-0.5	-0.4	-0.3	-0.2	-0.8	-0.8	-0.1	-0.9	-0.3
2-J	9,970		-0.3	-0.2	-0.2	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.1
2-K	10,396		-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.1
2-L	10,518	Niehaus Avenue	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.1
2-M	10,657		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
2-N	12,002	North of Redneck Avenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Highlighted cells represent flood reductions.

The extent of flooding would also be reduced to a lesser degree under Alternative 3. As shown in **Table 4.17-18**, **Figure 4.17-14**, and **Figure 4.17-15**, the extent of flooding in the Losen Slote floodplain would be reduced by approximately 6 acres for most storm events, which is less than half of the flood extent reduction anticipated under Alternative 2. This level of flood reduction would not change substantially under future conditions.

Table 4.17-18: Area at Risk of Flooding Under Alternative 3 in the Losen Slote Floodplain

Storm Event Frequency	Approximate Flood Extent (acres)					
	Existing Conditions (2023)	Under Alternative 3	Net Change	Future Conditions (2075)	Under Alternative 3	Net Change
2-year	302	296	-6	320	313	-7
10-year	356	349	-7	379	372	-7
25-year	381	375	-6	409	402	-7
50-year	397	391	-6	434	429	-5
100-year	414	407	-6	464	459	-5

Mathematical inconsistencies due to rounding.

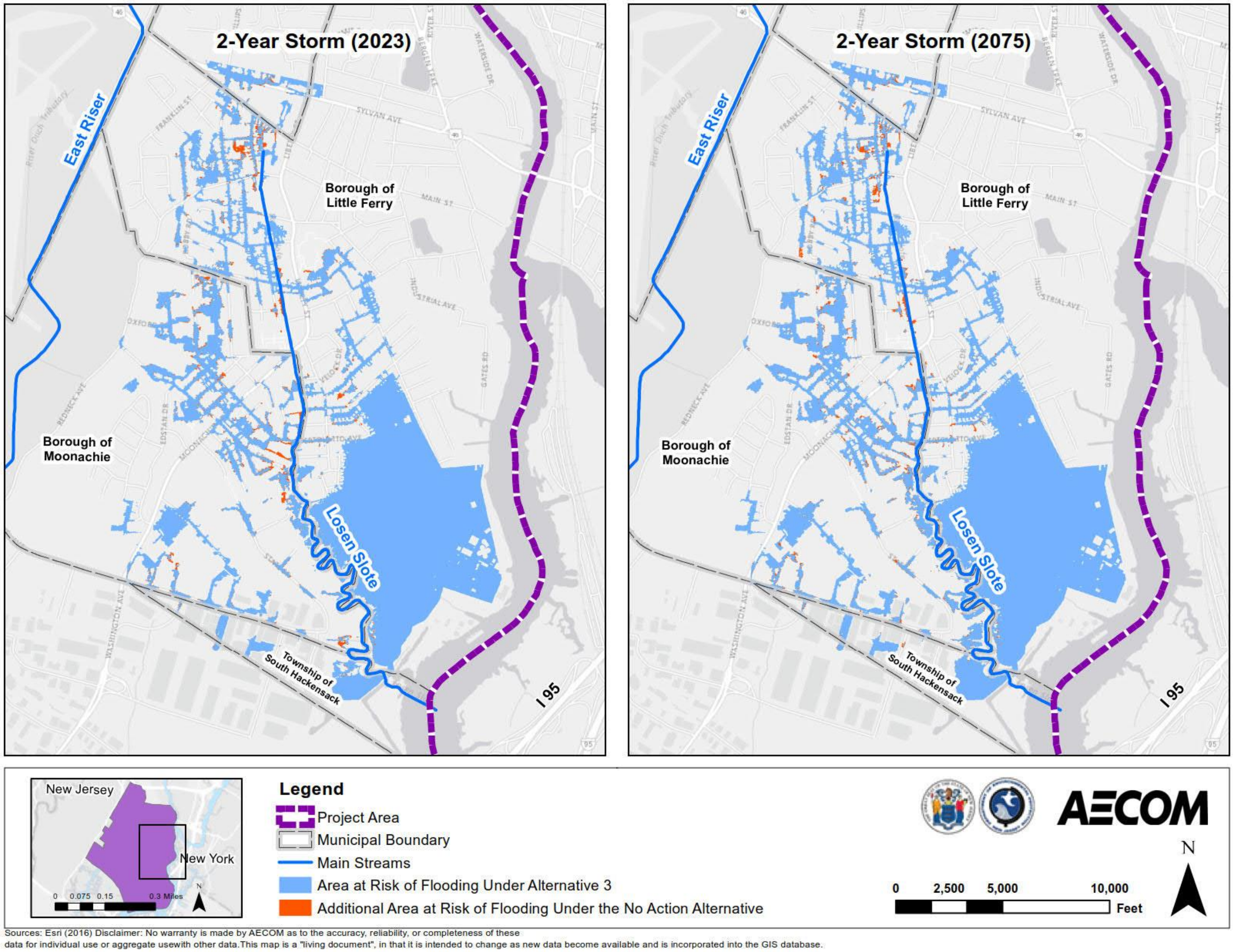
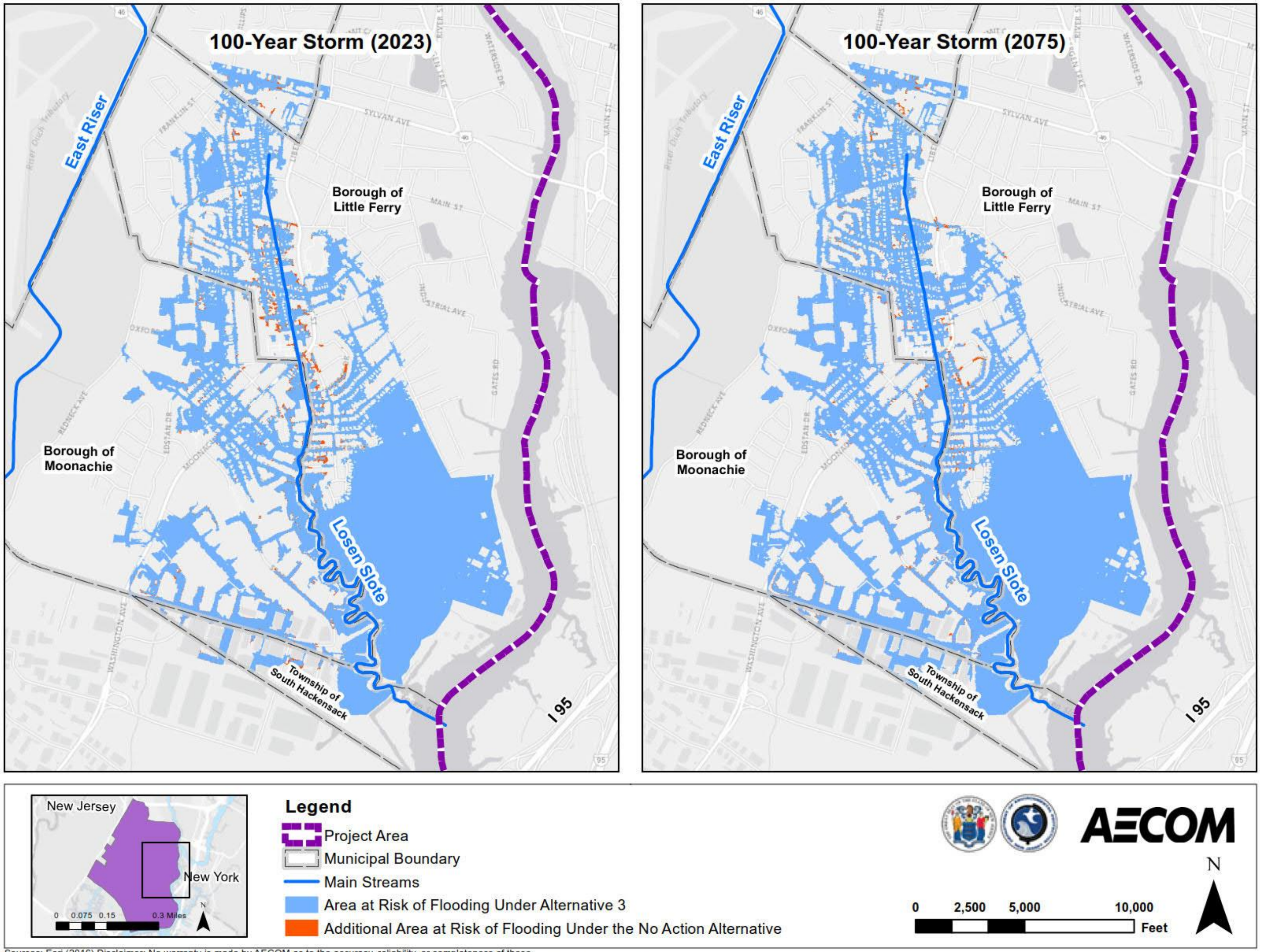


Figure 4.17-14: Comparison of Losen Slote Flooding Under Alternative 3 and the No Action Alternative for the 2-Year Storm



Sources: Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.17-15: Comparison of Losen Slote Flooding Under Alternative 3 and the No Action Alternative for the 100-Year Storm

Estimated reductions in buildings impacted and damages under Alternative 3 in the Losen Slote watershed are provided in **Table 4.17-19**. Alternative 3 would provide increased flood protection above ground level for up to approximately 44 additional buildings (i.e., during a 100-year storm), and increased flood protection above the level of the main floor for up to 5 additional buildings. Monetary savings for avoided stormwater flooding damage would be approximately $0 during a 2-year storm, $59,000 during a 10-year storm, $284,000 during a 25-year storm, and $550,000 during a 100-year storm.

Table 4.17-19: Reductions in Buildings Impacted By Inland (Stormwater) Flooding of Losen Slote Under Alternative 3

Flood Event Frequency	Reductions in Impacted Buildings		Estimated Damages Avoided ($,000)
	Flooding Above Ground Level	Flooding Above Main Floor Level	
2-year Storm	0	0	0
5-year Storm	13	1	65
10-year Storm	15	0	59
25-year Storm	12	1	284
50-year Storm	35	4	219
100-year Storm	44	5	550

Monetary flood damage reduction benefits for the three watersheds were calculated using the US Army Corps of Engineers’ Flood Damage Reduction Analysis software (HEC-FDA, ver. 1.4.1).

Indirect Impacts

Alternative 3 would not be expected to induce flooding or alter hydrology outside of the Project Area. No potential indirect impacts of Alternative 3 have been identified.

Mitigation Measures and BMPs

Mitigation Measures and BMPs related to Hydrology and Flooding would generally be the same as those listed in **Section 4.16.4.4**.

4.18 Coastal Zone Management

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on the coastal zone-regulated areas in the Project Area as described in **Section 3.18**. This section also identifies each alternative’s consistency with applicable CZM policies. Impacts to the regulated coastal zone can be either direct or indirect. An example of a direct impact would be the depletion or loss of coastal areas and/or resources in the Project Area, such that they would no longer be available; this would in turn constitute non-compliance with relevant CZM policies related to that resource. Furthermore, any non-compliance with a relevant CZM policy would be a direct impact. An indirect impact would occur if the Proposed Project would induce other future changes in the Project Area or its vicinity that would be inconsistent with CZM policies or diminish the value of the coastal zone.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to affect coastal zone-regulated areas and its consistency with CZM policies during both construction and operational activities, either by affecting the areas directly or by causing indirect effects that alter their functionality. This analysis also identifies measures that could be implemented to achieve compliance, including administrative and engineering controls, as appropriate.

4.18.1 Definition of Study Area

As described in **Section 3.18**, the study area for this resource area includes the portions of the Project Area included within the New Jersey Coastal Zone. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to the coastal zone in accordance with 40 CFR 1508.27.

4.18.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives on coastal zone-regulated areas and coastal resources are shown in **Table 4.18-1**.

4.18.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were compared to relevant CZM policies. The results of this comparison are presented in the Coastal Consistency Statement provided in **Appendix M.** For each alternative, the level of compliance and type(s) of measures necessary to achieve compliance, if any, were considered, and corresponding impact thresholds were assigned. Compliance with policies related to the New Jersey Coastal Management Program's Geographic Area of Particular Concern (16 USC 1455) and the NJSEA Master Plan (NJSEA 2004) is incorporated into the CZM policies and was evaluated during the preparation of the Coastal Consistency Statement.

With implementation of any Build Alternative, the NJDEP would comply with applicable CZM policies, as detailed in the New Jersey Coastal Zone Management Rules (NJAC 7:7), to the extent practicable. The NJDEP would also obtain appropriate coastal permits/authorizations from the NJDEP and USACE, including a Rivers and Harbors Act Section 10 permit, Individual Waterfront Development Permit and CWA Section 404 Permit and Section 401 Water Quality Certification. In cases where strict compliance would not be possible, mitigation measures are recommended that would satisfy the intent of the applicable policy. Applicable policies, requirements, permitting, and the results of the Coastal Consistency Determination process for each alternative are described in the following subsections.

Table 4.18-1: Coastal Zone Management Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct CZM Change	• Would not result in a change to the coastal zone or coastal resources, including the factors that affect CZM areas • Would result in no loss of CZM-regulated areas • Would be consistent with all applicable CZM policies
	Indirect CZM Change	• Would not induce activities that would be inconsistent with applicable CZM policies, or change the coastal zone or coastal resources
	Applies to All Effect Types	• Would result in no discernable changes to the coastal zone • Would alter the coastal zone for only an indiscernible or negligible period of time
Less-than-Significant	Direct CZM Change	• Would alter the coastal zone or coastal resources, but effects could be rendered consistent/achieve CZM compliance with engineering controls (e.g., seasonal restrictions on construction activities for the protection of migratory fish or breeding birds; use of erosion and sediment control measures to maintain water quality)
	Indirect CZM Change	• Would result in secondary changes to the coastal zone that could be mitigated with engineering controls, administrative controls, and/or design modifications • Would induce activities that only alter the coastal zone for a temporary period of time
	Applies to All Effect Types	• Effects on the coastal zone or coastal resources would be observable and measurable, but would not differ substantially from existing conditions, or would be highly localized • Would be compliant to the extent practicable with relevant CZM policies • Coastal zone would only be altered for a short, finite period • Short-term impacts would be localized in specific areas and not substantially affect or diminish factors that affect CZM areas

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct CZM Change	• Would substantially alter the coastal zone or coastal resources • Would diminish or remove coastal areas and/or resources such that they would no longer be available or would no longer provide value to the Project Area or region • Would be inconsistent with applicable CZM policies
	Indirect CZM Change	• Would induce activities that would be inconsistent with applicable CZM policies, would substantially change the coastal zone or coastal resources, or would result in substantial reduction in the factors contributing to the value of the coastal zone
	Applies to All Effect Types	• Impacts would substantially affect or diminish coastal zone resources throughout the Project Area • Coastal zone would be adversely altered/diminished for an extended or permanent period • Would result in non-compliance with one or more relevant CZM policies • CZM compliance could not be achieved through administrative or engineering controls or mitigation
Beneficial	Direct CZM Change	• Would result in improvements to the coastal zone and/or coastal zone resources • Would rebuild or revitalize the coastal zone • Would strengthen coastal resources and/or coastal resiliency
	Indirect CZM Change	• Would induce activities that would be consistent with applicable CZM policies, would improve the coastal zone or coastal resources, or would enhance the factors contributing to the value of the coastal zone
	Applies to All Effect Types	• Would result in coastal zone benefits, improvements, and/or enhancements in the Project Area

4.18.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to CZM associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.18.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be built and as such, the coastal zone-regulated areas and coastal resources of the Project Area would not be altered by construction or operation activities associated with the Proposed Project. There would be no direct impact to coastal zone-regulated areas and coastal resources, as there would be no new construction.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant, adverse impacts*** on coastal resources and coastal area uses by altering the coastal zone and not advancing the goals of the CZM policies. Depending on the magnitude, severity, and frequency of future flooding events and SLR, these effects reasonably could increase to ***indirect, potentially significant adverse*** impacts by resulting in longer term, more permanent effects to these resources. Per the significance criteria, the No Action Alternative:

- *Could increase long-term risk of coastal zone resources to identifiable hazards, such as flooding*
- *Could result in substantial reduction in the factors contributing to the value of the coastal zone*
- *Could adversely alter or diminish coastal zone for an extended or permanent period*
- *Could not achieve CZM compliance through administrative or engineering controls or mitigation*

Under the No Action Alternative, the goals of the CZM policies, as well as those of the NJSEA Master Plan (NJSEA 2004), would not be advanced. Specifically, the No Action Alternative would not assist in reducing flooding potential within the Project Area, nor would it increase riparian zone vegetation, public open space, public access, or recreational land.

4.18.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Short-term and long-term, less-than-significant, adverse*** impacts to coastal zone-regulated areas and coastal resources in the Project Area during the construction phase of Alternative 1.
- ***Long-term, less-than-significant, adverse*** impacts to coastal resources due to changes to existing marina access in Little Ferry, with the offsetting addition of a new public park and small craft (i.e., kayak) boat launch.
- ***Long-term, beneficial*** impacts to public open spaces, flood hazard areas, and public use due to increased public open spaces and recreational opportunities.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against coastal storm surges and fluvial flooding during heavy storms, which would thereby reduce damages impacting the coastal economy, human health, traffic, and human activities.

The following subsections provide greater detail.

Direct Impacts

While Alternative 1 is consistent with most CZM policies and consistent to the extent practicable with others, the construction and operation of the proposed LOP would have direct impacts to several areas and uses regulated under coastal policy. A complete analysis of coastal consistency and impacts is provided in the Coastal Consistency Statement included as **Appendix M**. An overview of impacts and policies, and explanation of the Proposed Project's compliance with the coastal policies, is provided in the following paragraphs.

Construction and operation of Alternative 1 involves a new tide gate near the mouth of an unnamed tidal tributary adjacent to the BCUA facility in the Borough of Little Ferry. This new tide gate would restrict fish access upstream; however, as the tributary consists of a very short length of open channel prior to transitioning to a subsurface piped conveyance, there is little habitat upstream of the proposed structure. In addition, the tributary is adjacent to the wastewater treatment facility and filled lands, with no direct connection to estuarine wetlands. Alternative 1 also proposes a storm surge barrier to be constructed across Berry's Creek, just south of State Route 120. This barrier would remain open during normal conditions and would only be closed during severe storm events. Although there would be some loss of open water habitat, fish passage would not be blocked by the structure under normal conditions. Alternative 1 is consistent to the extent practicable with policies for finfish migratory pathways and would result in ***long-term, less-than-significant, adverse*** impacts to coastal resources and uses in the Project Area.

During the construction phase, access to the existing Little Ferry Marina would be temporarily disrupted. Closure gates would allow for vehicular and pedestrian access to the docks at this marina during the operation phase of Alternative 1. Access to the Riverside Boat Works and nearby ramps on Riverside Avenue that provide water access would change as the result of the construction of the cantilever riverwalk associated with the new Riverside Park component of Alternative 1. Space and engineering constraints associated with the elevation of the flood protection measures in these locations, as well as planned conversion of these locations to a public park, would need to be coordinated with these facilities during the final design and permitting phase of Alternative 1 to establish long-term access for these marinas. The proposed public open space associated with this portion of Alternative 1 would include a boat dock and kayak launch at the northern end of the cantilever riverwalk to provide public access to the water for small watercraft. Impacts to marina access are inconsistent with policies for marina moorings detailed at NJAC 7:7-9.10; however, because potential impacts to the private marinas (including boat ramps and recreational docks and piers) would be offset by the addition of a proposed public park and small craft boat launch/dock, Alternative 1 would be consistent to the extent practicable with these policies and would result in ***long-term, less-than-significant, adverse*** impacts to coastal resources and uses in the Project Area.

Due to the nature and location of Alternative 1, direct impacts to riparian zones, wetlands and wetland buffers, and intertidal and subtidal shallows would be unavoidable during the construction phase. Additionally, construction of the Alternative 1 LOP would require realignment of water areas in certain locations (e.g., where insufficient space exists between existing development and the shoreline); however, necessary realignments would be minimized to the extent practicable. Mitigation would be performed as necessary for any permanent net loss of wetlands and wetland buffers, intertidal and subtidal shallows, riparian zones, or surface water realignments as discussed in **Section 4.16.4.2**. Mitigation would be coordinated with the NJDEP, USACE, USCG, and NJSEA, as well as other cooperating agencies, through the MIMAC. With the proposed compensatory mitigation, Alternative 1 would be consistent with policies for intertidal and subtidal shallows (NJAC 7:7-9.15), riparian zones (NJAC 7:7-9.26), wetlands and wetland buffers (NJAC 7:7-9.27 / 9.28), realignment of water areas (NJAC 7.7-12.19), and filling (NJAC 7.7-12.11), and would result in both ***short-term and long-term, less-than-significant, adverse*** impacts to coastal zone-regulated areas and coastal resources in the Project Area.

Alternative 1 would not eliminate or jeopardize an existing or documented habitat for any threatened or endangered species, and would not jeopardize the continued existence of local populations of any threatened or endangered species. Any sensitive habitats that would be temporarily disturbed as a result of construction of Alternative 1 would be identified during the permitting process and appropriate mitigation measures, as discussed in **Section 4.14.4.2**, would be followed to protect sensitive populations and habitats. With proposed mitigation measures, Alternative 1 would be consistent with policies for endangered or threatened wildlife or plant species habitat, detailed at NJAC 7:7-9.36, and would result in ***short-term, less-than-significant, adverse*** impacts to coastal zone-regulated areas and coastal resources in the Project Area.

As discussed in detail in **Section 4.6.4.2**, no known archaeological resources are located within the direct APE. However, five areas with a high potential to contain prehistoric or historic period archaeological resources (i.e., high archaeological sensitivity areas) were identified for portions of the direct APE; they include the proposed Fluvial Park, K-Town Park, DePeyster Creek Park, BCUA, and Berry’s Creek areas. Further, a total of 11 historic architectural resources were recorded within the Alternative 1 APE. Of those 11 resources, 4 of them were found to be potentially NRHP-eligible and one of them (US Route 46 Bascule Bridge) is NRHP-eligible. Under Alternative 1, the US Route 46 Bascule Bridge is anticipated to be impacted both directly and indirectly (see **Table 4.6-4**), while the four potentially eligible resources could be impacted indirectly. However, with the implementation of the mitigation measures set forth in **Section 4.6.4.2**, Alternative 1 would be consistent with policies for historic and archaeological resources (NJAC 7:7-9.34).

Alternative 1 includes a proposed, permanent storm surge barrier within Berry’s Creek. Although the structure would be “open” to allow water flow during normal operational conditions, would be closed only during severe storm events, and has been designed to minimize both direct and indirect sediment disturbance to the extent practicable, it would alter the normal flow patterns in Berry’s Creek. Berry’s Creek is a medium river and is considered navigable; however, due to its shallow depth and existing infrastructure, it is not navigable in practice except by small boats, such as canoes. Construction of the proposed storm surge barrier across Berry’s Creek would not result in additional impediments to navigation; therefore, Alternative 1 would be consistent with the navigation channels coastal policy (NJAC 7:7-9.7). Navigation would be hindered only during construction and infrequent closure of the storm surge barrier, at which time operation of small boats would be unlikely. Therefore, Alternative 1 would result in ***long-term, less-than-significant, adverse*** impacts to coastal zone-regulated areas and coastal resources in the Project Area. The USCG would be consulted during the planning phase to ensure compliance with applicable regulations (e.g., 33 CFR 110.155) regarding in-water construction work in Berry’s Creek and the Hackensack River.

Finally, the operation of Alternative 1 would have a ***long-term, beneficial*** impact on several special areas, including the Meadowlands District, public open space, flood hazard area, public use, and lands and waters subject to public trust rights. Alternative 1 would increase public open space and recreational opportunities through the addition of public parks, a public small boat launch and dock, and the addition of waterfront paths and walkways while providing increased flood protection.

Indirect Impacts

No indirect impacts to coastal zone-regulated areas and coastal resources would occur during the construction phase of Alternative 1. Operation of Alternative 1 would provide increased flood protection for the Project Area, resulting in a ***long-term, beneficial*** impact on the coastal economy, human health, traffic, and human activities.

Mitigation Measures and BMPs

No potentially significant adverse impacts to coastal zone resources have been identified from the proposed construction or operation of Alternative 1. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts, and would ensure the Proposed Project complies with applicable CZM policies to the extent practicable.

- Coordination with the Little Ferry Marina and Riverside Boat Works would be conducted during the final design and permitting phases of Alternative 1 to develop a plan to reduce disruptions to these marinas, and to establish long-term access for these marinas to the waterfront to reduce long-term marina impacts.
- Intertidal and subtidal impacts during construction activities in the Hackensack River (below mean high water), wetland impacts, filling, and riparian and wetland buffers would be minimized to the extent possible during the final design and permitting phase, and coordination with the NJDEP, USACE, USCG, NMFS, NJSEA, and other applicable regulatory agencies would be conducted, as appropriate, to ensure proper mitigation and compliance with applicable regulations regarding in-water construction activities (e.g., 33 CFR 110.155).
- The mitigation measures set forth in **Section 4.14.4.2** (Biological Resources) would be implemented to address adverse effects to biological resources associated with the construction and operation of Alternative 1. Any sensitive habitats for endangered or threatened wildlife or plants that would be temporarily disturbed during construction activities would be identified during the permitting process and appropriate mitigation measures, including timing restrictions and other measures as necessary, would be followed to protect sensitive populations and habitats.
- The mitigation measures set forth in **Section 4.16.4.2** (Water Resources) would be implemented to address adverse effects to water resources associated with the construction and operation of Alternative 1.
- The mitigation measures set forth in **Section 4.6.4.2** (Cultural and Historical Resources) would be implemented to address adverse effects to historic and archaeological resources associated with the construction and operation of Alternative 1.

4.18.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding from continued and increased precipitation events, but coastal flooding from storm surges would continue to adversely affect the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term and long-term, less-than-significant, adverse*** impacts to coastal zone-regulated areas and coastal resources in the Project Area during the construction phase of Alternative 2.
- ***Long-term, beneficial*** impacts to public open spaces, flood hazard areas/riparian zones, stormwater management/water quality, and public use due to increased public open spaces and recreational opportunities.

Alternative 2 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against inland flooding during heavy storms, which would thereby reduce damages impacting the coastal economy, human health, and human activities.

The following subsections provide greater detail.

Direct Impacts

While Alternative 2 is consistent with most CZM policies, the construction and operation of the proposed stormwater improvements would have direct impacts to several areas and uses regulated under coastal policy. A complete analysis of coastal consistency and impacts is provided in the Coastal Consistency Statement included as **Appendix M**. An overview of the impacts and policies, and an explanation of Alternative 2 compliance with these policies, is provided in the following paragraphs.

Construction and operation of Alternative 2 involves a new pump station near the existing tide gate on East Riser Ditch, dredging of the ditch along much of its length, and replacement of the existing railroad bridge supporting the NJ Transit Seaman Lead. Construction, access, and staging would result in the disturbance of riparian zone vegetation; this disturbance would be permanent within the footprint of grey infrastructure, including the permanent access road. ***Short-term and long-term, less-than-significant, adverse*** impacts to riparian zones would be expected to be offset by the ***long-term, beneficial*** impacts of the native plantings and habitat enhancements at the proposed Caesar Place Park, DePeyster Creek Park, Riverside Park, Fluvial Park, and along East Riser Ditch under Alternative 2. Therefore, Alternative 2 is expected to be consistent with policies for riparian zones (NJAC 7:7-9.26). The existing railroad bridge, which fills a need that cannot be met by other existing facilities, would be replaced in-kind, and would not be conducive to bicycle or pedestrian access or fishing platforms. Therefore, Alternative 2 would be consistent to the extent practicable with policies for bridges (NJAC 7.7-12.14).

Alternative 2 would not include new tide gates, a storm surge barrier, or any other new barriers to fish migration; it would be consistent with the policies for finfish migratory pathways and with policies for intertidal and subtidal shallows (NJAC 7:7-9.15). Therefore, Alternative 2 would be expected to result in fewer impacts to fish and intertidal and subtidal shallows in comparison to Alternative 1. In addition, Alternative 2 does not include floodwalls along the Hackensack River; therefore, construction related impacts along the shoreline of this tidal water would not be incurred. Shoreline construction associated with Alternative 2 would consist of creation of the new public parks and wetland/habitat creation and enhancement. Any ***short-term, less-than-significant, adverse*** impacts to these coastal resources and uses (i.e., marina moorings (NJAC 7:7-9.10), intertidal and subtidal shallows (NJAC 7:7-9.15), riparian zones (NJAC 7:7-9.26), wetlands and wetland buffers (NJAC 7:7-9.27 / 9.28), filling (NJAC 7.7-12.11), public open spaces (NJAC 7:7-9.38), boat ramps (NJAC 7:7-12.3), and recreational docks and piers (NJAC 7:7-12.5)) would be associated with the construction phase only and would be offset by the ***long-***

term, beneficial impacts resultant from increased public access, recreational opportunities, and habitat enhancements.

Alternative 2 would establish a public park (with boat launch and dock capable of supporting trailered vessels) around the existing Riverside Boat Works private marina. Unlike Alternative 1, Alternative 2 would not interfere with access to the Little Ferry Marina, an existing private marina in the Project Area, and is therefore consistent with the marina moorings policy detailed at NJAC 7:7-9.10. Alternative 2 advances coastal policies associated with public access and marina use, without incurring the adverse impacts that would be incurred with Alternative 1. Therefore, ***long-term, beneficial*** impacts would be expected from increased public acces and marina use.

Alternative 2 would not eliminate or jeopardize any existing or documented habitat for any threatened or endangered species, and would not jeopardize the continued existence of local populations of any threatened or endangered species. Any sensitive habitats that would be temporarily disturbed as a result of construction of Alternative 2 would be identified during the permitting process and appropriate mitigation measures, as discussed in **Section 4.14.4.2**, would be followed to protect sensitive populations and habitats. With proposed mitigation measures, Alternative 2 would be consistent with policies for endangered or threatened wildlife or plant species habitat, detailed in NJAC 7:7-9.36, and would result in ***short-term, less-than-significant, adverse*** impacts to coastal zone-regulated areas and coastal resources in the Project Area. However, impacts would be expected to be reduced in comparison to Alternative 1 since the overall construction duration for Alternative 2 components would be shorter and there would be fewer aboveground structures in proximity to environmentally sensitive natural resources.

As discussed in detail in **Section 4.6.4.3**, no known archaeological resources are located within the direct APE for Alternative 2. However, three areas with a high potential to contain prehistoric and historic period archaeological resources (i.e., high archaeological sensitivity areas) were identified, specifically within the proposed Caesar Place Park, Avanti Park, and DePeyster Creek Park locations. A total of 27 historic architectural resources were recorded within the Alternative 2 APE. Of these 27, only one (the US Route 46 Bascule Bridge) was determined to be NRHP-eligible, while six were determined to be potentially eligible based on a field survey. One potentially eligible resource was recommended as NRHP-eligible: the American Sokol Little Ferry. The US Route 46 Bascule Bridge would be directly and indirectly impacted (see **Table 4.6-6**) by Alternative 2, while the American Sokol Little Ferry could be indirectly impacted. However, with the implementation of the mitigation measures set forth in **Section 4.6.4.3**, Alternative 2 would be consistent with policies for historic and archaeological resources (NJAC 7:7-9.34). For comparison, five areas with high archaeological sensitivity and 11 historic architectural resources were identified under Alternative 1.

Similar to Alternative 1, Alternative 2 would have a ***long-term, beneficial*** impact on several special areas, including the Meadowlands District, public open space, flood hazard area, public use, and lands and waters subject to public trust rights. Alternative 2 would additionally have a ***long-term, beneficial*** impact on stormwater management and water quality while providing increased flood protection during precipitation events.

Indirect Impacts

No indirect impacts to coastal zone-regulated areas and coastal resources would occur during the construction phase of Alternative 2. Operation of Alternative 2 would provide increased flood protection from inland flooding for the Project Area, resulting in a ***long-term, beneficial*** impact on the coastal economy, human health, and human activities.

Mitigation Measures and BMPs

No potentially significant adverse effects to coastal zone resources have been identified from the proposed construction or operation of Alternative 2. With the exception of coordinating with the Little Ferry Marina, the same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2 (see **Section 4.11.4.2**).

4.18.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project would affect coastal resources, and thus would not change the impact analysis.

Impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. These differences are summarized below.

Direct Impacts

While Alternative 3 is consistent with most CZM policies, the construction and operation of the proposed *Build Plan* would have direct impacts to several areas and uses regulated under coastal policy. A complete analysis of coastal consistency and impacts is provided in the Coastal Consistency Statement included as **Appendix M**. An overview of impacts and policies, and explanation of Alternative 3 compliance with the coastal policies, is provided in the following paragraphs.

Any ***short-term, less-than-significant, adverse*** impacts to coastal resources and uses (i.e., marina moorings (NJAC 7:7-9.10), intertidal and subtidal shallows (NJAC 7:7-9.15), riparian zones (NJAC 7:7-9.26), wetlands and wetland buffers (NJAC 7:7-9.27 / 9.28), filling (NJAC 7.7-12.11), public open spaces (NJAC 7:7-9.38), boat ramps (NJAC 7:7-12.3), endangered or threatened species and habitat (NJAC 7:7-9.36), bridges (NJAC 7.7-12.14), and recreational docks and piers (NJAC 7:7-12.5)) associated with construction activities would be the same or less in comparison to Alternative 2 because less ground-disturbing activities would occur. However, ***long-term, beneficial*** impacts resulting from increased public access, recreational opportunities, and habitat enhancements would also be slightly less because Fluvial Park and DePeyster Creek Park would not be created.

As discussed in detail in **Section 4.6.4.3**, no known archaeological resources are located within the direct APE for Alternative 3. In comparison to Alternative 2, only two areas with a high potential to contain prehistoric and historic period archaeological resources (i.e., high archaeological sensitivity areas) were identified, due to the exclusion of DePeyster Creek Park. With the exception of the US Route 46 Bascule Bridge, the historic architectural resources recorded within the Alternative 3 APE are the same as Alternative 2. Similar to Alternatives 1 and 2, with the implementation of the mitigation measures set forth in **Section 4.6.4.3**, Alternative 3 would be consistent with policies for historic and archaeological resources (NJAC 7:7-9.34).

Similar to Alternative 2, Alternative 3 would have a ***long-term, beneficial*** impact on several special areas, including the Meadowlands District, public open space, flood hazard area, public use, and lands and waters subject to public trust rights. However, because fewer parks are included in Alternative 3 than in Alternative 2, Alternative 3 would not advance the coastal policies related to riparian zones, (NJAC 7:7-26), public open space (NJAC 7:7-38), and public access (NJAC 7:7-16.9) to the same extent as Alternative 2. As with Alternative 2, Alternative 3 would have ***long-term, beneficial*** impacts on stormwater management and water quality while providing increased flood protection during precipitation events.

Indirect Impacts

No indirect impacts to coastal zone-regulated areas and coastal resources would occur during the construction phase of Alternative 3. Operation of Alternative 3 would provide increased flood protection for the Project Area, resulting in a ***long-term, beneficial*** impact on the coastal economy, human health, and human activities. However, beneficial impacts would be slightly less because Losen Slote pump station C and force main would not be constructed.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.18.4.3**).

4.19 Sustainability/Green Infrastructure

This section analyzes the potential direct and indirect impacts of the three Build Alternatives and the No Action Alternative on sustainable stormwater management and green infrastructure in the Project Area. Examples of a direct impact would be a proposed increase in impervious surfaces or loss of existing open space that could potentially increase the rate and volume of stormwater runoff or the input of pollutants into waterways. Conversely, another example of a direct impact would be a proposed increase in pervious surfaces within a sub-watershed using green infrastructure features that could achieve beneficial effects, including reducing stormwater runoff and reducing pollutant transport. An indirect impact would result if a considered alternative would prevent the implementation of sustainable stormwater management or green infrastructure projects in the future.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to affect sustainable stormwater management and green infrastructure during both construction and operation, either by affecting or installing these elements directly, or by causing indirect effects that alter future potential, function, and/or utility of such elements. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.19.1 Definition of Study Area

As described in **Section 3.19**, the study area for this resource area includes the Project Area, which spans five municipalities in Bergen County. This study area was defined based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to these resources, in accordance with 40 CFR 1508.27.

4.19.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives on sustainability and green infrastructure are shown in **Table 4.19-1**.

Table 4.19-1: Sustainability/Green Infrastructure Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Sustainability/Green Infrastructure Change	• Would result in no change to impervious or pervious surfaces • Would result in no change in the amount of open space • Would result in no change in hydrology over pre-Project conditions
	Indirect Sustainability/Green Infrastructure Change	• Would not result in a change in drainage patterns • Would not induce activities that could alter the future potential for green infrastructure implementation
	Applies to All Effect Types	• Would result in no discernable changes to sustainability or green infrastructure in the Project Area • Would only alter sustainability or green infrastructure for an indiscernible or negligible period of time
Less-than-Significant	Direct Sustainability/Green Infrastructure Change	• Would result in a minimal or short-term increase in impervious surfaces • Would result in a minimal or short-term loss of open space • Would minimally or temporarily alter hydrology over pre-Project conditions
	Indirect Sustainability/Green Infrastructure Change	• Would minimally or temporarily change drainage patterns • Would induce activities that could minimally or temporarily reduce the future potential for green infrastructure implementation
	Applies to All Effect Types	• Sustainability or green infrastructure would only be altered or diminished for a short, finite period or in a minimal manner • Short-term or minimal impacts would be localized and not substantially diminish sustainability or green infrastructure broadly

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Sustainability/Green Infrastructure Change	• Would result in a moderate, substantial, and/or long-term increase in impervious surfaces • Would result in a moderate, substantial, and/or long-term loss of open space • Would moderately, substantially, and/or permanently alter hydrology over pre-Project conditions
	Indirect Sustainability/Green Infrastructure Change	• Would result in a moderate, substantial, and/or long-term increase in impervious surfaces • Would result in a moderate, substantial, and/or long-term loss of open space • Would moderately, substantially, and/or permanently alter hydrology over pre-Project conditions
	Applies to All Effect Types	• Sustainability or green infrastructure would be adversely altered or diminished for an extended period or permanently • Impacts would substantially affect or diminish sustainability or green infrastructure throughout the Project Area
Beneficial	Direct Sustainability/Green Infrastructure Change	• Would increase pervious surfaces or decrease impervious surfaces • Would increase amount of open space • Would maintain or improve pre-Project hydrology by reducing peak runoff rates and/or treating runoff before discharging to receiving waterbodies • Would provide economic benefits, built human environment or social benefits, and/or ecological or environmental benefits
	Indirect Sustainability/Green Infrastructure Change	• Would change drainage patterns to decrease the rate of runoff to receiving waters • Would induce activities that increase the future potential for green infrastructure implementation
	Applies to All Effect Types	• Would result in sustainability or green infrastructure benefits or improvements in the Project Area

4.19.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to sustainability and green infrastructure within the study area; existing resources are described in **Section 3.19**.

When planning for a proposed Federal construction project, EISA Section 438 requires increases in stormwater runoff to be controlled and the pre-development hydrology[75] of a site to be maintained. These requirements ensure that receiving waters would not be adversely impacted by changes in runoff volumes and rates, as well as by runoff durations and temperatures, resulting from proposed Federal projects.

In conducting this analysis, pre-development hydrology was first determined by examining site-specific conditions and local meteorology, and then developing calculations of pre-development hydrology based on the 95th percentile rainfall event (Option 1, as described in EISA Section 438).

The ability of proposed green infrastructure associated with each considered alternative to retain the 95th percentile rainfall event based on NOAA rainfall data was also analyzed (i.e., per Option 1 as described in EISA Section 438). The analysis assessed the proposed LID and green infrastructure components of each alternative, including their potential to maintain or improve the pre-development hydrology, and thereby reduce peak runoff rates or treat runoff before discharging to receiving waters. To correlate these potential sustainable stormwater management benefits within the broader affected environment, the analysis relied on data presented in other sections of this EIS, including Land Use and Land Use Planning (**Section 3.2**); Recreation (**Section 3.11**); Utilities and Service Systems (**Section 3.12**); Water Resources, Water Quality, and WOUS (**Section 3.16**); and Hydrology and Flooding (**Section 3.17**).

This impact analysis also focuses on the ability of each considered alternative to satisfy the drivers for implementing sustainable stormwater features within the Project Area as part of the Proposed Project. These drivers include:

- Compliance with Federal sustainability directives, such as EISA 2007 and EO 13693 (*Planning for Federal Sustainability in the Next Decade);*
- A Proposed Project goal to improve stormwater management and drainage in the Project Area (see **Section 1.4.1**); and
- A Proposed Project goal to achieve co-benefits or community-level benefits beyond stormwater management (see **Section 1.4.1**).

Compliance, improvements, and benefits were measured through qualitative and quantitative assessments of green infrastructure features proposed as part of each considered alternative, thereby determining how well each alternative would satisfy each of these drivers. In addition, other sustainability benefits, including potential built environment, social, economic, ecological, and environmental improvements, were qualitatively assessed and are described for each considered alternative. Where potential adverse effects were identified, mitigation measures were recommended, as appropriate.

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[75] Pre-development hydrology, more fully described in **Section 3.19.2.1**, is the volume of water generated from a "green" or undeveloped property prior to development.

4.19.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to sustainability and green infrastructure associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.19.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be constructed and no changes would occur to existing conditions within the Project Area due to the construction or operation of the Proposed Project. Existing conditions specific to hydrology (i.e., current drainage networks, impervious surface coverage, and open space) that generate peak runoff flow rates and volumes at the watershed and sub-watershed scale would remain unaffected by the Proposed Project.

Existing localized flooding, erosion, sedimentation, turbidity, and water quality impairments within receiving waterbodies would be expected to continue, and would likely worsen over time (see **Section 4.1.2.1**). As such, the No Action Alternative could have ***indirect, potentially significant adverse*** impacts on stormwater management and drainage (i.e., sustainability), especially drainage in low-lying areas of the Project Area where storm sewers are unable to drain until there is positive head between the tidal backwater and the invert of the storm sewers. Additional information about existing hydrologic conditions is provided in **Section 3.17**. Per the significance criteria, the No Action Alternative, at a minimum:

- *Could result in a moderate, substantial, and/or long-term change in drainage patterns that could increase the rate of runoff to receiving waters without water quality treatment.*

As stated in **Section 3.19.3**, no green infrastructure features currently exist in the Project Area. Two municipalities, the Boroughs of Moonachie and Little Ferry, have documented intentions to incorporate sustainability and green infrastructure improvements in future work, but no specific efforts are underway. The Borough of Moonachie has pursued NJDCA Post Sandy Planning Assistance Grants, under Phase II of the Planning Assistance Program, but according to a May 2016 program document, grants had not yet been approved (Borough of Moonachie 2016). The Little Ferry's Master Plan Reexamination Report (2013) from the Borough of Little Ferry states that the Borough should consider green infrastructure through the use of vegetated swales, bioretention, and green roofs in its flood mitigation efforts. It further states the Borough should consider the use of open space, specifically for water storage during weather events (Borough of Little Ferry Planning Board 2013). Therefore, under the No Action Alternative, it is reasonably anticipated that no holistic or large-scale, community-driven sustainable stormwater management or green infrastructure improvements would be implemented. At a site-specific level, Federal, State, and local stormwater management requirements would regulate new development and redevelopment within the Project Area. Existing impervious surface coverage, therefore, would be expected to decrease throughout the Project Area or, in areas where increased, runoff would be managed to be consistent with the New Jersey Stormwater Best Management Practices Manual.

4.19.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Long-term, beneficial*** impacts to hydrology due to a net decrease in impervious surfaces from existing conditions and improvements to pre-Project hydrology.
- ***Long-term, beneficial*** impacts to the community and environment through increased open space.

- ***Long-term, beneficial*** impacts to the quality of runoff in the Project Area by reducing peak runoff rates.
- ***Long-term, beneficial*** effects by changing hydrology, which would thereby reduce flooding and the associated damages impacting coastal economy, human health, and human activities.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by inducing activities that increase the future potential for green infrastructure implementation through demonstrating the performance and community benefits of green infrastructure as part of open space improvements.

The following subsections provide greater detail.

Direct Impacts

During the construction phase of Alternative 1, no impacts to existing sustainable stormwater management and green infrastructure features would occur. All construction is anticipated to be completed by September 2022. None of the five communities have plans to implement green infrastructure improvements within this timeframe. Therefore, construction activities would not moderately, substantially, or permanently reduce the potential for green infrastructure. Appropriate erosion and sedimentation controls, in accordance with Federal, State, and local regulations, would be implemented to protect hydrology and surface waterbodies from proposed short-term construction activities (see **Section 4.17.4.1**).

Alternative 1 consists of an LOP that is approximately 23,000 LF in total length, resulting in an overall project footprint of approximately 15.5 acres. Proposed impervious surfaces that would generate stormwater runoff include floodwalls; compacted earthen levees; paved access paths; concrete, cantilevered, or elevated walkways; turf sports fields; and a pump station. Pervious surfaces that would retain or slow down the flow of stormwater runoff proposed under Alternative 1 include permeable pavement, upland and riparian plantings, and drainage swales. Approximately 9.6 acres of impervious surface would be removed during construction activities, and approximately 8.8 acres of impervious surfaces would be developed within the Alternative 1 footprint. This represents a net decrease of approximately 0.8 acre of impervious surface within the Alternative 1 footprint from existing conditions. Therefore, Alternative 1 would result in ***long-term, beneficial*** impacts to hydrology from a minimal decrease in impervious surfaces from existing conditions.

The ability of Alternative 1 to meet Federal sustainability directives, improve stormwater management and drainage, and contribute toward co-benefits during its operation is assessed below.

<u>Federal Sustainability Directives</u>

Alternative 1 was reviewed for consistency with EO 13693 (*Planning for Federal Sustainability in the Next Decade*) and Section 438 of EISA 2007 to determine the extent to which the pre-development hydrology of the Project Area could be restored based on site planning and design strategies, including green infrastructure features and impervious to pervious surface conversions. Alternative 1 is consistent with these directives.

Given that the Project Area, particularly the waterfront area where the LOP is proposed, was previously disturbed and developed, returning to pre-development hydrology is not feasible. However, drainage swales and ditches, vegetation, and open space enhancements integrated into the design of the proposed floodwall and levee segments throughout the LOP would improve hydrology and drainage in the Project Area consistent with the purpose of and need for the Proposed Project (see **Section 1.4**).

Section 438 of EISA 2007 is primarily concerned with restoring pre-development hydrology within a watershed to prevent relative increases in runoff volume, peak flow, discharge duration, pollutant loadings, and temperature. These issues are primarily related to impervious surfaces within the Project Area. With implementation of Alternative 1, the proposed impervious surfaces total approximately 8.8 acres. Most of the concrete, grading, and roadway features include linear swaths of impervious area that span peripherally across different sub-watersheds and may contribute to the issues listed above. Where floodwalls impede precipitation-based flows, drainage structures have been designed to manage this runoff. However, most of the impervious surfaces are narrow, linear features that are elevated above, or immediately adjacent to, pervious surfaces or open water. Due to the short distance that runoff would travel to meet pervious surfaces or open water, the footprints of these features would not have a significant effect on the runoff volume, peak flow, discharge duration, pollutant loadings, or temperature.

Alternative 1 proposes a net decrease of approximately 0.8 acre of impervious surface within the Project Area. This would provide a ***long-term, beneficial*** effect to the Project Area by helping to restore the hydrologic cycle and manage stormwater before discharging to receiving waterbodies. The proposed pervious areas include new public open spaces at Fluvial Park, K-Town Park, Riverside Park, and DePeyster Creek Park. These proposed parks include features to provide active and/or passive recreational spaces, waterfront access, and ecological restoration. The creation of Fluvial Park, K-Town Park, Riverside Park, and DePeyster Creek Park would provide a ***long-term, beneficial*** impact by increasing open space. The design of these proposed parks may also include green infrastructure features to further capture, treat, and/or slowly discharge stormwater runoff, including permeable pavement, planters, and vegetated swales. Additional information about the planned open spaces, including potential for impacts during the operation of Alternative 1, is provided in **Section 4.11**.

Stormwater Management and Drainage

The drainage features included in Alternative 1 would convey stormwater runoff from the protected side of the LOP to receiving waterbodies during rainfall events of varying durations and intensities. This includes the proposed construction of 43 storm drainage outlet structures to the Hackensack River along the entire LOP. However, stormwater would not be collected or treated in any new or existing stormwater mains. Drainage would also be integrated along the perimeters of the proposed parks and the paved access paths. Where feasible, drainage features, such as swales and ditches, would be vegetated to deliver various co-benefits, such as ecological restoration and improved public spaces. The 0.1 acre of permeable pavers proposed at DePeyster Creek Park, for example, would filter stormwater before discharging it to receiving waterbodies. Therefore, Alternative 1 would be designed to manage stormwater drainage associated with the LOP, but it would not reduce the risk of precipitation-based flooding within the Project Area. However, Alternative 1 would provide ***long-term, beneficial*** impacts to the quality of runoff in the Project Area from some of the proposed improvements described above. In total, Alternative 1 would be anticipated to reduce annual stormwater runoff in the Project Area by approximately 3.2 million gallons. Additional information about drainage, including potential for impacts during the operation of Alternative 1, is provided in **Section 4.17**.

Infiltration of runoff and groundwater recharge is a statewide stormwater management goal; however, such sustainable stormwater management opportunities are limited in the Project Area. A high incidence of tidal marsh deposits (i.e., consisting of peat and organic silt and clays) throughout the Project Area limits the potential of stormwater infiltration. The communities in the Project Area do not use groundwater sources for water supply due to historical issues related to saltwater intrusion and contamination. Therefore, the potential for groundwater recharge under Alternative 1 is limited; this benefit of green infrastructure is not analyzed for the Proposed Project. Additional information about groundwater resources within the Project Area is provided in **Section 3.16**.

Sustainability Co-Benefits

In addition to reducing flood risk and increasing the resiliency of the communities and ecosystems within the Project Area, Alternative 1 would provide multiple co-benefits. Alternative 1 proposes an interconnected corridor of recreational areas, multi-use facilities, and other design elements that would integrate the Proposed Project into the fabric of the community. In this way, the Proposed Project would be independent of, but still complement, local strategies for future growth to the extent possible. Specifically, Alternative 1 includes the following proposed improvements:

- A LOP that would provide increased coastal flood protection to the Project Area, including associated social, economic, and environmental well-being benefits
- Drainage enhancements integrated into the design of the proposed floodwall and levee segments, including vegetated swales, ditches, open spaces, and green infrastructure
- Approximately 10.1 acres of public open space, including a net decrease of approximately 0.8 acre of impervious surface in the Project Area
- Approximately 1.7 acres of riparian and upland plantings
- Approximately 1.1 acres of newly created wetlands.

These proposed improvements would result in the following co-benefits to the community and environment:

- Access to the Hackensack River, including via cantilever walkways, river walkways, viewing areas, boat docks, and kayak and canoe launches
- Beautification of the environment, including sculpted landforms, views of the Hackensack River, and transformation of vacant lots into attractive landscaped open areas
- Passive recreation areas for walking, leisure, picnicking, bird watching, and wildlife viewing
- Performance spaces and seating for public events
- Fields for sporting events and active recreation
- Ecological uplift by providing and improving habitat for local birds, fish, mammals, amphibians, reptiles, and pollinators, including increased native plantings and removal of invasive species
- Improved hydrological function due to conversion of impervious surfaces to pervious surfaces and reduced stormwater runoff.

Overall, the operation of Alternative 1 would enhance the sustainability of the Project Area by partially mitigating the effects of climate change and improving the Project Area's overall resiliency. It is anticipated that final design and permitting of Alternative 1 would demonstrate compliance with Federal and State stormwater management regulations, as described above. Operation of Alternative 1 would provide increased flood protection for the Project Area while simultaneously providing the identified co-benefits, resulting in a ***long-term, beneficial*** impact on the coastal economy, human health, and human activities.

Indirect Impacts

Because there are no existing or otherwise planned green infrastructure assets in the Project Area, no indirect adverse impacts on sustainability or green infrastructure would occur during the construction or operation of Alternative 1.

Operation of Alternative 1 could have a ***long-term, beneficial*** impact on the region, as Alternative 1's proposed green infrastructure components could provide a positive, tangible example of beneficial, sustainable, and resilient practices. A successfully executed O&M plan would reinforce a positive public opinion of these practices and could help promote and encourage future green infrastructure initiatives. The associated benefits could include drainage solutions that minimize runoff from development, restore the natural hydrologic cycle, preserve or enhance open spaces, and provide long-term benefits for the affected communities.

Mitigation Measures and BMPs

No adverse effects to sustainability or green infrastructure have been identified. Implementation of mitigation measures identified in **Section 4.11**, **Section 4.15**, **Section 4.16**, **Section 4.17**, and **Section 4.18** would further enhance the sustainability and green infrastructure benefits provided by Alternative 1.

4.19.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding from heavy precipitation events, but coastal storm surges (coastal flooding) would continue to adversely affect the Project Area.

Alternative 2 would result in the following direct impacts:

- ***Long-term, beneficial*** impacts to hydrology due to a net increase in pervious surfaces from Alternative 1 and existing conditions, and improvements to pre-Project hydrology.
- ***Long-term, beneficial*** impacts to the community and environment through the creation of five new parks, access to the waterfront (i.e., Riverside Park, Fluvial Park, and DePeyster Creek Park), and improvements to five existing open spaces/public amenities.
- ***Long-term, beneficial*** impacts to the quantity and quality of runoff in the Project Area by reducing peak runoff rates and managing stormwater to complement drainage improvements for more frequent rainfall events.
- ***Long-term, beneficial*** effects by changing hydrology, which would thereby reduce inland flooding and the associated damages impacting the community's economy, human health, and human activities.

Alternative 2 would result in the following indirect impacts:

- ***Long-term, beneficial*** effects by inducing activities that increase the future potential for green infrastructure implementation through demonstrating the performance and community benefits of green infrastructure as part of open space improvements.

The following subsections provide greater detail.

Direct Impacts

Similar to Alternative 1, no impacts to existing sustainable stormwater management and green infrastructure features would occur as a result of construction activities. All construction is anticipated to be completed by September 2022. None of the five communities have plans to implement green infrastructure improvements within this timeframe. Therefore, construction activities would not moderately, substantially, or permanently reduce the potential for green infrastructure. Appropriate erosion and sedimentation controls, in accordance with Federal, State, and local regulations, would be implemented to protect hydrology and surface waterbodies from proposed short-term construction activities (see **Section 4.17.4.3**).

Compared to Alternative 1, Alternative 2 would result in greater ***long-term, beneficial*** impacts to hydrology through increased stormwater conveyance and the reduction of impervious surfaces by 3.4 acres in the Project Area from the establishment of green infrastructure, new open space, and wetland habitat creation and enhancements. In addition, Alternative 2 could potentially have fewer conflicts than Alternative 1 with regard to utilities as the green infrastructure improvements within the rights-of-way would be designed to accommodate existing utilities and avoid the cost of utility relocation.

The ability of Alternative 2 to meet Federal sustainability directives, improve stormwater management and drainage, and contribute toward co-benefits during its operation is assessed below.

<u>Federal Sustainability Directives</u>

Similar to Alternative 1, Alternative 2 was reviewed for consistency with EO 13693 (*Planning for Federal Sustainability in the Next Decade*) and Section 438 of EISA 2007 and is consistent with these directives that aim to restore the pre-development hydrology of the Project Area. While returning to pre-development hydrology is not feasible given that the Project Area was previously disturbed and developed, the introduction of bioswales, rain gardens, storage trenches, tree trenches, new parks, and grey infrastructure improvements, would improve hydrology and drainage in the Project Area consistent with the purpose of and need for the Proposed Project (see **Section 1.4**).

Section 438 of EISA 2007 is primarily concerned with restoring pre-development hydrology within a watershed to prevent relative increases in runoff volume, peak flow, discharge duration, pollutant loadings, and temperature. These issues are primarily related to impervious surfaces within the Project Area. With implementation of Alternative 2, the proposed impervious surfaces would be reduced through replacement with green infrastructure strategies. Alternative 2 proposes a net increase of approximately 3.4 acres of pervious surface within the Project Area, in comparison to only 0.8 acre under Alternative 1. Therefore, Alternative 2 would provide a slightly greater ***long-term, beneficial*** effect to the Project Area by helping to restore the hydrologic cycle and manage stormwater before discharging to receiving waterbodies.

<u>Stormwater Management and Drainage</u>

Under Alternative 2, the proposed stormwater improvements would increase stormwater conveyance in the East Riser Ditch and Losen Slote drainage areas, increase stormwater infiltration, and increase water quality treatment within the Project Area. Stormwater management and drainage would be promoted through the development of 41 green infrastructure systems (e.g., bioswales, rain gardens, and storage trenches), and the establishment of new open spaces, increased permeable surfaces, and habitat creation and enhancements. Alternative 2 would provide ***long-term, beneficial*** impacts to the quantity and quality of stormwater runoff in the Project Area. As described in **Section 4.16.4.3**, Alternative 2 would reduce annual stormwater runoff in the Project Area by approximately 24.9 million gallons. Additionally, the green infrastrcutre systems would be designed to reduce approximately 80 percent of total suspended solids, approximately 60 percent of total phosphorus, and approximately 30 percent of total nitrogen from stormwater runoff. Additional information about drainage, including potential for impacts during the operation of the Alternative 2, is provided in **Section 4.17**.

Sustainability Co-Benefits

In addition to increasing the resiliency of the communities and ecosystems within the Project Area, Alternative 2 would provide multiple co-benefits. Alternative 2 proposes a variety of green infrastructure and open space improvements that would integrate the Proposed Project into the community. Specifically, Alternative 2 includes the following proposed improvements:

- An increase in the stormwater conveyance capacity within the East Riser Ditch and Losen Slote drainage areas from three new pump stations, two new force mains, and dredging of the lower reach of East Riser Ditch.
- An increase in stormwater filtration capacity and water quality treatment in the Project Area through the installation of 41 green infrastructure systems (bioswales, storage/tree trenches, and rain gardens) along roadways, five new parks, and improvements to five existing open spaces/public amenities.
- Creation of approximately 20.0 acres of new park space.
- A net decrease of 3.4 acres of impervious surfaces within the Project Area.
- Publicly accessible riverfront access from the creation of Fluvial Park, Riverside Park, and DePeyster Creek Park.
- Creation and/or enhancement of approximately 7.2 acres of wetland habitat.

These proposed improvements would result in the following co-benefits to the community and environment:

- Access to the Hackensack River, via walking paths and trails, viewing areas, boat launch/docks, and a kayak and canoe launch.
- Beautification of the environment, including sculpted landforms, views of the Hackensack River, and transformation of vacant lots into attractive landscaped open areas.
- Passive recreation areas for walking, leisure, picnicking, bird watching, sunbathing, wildlife viewing, and informal games.
- Fields for sporting events and active recreation.
- Ecological uplift by providing and improving habitat for local birds, fish, mammals, amphibians, reptiles, and pollinators, including increased native plantings and removal of invasive species.
- Improved hydrological function due to conversion of impervious surfaces to pervious surfaces and reduced stormwater runoff.

Overall, the operation of Alternative 2 would enhance the sustainability of the Project Area by partially mitigating the effects of climate change and improving the Project Area’s overall resiliency to inland flooding from heavy precipitation events. However, unlike Alternative 1, this alternative would not enhance the Project Area’s ability to mitigate coastal flooding and the effects of climate change associated with it. It is anticipated that final design and permitting of Alternative 2 would demonstrate compliance with Federal and State stormwater management regulations, as described above. Therefore, operation of Alternative 2 would provide improved stormwater management for the Project

Area during and following rainfall events while simultaneously providing the identified co-benefits, resulting in a ***long-term, beneficial*** impact on the coastal economy, human health, and human activities.

Indirect Impacts

Because there are no existing or otherwise planned green infrastructure assets in the Project Area, no indirect adverse impacts on sustainability or green infrastructure would occur during the construction or operation of Alternative 2.

Similar to Alternative 1, operation of Alternative 2 could have a ***long-term, beneficial*** impact on the region proposed green infrastructure components by demonstrating best stormwater management practices. A successfully executed O&M plan would reinforce a positive public opinion of these practices and could help promote and encourage future green infrastructure initiatives. The associated benefits could include drainage solutions that minimize runoff from development, restore the natural hydrologic cycle, preserve or enhance open spaces, and provide long-term benefits for the affected communities.

Mitigation Measures and BMPs

No adverse effects to sustainability or green infrastructure have been identified. Implementation of the same mitigation measures and BMPs identified under Alternative 1 would further enhance the sustainability and green infrastructure benefits provided by Alternative 2.

4.19.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer stormwater improvements due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and force main C. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project would affect the sustainability of the Project Area, and thus would not change the impact analysis.

Alternative 3 proposes a net decrease of approximately 3.7 acres of impervious surface within the Project Area. Therefore, Alternative 3 would have a slightly greater ***long-term, beneficial*** effect from a reduction of impervious surfaces within the Project Area, in comparison to Alternative 1 (net decrease of 0.8 acre) and Alternative 2 (net decrease of 3.4 acres). However, compared to Alternative 2, Alternative 3 would have slightly less ***long-term, beneficial*** impacts due to the exclusion of some of the stormwater improvements for the following reasons.

- Increased stormwater conveyance capacity would be less in the Losen Slote drainage area because only one pump station and force main would be constructed.
- Increased stormwater runoff reduction and water quality treatment in the Project Area would be less due to the exclusion of Fluvial Park and DePeyster Creek Park (only approximately 19.0 million gallons annually).
- New park space would be approximately 12.4 acres less than Alternative 2.
- Publicly accessible riverfront access would only occur from the creation of Riverside Park.
- Creation and/or enhancement of wetland habitat would be approximately 3.7 acres less than Alternative 2.

Mitigation Measures and BMPs

No adverse effects to sustainability or green infrastructure have been identified. Implementation of the same mitigation measures and BMPs identified under Alternative 1 would further enhance the sustainability and green infrastructure benefits provided by Alternative 3.

4.20 Hazards and Hazardous Materials

This section analyzes the potential impacts of the three Build Alternatives and the No Action Alternative on hazards and hazardous materials within the Project Area. Impacts to hazardous materials can be either direct or indirect. A direct impact would occur, for example, if construction of an alternative would take place on an existing contaminated site, such that construction could result in the exposure of contamination in the immediate environment. An indirect impact would occur if a Proposed Project alternative would preclude or limit future remediation activities at a contaminated location.

This analysis specifically addresses the potential for the Proposed Project's considered alternatives to affect hazardous materials during both construction and operation, either by affecting these resources directly or by causing indirect effects to such materials later in time or further in distance (e.g., off-site impacts or imposing future limitations). This analysis also identifies the location of impacts and, where possible, quantifies potential effects.

4.20.1 Definition of Study Area

As described in **Section 3.20**, the study area for this Technical Resource Area includes the portions of the Project Area with the potential to be disturbed during construction and operational activities for each of the Build Alternatives, and up to one mile in the vicinity of these footprints. This study area was selected based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to hazardous materials, in accordance with 40 CFR 1508.27. Due to the nature of the different categories of contaminated sites, the study area for each category varies and is summarized below in **Table 4.20-1**. More detail on the database searches and the types of sites per category are providing in **Appendix N**.

Table 4.20-1: Hazards and Hazardous Materials Study Areas for Contaminated Sites

Contaminated Site Category	Maximum Search Distance from Build Alternatives
NPL	1.0 mile
CERCLA	0.5 mile
RCRA	1.0 mile (Corrective Action Sites); 0.5 mile (Transfer, Storage and Disposal Facilities); and 0.25 (Hazardous waste generators without corrective actions)
State Hazardous Waste Sites / KCS	3,000 feet of Build Alternatives as specified in 24 CFR § 50.3(i) and 24 CFR § 58.5(i)(2); 1.0 mile ASTM E1527-13 (used larger search radius)
CEAs	0.5 mile
Landfills	3,000 feet of Build Alternatives as specified in 24 CFR § 50.3(i) and 24 CFR § 58.5(i)(2)
USTs	0.5 mile (leaking and historic USTs) and 0.25 (registered USTs)

Contaminated Site Category	Maximum Search Distance from Build Alternatives
Sites with institutional and/or engineering controls	0.5 mile
Emergency Response Notification System	Within Build Alternative Footprints
NJ Spills, NJ Releases, Historic Gas Stations, Dry Cleaners	Within or adjacent to Build Alternative Footprints

4.20.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects from the alternatives on hazards and hazardous materials are provided in **Table 4.20-2**.

4.20.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to areas containing hazards and hazardous materials within the study area; these resources are described in **Section 3.20**. These sites include Superfund sites, historic landfills, sites with groundwater CEAs, KCSs, active UST sites, automobile service stations and filling stations, and NJDEP-mapped historic fill.

The Superfund sites, historic landfills and un-remediated KCSs, USTs, automotive facilities, and historic fill are RECs. Any previously remediated sites in these listings that meet Unrestricted Use criteria are considered HRECs. Sites with groundwater CEAs, capped historic fill, or other listings addressed with engineering and/or institutional controls are identified as CRECs. Any contaminated site that has not been remediated to meet Unrestricted Use criteria or CREC sites that remain contaminated but with engineering and/or institutional controls are considered RECs for the purpose of this analysis if impacted by the Proposed Project. While these REC locations are the focus of the analysis due to the nature of these sites and their potential for adverse impacts, all sites known to contain, or potentially contain, hazardous materials were reviewed to ensure the full range of potential impacts was evaluated.

To conduct this analysis, the footprint of each Build Alternative was overlaid onto mapped existing hazardous materials environment using GIS, and the spatial relationships between Proposed Project components and contaminated or potentially contaminated sites were identified. Using these data, potential direct temporary and long-term impacts to contaminated properties, and corresponding potential indirect impacts, at specific locations were identified. Potential impacts considered included the potential to: (1) affect ongoing remedial investigations or activities; (2) introduce or spread contamination in the environment; or (3) conflict with future remedial activities or attainment of remediation goals.

In addition, a qualitative analysis of anticipated changes to hazards and hazardous materials in the study area was conducted. This qualitative analysis considered several site-specific conditions (e.g., type of contaminated media, Superfund or other type of regulated site, historic fill) and the likely interaction with specific Proposed Project components (e.g., construction of a rain garden or bioswale).

Table 4.20-2: Hazards and Hazardous Materials Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Hazardous Materials Change	• Would avoid RECs, HRECs, CRECs, Superfund sites, historic landfills, CEAs, KCSs, USTs, historic fill, and unknown contaminated sites • Would maintain the ASD from all stationary hazards, such as ASTs • Would not introduce new contaminants into the environment or alter the risk of spreading contaminants • Would not affect existing remedial investigations or remedial actions
	Indirect Hazardous Materials Change	• Would not induce any further changes that would affect contaminated sites • Would not induce any further changes that would introduce new contaminants or increase the risk of spreading contaminants • Would not induce any further activities that would affect existing remedial investigations or remedial actions • Would not limit or conflict with future remedial activities • Would not result in offsite or future release/transport of contaminants
	Applies to All Effect Types	• Would not induce any further changes that would affect contaminated sites • Would not induce any further changes that would introduce new contaminants or increase the risk of spreading contaminants • Would not induce any further activities that would affect existing remedial investigations or remedial actions • Would not limit or conflict with future remedial activities • Would not result in offsite or future release/transport of contaminants
Less-than-Significant	Direct Hazardous Materials Change	• Would minimally or temporarily affect a contaminated site or introduce minimal amounts of contaminants into the environment temporarily, but would include proper controls and measures to avoid the spread of contamination • Would temporarily affect remedial investigations or remedial actions
	Indirect Hazardous Materials Change	• Would induce other activities that would temporarily affect contaminated sites, introduce minimal amounts of contaminants, minimally increase the risk for spreading contaminants, and/or affect existing remedial investigations or remedial actions • Would place minimal limitations on future remedial activities that would not preclude attaining remediation goals
	Applies to All Effect Types	• Ongoing or planned remedial activities would only be affected for a short, finite period of time • Short-term impacts would be localized in specific areas and not introduce contaminants, spread contamination, alter hazards, or affect long-term remedial activities • Potential hazardous materials effects would be controlled through BMPs, engineering controls, and/or institutional controls

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Hazards and Hazardous Materials Change	• Would moderately/substantially or permanently impact a contaminated site and would limit the remediation activity • Would moderately/substantially or permanently increase the risk of spreading contaminants or introduce contaminants to the environment • Would moderately/substantially or permanently conflict with ongoing remedial investigations or remedial actions
	Indirect Hazardous Materials Change	• Would induce further changes that would affect contaminated sites, introduce sizeable amounts of contaminants, increase the risk of spreading of contaminants over an extended timeframe, and/or moderately/substantially/permanently conflict with existing remedial investigations or remedial actions • Would limit or conflict with future remedial activities • Would result in offsite or future release/transport of contaminants
	Applies to All Effect Types	• Would substantially limit remedial activities, introduce sizeable amounts of contaminants, and/or increase the risk of spreading contaminants in the environment • Would potentially result in increased risk to people or property from contamination or failure to maintain the ASD from stationary hazards
Beneficial	Direct Hazardous Materials Change	• Would reduce contamination, the risk for spreading contaminants, or the potential risk to people, property, and/or the environment from contamination • Would expedite, benefit, or improve remedial investigations and remedial actions • Would reduce the amount of contamination in the environment over the short- or long-term
	Indirect Hazardous Materials Change	• Would induce improvements that would reduce contamination, reduce the risk for spreading contaminants, or reduce the potential risk to people, property, and/or the environment from contamination • Would expedite, benefit, or improve future remedial activities • Would result in a decrease in offsite or future release/transport of contaminants
	Applies to All Effect Types	• Would result in hazardous materials benefits, improvements, and/or risk reductions in the Project Area

These include factors that could result in a release or spread of contaminants from an area containing hazardous materials, such as proximity to a stream or lack of cover on a landfill. The concentration and toxicity of chemicals known to be present, presence of engineering/institutional controls, and technical or regulatory requirements were also considered, among other criteria. This analysis considered impacts from both temporary construction and long-term operational activities.

For locations of Build Alternatives where RECs or CRECs were identified, additional information regarding site history, contaminants detected, remedial action, regulatory status, and other relevant data were obtained and reviewed from reliable sources, including NJDEP and municipal files for the contaminated sites, to identify specific impacts associated with each Build Alternative.

As discussed in **Section 3.20.3.6** and in accordance with 24 CFR Part 51C and the guidelines set forth by HUD, an assessment was conducted to determine the ASD of applicable Proposed Project features in proximity to hazardous operations (specifically, ASTs). The ASD is the area in which members of the public would be safe from any potential explosive or combustible hazards associated with the ASTs. The significance criteria used to evaluate potential effects from ASTs on the three Build Alternatives were provided by HUD, and the methods used for determining the ASD of ASTs were also in accordance with HUD's Acceptable Separation Distance Guidebook (HUD 2011). The Proposed Project would create open spaces, such as parks, where people congregate; therefore, HUD's Thermal Radiation standard that is applicable to people (the ASD where the thermal radiation flux would not exceed 450 Btu per hour) was applied.

The ASD for thermal radiation for people was calculated for each of the evaluated ASTs using HUD's online Acceptable Separation Distance Electronic Assessment Tool (HUD 2017). The calculated ASD for thermal radiation for people was noted for each AST and plotted in GIS as a radius extending from the center of each tank. Using GIS, these ASDs were viewed relative to the locations of proposed recreational improvements for the three Build Alternatives. ASTs with ASDs that did not intersect with locations of proposed improvements were excluded from further analysis; ASDs that were found to intersect proposed build features were analyzed further for potential impacts. For more detailed information on the methodology and results of this analysis, refer to **Appendix O**.

For locations where the available information was not sufficient, a visual site reconnaissance was conducted to assess current conditions regarding the presence of hazardous materials, including the factors identified above. Where potential adverse conditions or effects were identified, the analysis recommended mitigation measures where reasonable and practicable.

4.20.4 Impact Analysis

The following subsections assess potential direct and indirect impacts to areas containing hazards and hazardous materials associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.20.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be built and no changes attributable to the Prosed Project would occur to hazards or hazardous materials within the Project Area. As such, there would be no direct impacts to hazards and hazardous materials from the Proposed Project.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant adverse*** impacts on hazards and hazardous material sites within the Project Area. Depending on the magnitude, severity, and frequency of future flooding events and SLR and the location and type of hazard affected, these effects reasonably could increase to ***indirect, potentially significant adverse*** impacts. Per the significance criteria, the No Action Alternative:

- *Could affect contaminated sites, introduce sizeable amounts of contaminants, increase the risk of spreading of contaminants over an extended timeframe, and/or conflict with existing remedial investigations or remedial actions*
- *Could limit or conflict with future remedial activities*
- *Could result in offsite or future release/transport of contaminants*

Under the No Action Alternative, a large portion of the BCSA (**Figure 3.20-1**) would be inundated during a 50-year storm event under both SLR scenarios. Further, Superfund sites in the Project Area and numerous KCS sites would be inundated as well. Long-term or permanent inundation of contaminated sites could severely limit the feasibility of conducting remediation investigations and actions. Continued and increased flooding could lead to contaminants being carried off contaminated sites or new contaminants being introduced within existing sites. Flooding has the potential to increase the erosion of protective caps, damaging the remedy and transporting contaminants off-site. Further, shoreline erosion and sedimentation could lead to the release of contaminated sediment into the waterways and to downstream areas outside the Project Area.

4.20.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would reduce flooding of the Project Area from coastal storm surges (coastal flooding), but continued and increased inland flooding from heavy precipitation events would continue to adversely affect the Project Area (see **Section 4.1.2.2**).

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, potentially significant, adverse*** impacts from discharges, or the transfer, sale, or closing of an industrial establishment or property regulated under the ISRA, that triggers near-term remediation during the construction phase of Alternative 1.
- ***Long-term, potentially significant, adverse*** impacts from the disruption or mobilization of previously unknown hazardous materials encountered during construction.
- ***Short-term, less-than-significant, adverse*** impacts from subsurface disturbance of hazardous materials at known or suspected contaminated sites during construction.
- ***Short-term, less-than-significant, adverse*** impacts to planned remedial activities being delayed temporarily because they occur within the proposed construction staging areas for Alternative 1.
- ***Short-term, less-than-significant, adverse*** impacts from construction activities within the BCSA.
- ***Short-term and long-term, less-than-significant, adverse*** impacts from potential spills (e.g., gasoline and diesel fuel) during construction and operational activities.
- ***Long-term, beneficial*** impacts to the Project Area from the removal of potentially-contaminated soils during construction.

Alternative 1 could result in the following ***indirect*** impacts:

- ***Long-term, potentially significant, adverse*** impacts from ground-disturbing activities during construction inadvertently creating preferential pathways for methane and VOC-contaminated soil vapor and/or groundwater to migrate off-site that pose a risk to occupants of nearby buildings.
- ***Long-term, potentially significant, adverse*** impacts from mobilization of contaminant plumes in soil or groundwater due to dewatering during construction, or increased stormwater infiltration during operation.
- ***Long-term, potentially significant, adverse*** impacts to people at the proposed Northern Segment riverwalk during construction and operation due to the increased risk from thermal radiation or blast-overpressure damage.
- ***Long-term, potentially significant, adverse*** impacts to future remedial investigations that are hindered due to the presence of the LOP.
- ***Long-term, beneficial*** impacts from the protection of KCSs and historic fill from the erosive effects of coastal flooding that could mobilize uncapped contaminated sediments and/or soil to offsite properties, waterways, and/or coastal wetlands.

The following subsections provide greater detail.

Direct Impacts

Table 4.20-3 provides a summary of the contaminated sites that would be directly impacted by construction of Alternative 1, and the potential short-term and long-term impacts that could result from construction and operation of Alternative 1, respectively, to these sites. Under Alternative 1, up to 13 contaminated sites could be directly impacted. **Figure 4.20-1** through **Figure 4.20-4** depict the mapped contaminated sites within and in the vicinity of the Alternative 1 footprint.

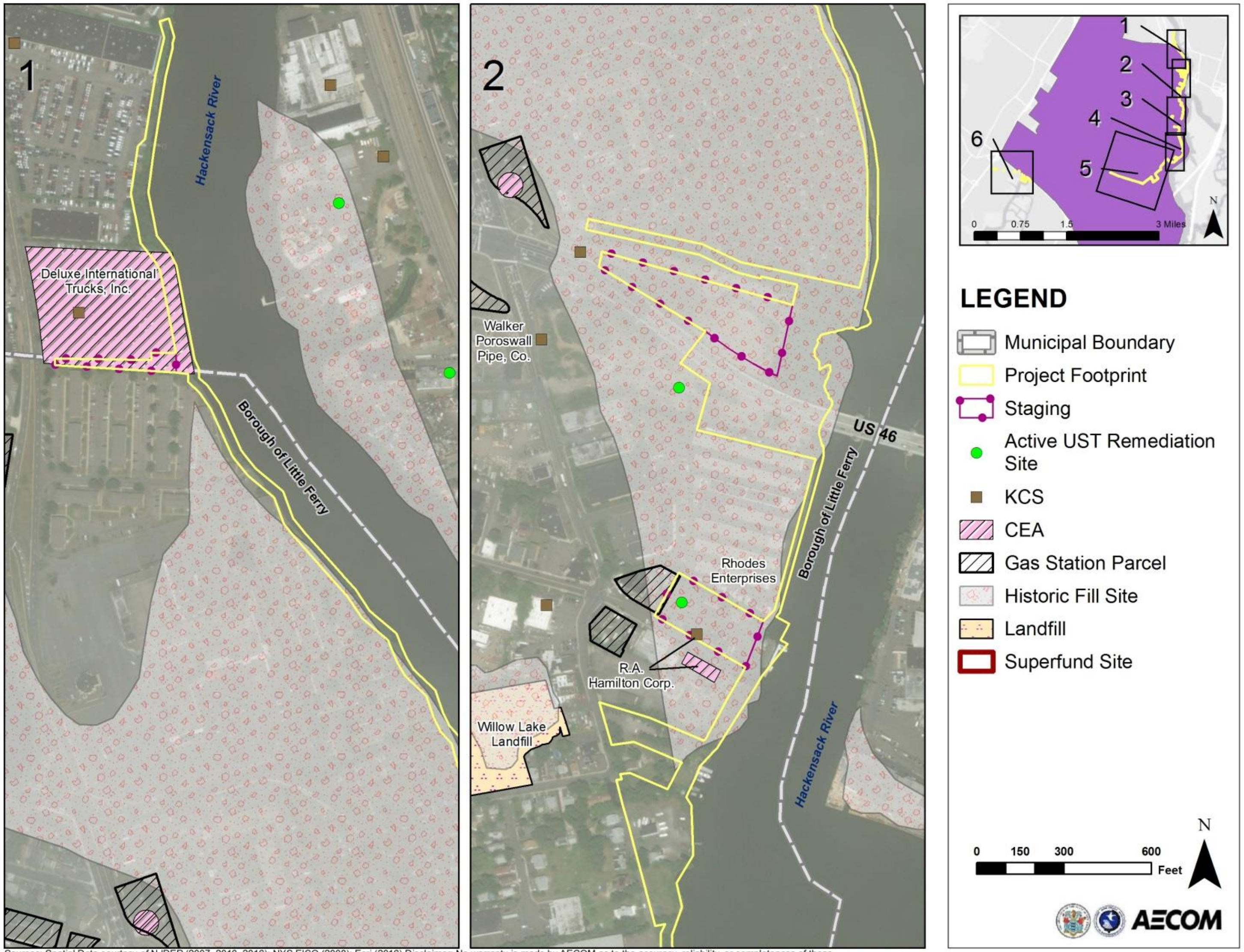
Table 4.20-3: Potentially Contaminated Sites and Direct Impacts under Alternative 1

Site Name	Site Categories	Location / Distance to Alternative 1 Footprint	Potential Short-term Impacts	Potential Long-Term Impacts
Deluxe International Trucks, Inc.	KCS, CEA	Within Alternative 1 footprint (Northern Segment)	Potential temporary exposure to contaminants during construction due to groundwater contaminated with benzene; location of construction staging area could cause conflict with remedial activities	Construction of proposed floodwall and shoreline excavation could conflict with future remedial investigation and/or remedial action at the site
Walker Poroswall Pipe Co.	KCS, Active UST remediation	Staging area and within Alternative 1 footprint (Central Segment)	Potential temporary exposure to contaminants during construction due to an active spill under LSRP oversight; location of construction staging area could cause conflict with remedial activities	N/A
Rhodes Enterprises	Active UST remediation	Located on proposed K-Town and Fluvial Park sites within Alternative 1 footprint	Potential temporary exposure to contaminants during construction because facility is non-compliant for failure to remove USTs; location of construction staging area could cause conflict with remedial activities	Establishment of the proposed Fluvial Park and cantilever riverwalk could conflict with future remedial investigation and/or remedial action at this un-remediated site
R.A. Hamilton Corp.	KCS, CEA	Located adjacent to proposed K-Town and Fluvial Park sites within Alternative 1 footprint	Potential temporary exposure to contaminants during construction due to groundwater contaminated with benzene and diesel fuel free product, soil vapor contaminated with benzene, and soil contaminated with PAHs	Establishment of the proposed Fluvial Park and cantilever riverwalk could conflict with future remedial investigation and/or remedial action

Site Name	Site Categories	Location / Distance to Alternative 1 Footprint	Potential Short-term Impacts	Potential Long-Term Impacts
Little Ferry Landfill	Landfills	Two separate locations within Alternative 1 footprint (Central Segment)	Potential temporary exposure to contaminants during construction because the site is an improperly closed historic landfill	Construction of the proposed floodwall and other Alternative 1 features could conflict with future remedial investigation and/or remedial action at this improperly closed historic landfill
Gates Construction Corp.	KCS, active UST remediation	Within Alternative 1 footprint (Central Segment)	Potential temporary exposure to contaminants during construction due to a leaking UST and contaminated groundwater	Construction of proposed Alternative 1 features could conflict with future remedial investigation and/or remedial action at this leaking UST site with contaminated groundwater
Wastewater Treatment Facility	KCS, active UST remediation	Within Alternative 1 footprint (Central Segment)	Potential temporary exposure to contaminants during construction due to leaking USTs and contaminated groundwater	Construction of proposed Alternative 1 features could conflict with future remedial investigation and/or remedial action at this leaking UST site with contaminated groundwater
N/A (historic fill in Central and Southern Segments of LOP)	Historic fill	Most of the Alternative 1 footprint on or adjacent to areas of historic fill	Potential temporary exposure to contaminants during construction because historic fill is frequently contaminated with PAHs and metals.	Alternative 1 structures could act as caps over historic fill, substantially reducing or eliminating the risk of exposure from direct contact and mobilization of contaminants, creating a beneficial impact
N/A (historic fill near proposed Berry's Creek Storm Surge Barrier)	Historic fill	Within Alternative 1 footprint	Potential temporary exposure to contaminants during construction because historic fill is frequently contaminated with PAHs and metals	Construction of the proposed storm surge barrier would likely require removal of contaminated sediment and soil prior to construction, resulting in removal of contamination from the Project Area.

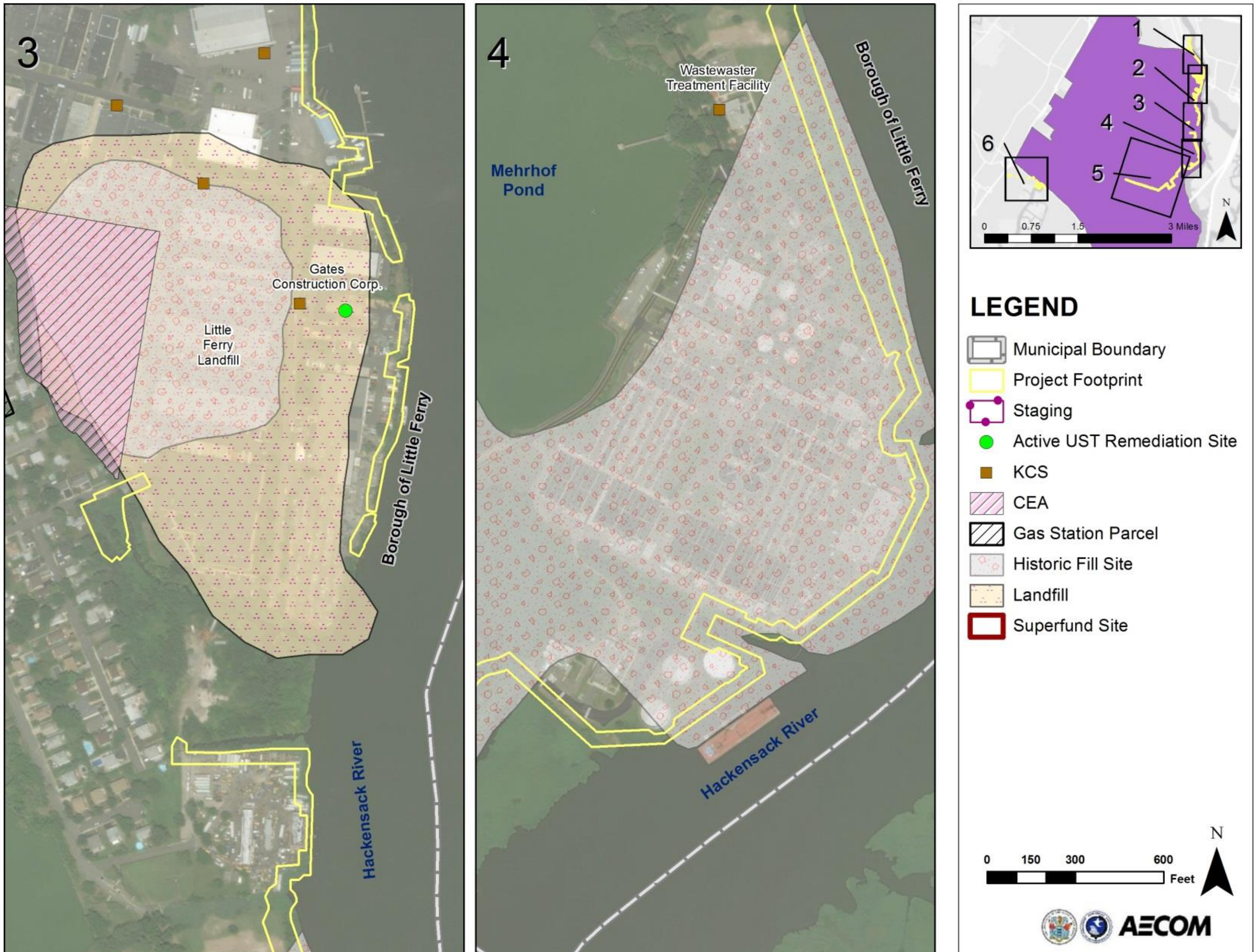
Site Name	Site Categories	Location / Distance to Alternative 1 Footprint	Potential Short-term Impacts	Potential Long-Term Impacts
BCSA (near proposed Berry's Creek Storm Surge Barrier)	Superfund	Within Alternative 1 footprint	Construction of the storm surge barrier and pump station could result in potential temporary exposure to contaminants during construction due to contamination associated with the BCSA (likely metals and particularly mercury); Construction of the storm surge barrier could also temporarily affect remediation of BCSA	Construction of the proposed storm surge barrier and pump station could conflict with future remedial investigation and/or remedial action; operation of the Berry's Creek storm surge barrier would likely be an overall beneficial impact, protecting the upstream portion of Berry's Creek within the BCSA from flooding and scour and stabilizing the area to reduce further transport and spread of contamination downstream
UOP	Superfund	Closure gate and floodwall on UOP site and UOP site is tidally connected to the Alternative 1 footprint	Potential temporary exposure to contaminants during construction due to buried waste material	Construction of proposed closure gate, floodwall, and other Alternative 1 features could conflict with future remedial investigation and/or both completed and future remedial action at this site that contains buried waste material
Berry's Creek Drainage Basin	KCS	Within Alternative 1 staging area	Potential temporary exposure to contaminants during construction; location of construction staging area could cause conflict with remedial activities	N/A
Mario's Services	KCS	Within Alternative 1 staging area (Berry's Creek area)	Potential temporary exposure to contaminants during construction; location of construction staging area could cause conflict with remedial activities	N/A

Site Name	Site Categories	Location / Distance to Alternative 1 Footprint	Potential Short-term Impacts	Potential Long-Term Impacts
N/A	ISRA	To be determined - should ISRA be triggered during construction	Potential temporary exposure during construction due to proximity to soil and/or groundwater contamination; could cause conflict with remedial activities.	N/A
All	Superfund KCS, Landfills, CEA	Located on and adjacent to Alternative 1 footprint	Potential temporary hazards associated with the transport and handling of excavated materials during construction	N/A



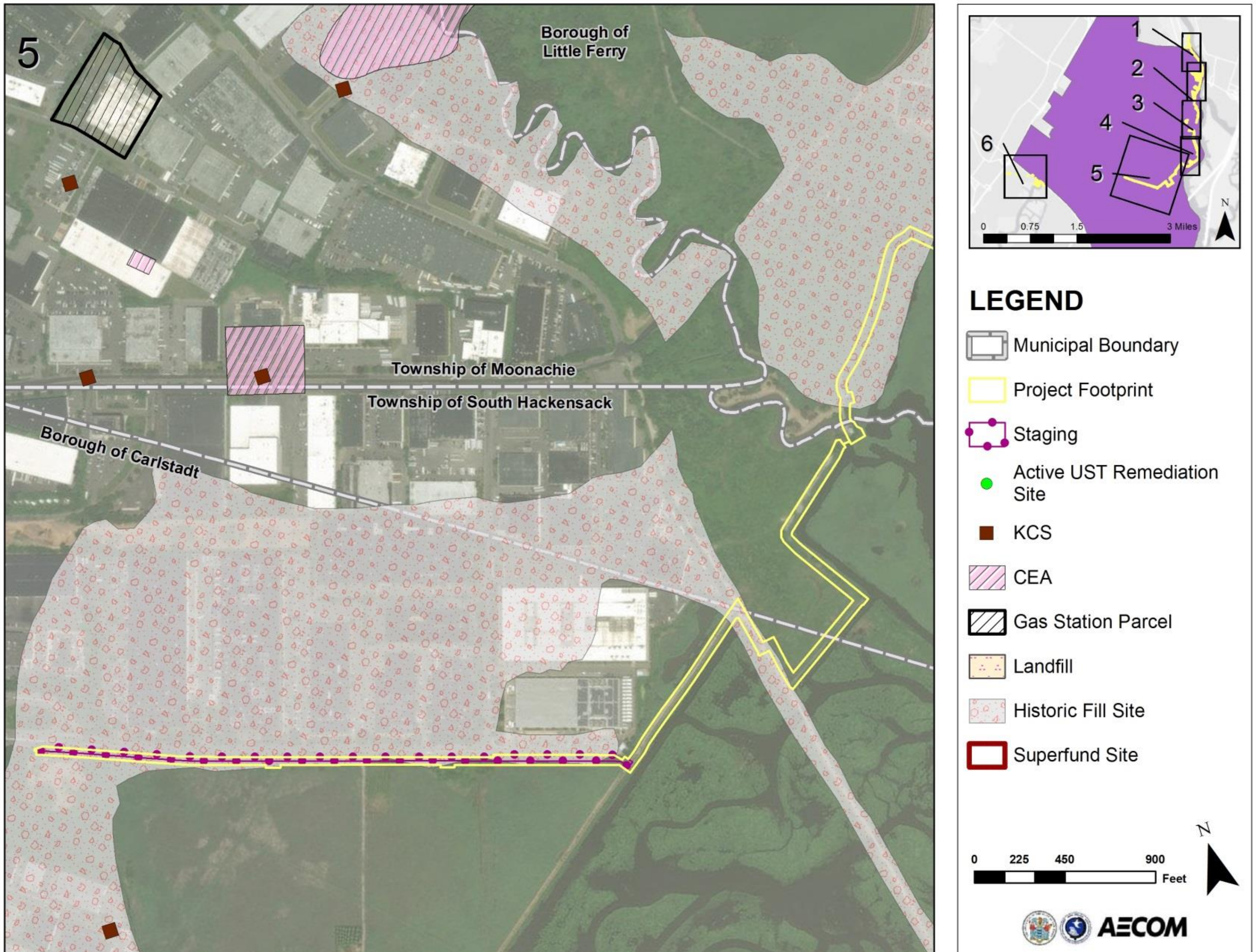
Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-1: Contaminated Sites within the Alternative 1 LOP (Northern and Central Segments; Figure 1 of 4)



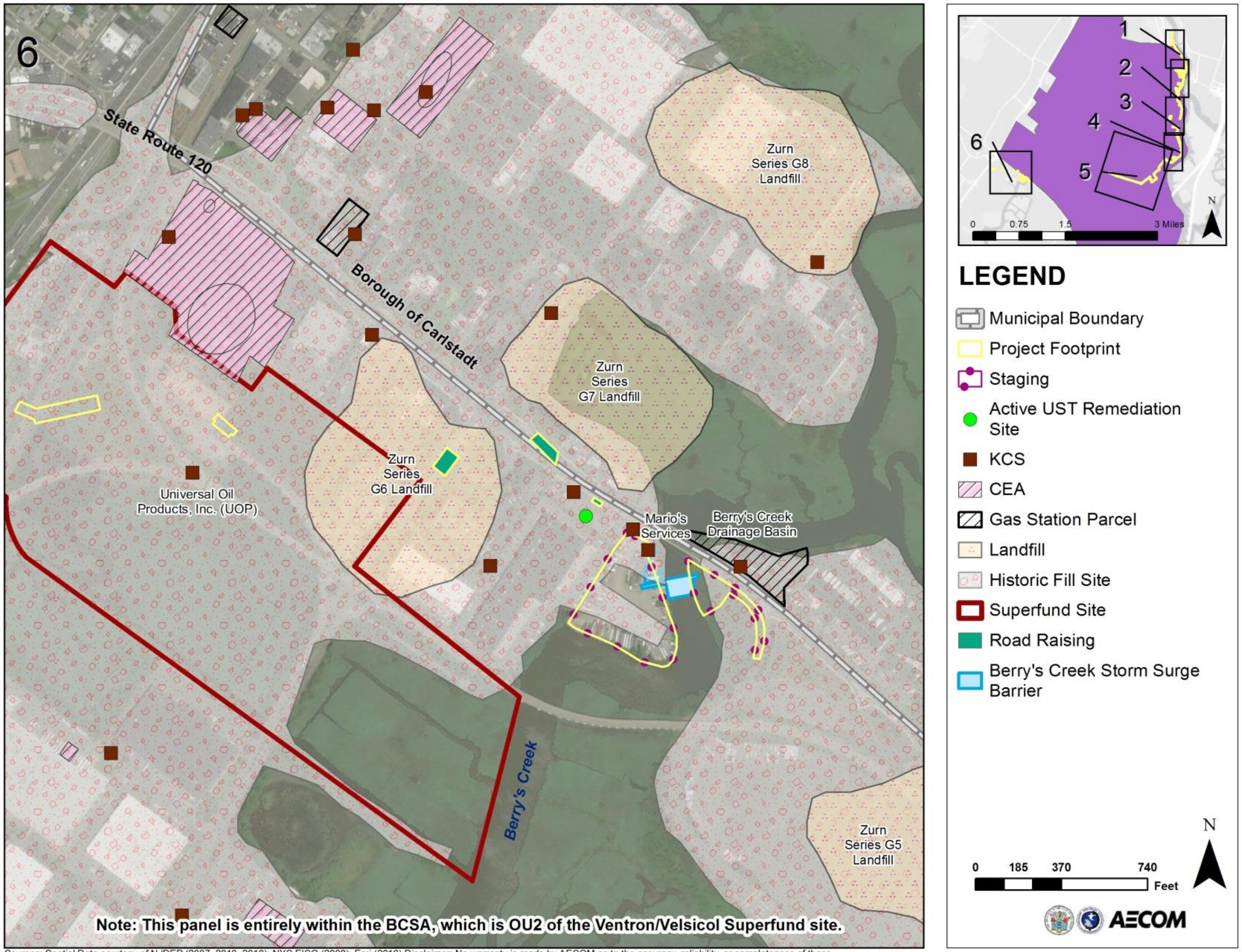
Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-2: Contaminated Sites within the Alternative 1 LOP (Central Segment; Figure 2 of 4)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-3: Contaminated Sites within the Alternative 1 LOP (Central and Southern Segments; Figure 3 of 4)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate usewith other data.This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-4: Contaminated Sites within the Alternative 1 LOP (Berry's Creek Storm Surge Barrier; Figure 4 of 4)

Changes in the Potential Spread or Release of Contaminants

Construction activities, including excavation, land clearing, and dewatering, would occur in areas, including waterways, suspected or known to contain hazardous materials and would result in ***short-term, less-than-significant, adverse*** impacts. Construction activities at these sites have the potential to disturb hazardous materials. Sites that could be affected include Deluxe International Trucks, Inc., Walker Poroswall Pipe Co., Rhodes Enterprises, Little Ferry Landfill, Wastewater Treatment Facility, Gates Construction Corp., BCSA, and UOP (see **Table 4.20-3**). For Alternative 1 elements that require excavation, it is possible that construction could result in additional disruption of caps over historic fill, two solid waste landfills, and two Superfund sites (see **Figure 4.20-1** through **Figure 4.20-4**). This could result in temporary discharges and/or the spread of contamination throughout a large portion of the study area. However, when working in RECs, appropriate controls (i.e., air monitoring, worker personal protective equipment, emergency response plans, etc.) would be in place to prevent the exposure and spread of contamination.

In addition to disruption of hazardous materials at known or suspected sites, it would be possible during construction to encounter and disrupt undocumented hazardous materials that could potentially become mobilized. For example, the LOP would be developed along the Hackensack River, which is a proposed Superfund site. Installation of the floodwall could potentially disrupt and mobilize contaminated sediments and would require appropriate controls to be in place during construction. Disruption or mobilization of previously unknown hazardous materials would cause ***long-term, potentially significant, adverse*** impacts, and would require reporting and cleanup that would likely lead to construction delays.

Further, potential discharges resulting from normal use of hazardous materials (e.g., gasoline and diesel fuel) commonly used in construction projects and O&M activities could occur within the Alternative 1 footprint, resulting in ***short-term*** and ***long-term, less-than-significant, adverse*** impacts. There are risks to water quality associated with incidental spills or releases of these materials during construction and operation of Alternative 1 components. However, construction contractors and O&M personnel would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations during construction.

Construction of the Alternative 1 features could also have ***long-term, beneficial*** impacts on the Project Area by reducing the amount, and potential exposure, of hazardous materials in the Project Area. LOP structures could act as caps over existing contaminated areas in the Alternative 1 footprint, thereby eliminating or substantially reducing the existing threat of direct contact exposure and mobilization of contaminants from those areas. In addition, construction of Alternative 1 would result in the excavation and export of approximately 84,900 CY of soil from the Project Area. Given the extent of historic fill in the Project Area, it is likely that these excavated soils would contain contaminants; any imported fill material would be clean.

Potential Conflicts with On-Going or Future Remedial Activities

Many of the construction staging areas proposed for Alternative 1 would be located on or adjacent to contaminated sites that are not remediated. For example, two KCS sites (Berry's Creek Drainage Basin and Mario's Services) and a large known historic fill area occur within the proposed staging areas, while the Deluxe International Trucks, Inc. site, Walker Poroswall site, and Rhodes Enterprises site occur adjacent to them. If the landowner (or responsible entity) plans to remediate during the construction period, their plans could be temporarily delayed. Additionally, postponement of site remediation would increase the possibility that contaminants could further spread during this time. This conflict would be a

short-term, less-than-significant, adverse impact, as remediation plans would need to be rescheduled.

Construction of the Berry's Creek storm surge barrier and other nearby LOP components would require the excavation of soils within the BCSA, which is actively being studied for remediation. Soil and sediment disturbance within the BCSA could result in potential temporary exposure to contaminants during construction due to existing contamination within this site. Because remediation within the footprint of Alternative 1 would be required prior to construction in these areas, a ***short-term, less-than-significant, adverse*** impact would occur from construction activities within the BCSA. These impacts would be minimized through coordination with the USEPA and the BCSA Cooperating PRP Group throughout the design and construction phases of Alternative 1.

Potential conflicts between construction activities and remedial actions could also arise on ISRA sites within the study area. ISRA sites are properties occupied by facilities with specific NAICS codes listed in the ISRA regulation. ISRA can trigger unplanned, near-term remedial action at these sites from the transfer, sale, or closing of an industrial establishment or property, which is not always planned (e.g., a business owner dies and the business is sold). Similarly, a discharge (i.e., unplanned release of contamination into lands or waters of the State) on any site can also trigger unplanned, near-term remedial action. If an ISRA-triggering event or discharge happens during the construction of Alternative 1, a ***short-term, potentially significant, adverse*** impact to the Proposed Project could occur from an unexpected schedule delay associated with these unplanned, remedial activities. Unplanned remediation would require close coordination with the landowners and all applicable Federal, State, and local regulators.

Indirect Impacts

Table 4.20-4 provides a summary of the contaminated sites that would be indirectly impacted by construction of Alternative 1. Under Alternative 1, up to 11 contaminated sites could be indirectly impacted. **Figure 4.20-1** through **Figure 4.20-4** depicts the mapped contaminated sites within and in the vicinity of the Alternative 1 footprint.

Table 4.20-4: Potentially Contaminated Sites and Long-Term Indirect Impacts – Alternative 1

Site Name	Site Categories	Location/Distance to Alternative 1 Footprint	Impact Details
Deluxe International Trucks, Inc.	KCS, CEA	Within Alternative 1 footprint (Northern Segment)	The proposed floodwall could potentially limit the migration of contaminated groundwater to the Hackensack River (i.e., perpendicular migration) by acting as a subsurface barrier.
Rhodes Enterprises	Active UST remediation site	Located on proposed K-Town and Fluvial Park sites within Alternative 1 footprint	Construction of the proposed Fluvial Park could limit or conflict with future remedial investigation and remedial action associated with the Hackensack River; pavement/soil/vegetative cover could act as a cap to subsurface contamination, providing a beneficial impact by reducing risks to people and ecological resources and providing a beneficial impact by limiting direct contact exposure and preventing floodwaters from spreading surface/subsurface contamination.

Site Name	Site Categories	Location/Distance to Alternative 1 Footprint	Impact Details
R.A. Hamilton	KCS, CEA	Located adjacent to proposed K-Town and Fluvial Park sites within Alternative 1 footprint	Remedial action is complete at this site, but pavement/soil/vegetative cover could act as a cap to remaining subsurface contamination, providing a beneficial impact by reducing risks to people and ecological resources and providing a beneficial impact by limiting direct contact exposure and preventing floodwaters from spreading surface/subsurface contamination.
Little Ferry Landfill	Landfills	Two separate locations within Alternative 1 footprint (Central Segment)	Construction of the proposed floodwall and other Alternative 1 features could conflict with future remedial investigation and/or remedial action associated with eventual closure of this improperly closed landfill. Construction could encounter methane gas potentially generated by the historic landfill.
Gates Construction Corp.	KCS, active UST remediation site	Within Alternative 1 footprint (Central Segment)	Construction of Alternative 1 features could conflict with future remedial investigation and/or remedial action associated with the Hackensack River.
Wastewater Treatment Facility	KCS, active UST remediation site	Within Alternative 1 footprint (Central Segment)	Construction of Alternative 1 features could conflict with future remedial investigation and/or remedial action associated with the Hackensack River.
N/A (historic fill in the Central and Southern Segments of the LOP)	Historic fill	Much of the Alternative 1 footprint on or adjacent to an area of historic fill	Construction of Alternative 1 features could conflict with future remedial investigation and/or remedial action associated with the Hackensack River.
N/A (historic fill near proposed Berry's Creek storm surge barrier)	Historic fill	Within Alternative 1 footprint	Construction of proposed storm surge barrier and pump station could conflict with future remedial investigation and/or remedial action associated with the BCSA.
BCSA (near proposed Berry's Creek storm surge barrier)	Superfund	Within Alternative 1 footprint	Construction of the proposed storm surge barrier and pump station could conflict with future remedial investigation and/or remedial action associated with the BCSA; operation of the Berry's Creek storm surge barrier would likely be an overall beneficial, indirect impact, providing a decrease in off-site or future releases of contaminants, reducing the risk of spreading contaminants and the risks to ecological receptors from contaminants.

Site Name	Site Categories	Location/Distance to Alternative 1 Footprint	Impact Details
UOP	Superfund	Closure gate and floodwall on UOP site and UOP site is tidally connected to the Berry's Creek storm surge barrier	Construction of proposed closure gate, floodwall, and other Alternative 1 features could conflict with future remedial investigation and/or both completed and future remedial actions associated with UOP and the BCSA.
Zurn Series G Landfills	Landfills	Alternative 1 features at UOP and proposed Berry's Creek storm surge barrier are within 3,000 ft.	Construction of proposed Alternative 1 features at UOP and Berry's Creek storm surge barrier could encounter methane gas potentially generated by historic landfills.
All	All	Within flood zones protected by Alternative 1	Portions of the Project Area with hazardous material sites would receive enhanced flood protection as well as reduced impacts from SLR.

Induced Changes in the Potential Spread or Release of Contaminants

Installation of the floodwall footings could inadvertently create preferential pathways for methane and VOC-contaminated soil vapor and/or groundwater. These contaminants move more readily through porous gravel, which is often used as bedding material for construction foundations, than through finer-grained (i.e., native) soils. The installation of gravel bedding material beneath the foundations of the LOP could facilitate the movement of these contaminants offsite along the proposed LOP (i.e., parallel migration). In some areas, the created preferential pathways could lead to occupied buildings, which would create a hazard to occupants. These impacts could occur following construction of the LOP in the vicinity of historic landfills, CEA sites, gasoline/automotive service stations, dry cleaners, and active UST remediation sites. Further, potential contact with methane during construction would represent an identifiable hazard to nearby personnel and properties. The potential to create preferential pathways for these contaminants would be a ***long-term, potentially significant, adverse*** impact on the Project Area. However, numerous standard construction practices would be implemented in order to mitigate these hazards. Methane mitigation measures would include monitoring prior to and during construction, using spark-resistant equipment, and ventilating the site during and after construction. Mitigation measures for VOCs would include initial sampling, subslab depressurization systems, and vapor barriers.

Construction and operation of Alternative 1 could also result in the mobilization of contaminated groundwater. During construction, dewatering activities in close proximity to sites with contaminated groundwater have the potential to draw contaminated groundwater to the construction site (due to alteration of the soil moisture gradient) and thereby increase the size of the existing contaminated plume. Additionally, some Alternative 1 components (i.e., landscaping at new parks) would be designed to increase local stormwater infiltration. Increased infiltration could mobilize subsurface soil contaminants and create localized groundwater mounds, increasing the velocity and size of groundwater contaminant plumes and spreading contamination. Mobilization of existing soil and groundwater contaminants during construction and operation of Alternative 1 would be a ***long-term, potentially significant, adverse*** impact on the Project Area. However, prior to construction, investigations would be conducted to determine the levels of contaminants in the underlying and surrounding soils and groundwater, and identify measures to minimize these impacts to the extent feasible.

Operation of Alternative 1 would likely induce a ***long-term, beneficial*** impact associated with increased flood protection of existing hazardous material sites in the study area. Alternative 1 would help to protect the KCSs and historic fill from the erosive effects of coastal flooding, thereby potentially preventing or reducing mobilization of uncapped contaminated sediments to offsite properties, waterways, and/or coastal wetlands that would otherwise occur under the No Action Alternative. These beneficial impacts would be realized at the uncapped contaminated sites and in areas that contain historic fill. Notably, the proposed Berry's Creek storm surge barrier would help protect the upstream portion of Berry's Creek from flooding and scour. Berry's Creek and the upstream tributaries are known to be contaminated. Stabilizing those areas would likely reduce further transport and spread of contamination downstream to existing, less contaminated areas. Analysis of the potential scour effects associated with Alternative 1 is provided in **Section 4.16.4.2**.

<u>Proximity to Existing ASTs</u>

One existing AST (AST 1) was identified within the ASD of a park or recreational feature associated with Alternative 1. The ASD is the area beyond which the explosive or combustive hazard would not cause thermal radiation or blast-overpressure damage to buildings or individuals. The ASD for AST 1 was calculated to be 503 feet. AST 1 is located 434 feet northeast of the proposed Northern Segment riverwalk across the Hackensack River; it is in the direct line-of-sight of this public space. Therefore, Alternative 1 would result in a ***long-term, potentially significant, adverse*** impact from the increased risk to people utilizing this proposed open space feature from thermal radiation or blast-overpressure damage. No natural or man-made abatements occur between the proposed location of the Northern Segment riverwalk and AST 1. Mitigation measures would be implemented to reduce effects to less-than-significant levels in accordance with HUD's ASD guidance. For more information on this AST analysis, please refer to **Appendix O**.

<u>Induced Potential Conflicts with On-Going or Future Remedial Activities</u>

Construction of Alternative 1 could potentially conflict with future remedial activities nearby. The shoreline is the location where the groundwater and surface waters meet, and many remedial actions occur at this interface. In the study area, groundwater flows toward surface waters, and remediation of groundwater contamination that discharges to surface water often involves the installation of a subsurface hydraulic barrier parallel to the surface water body to prevent contaminated groundwater from reaching surface water. The potential for remedial activities at CEA sites could be complicated at locations where the LOP is proposed along the shoreline, as hydraulic barriers are typically installed proximate to the shoreline. These potential future conflicts would constitute ***long-term, potentially significant, adverse*** impacts.

Mitigation Measures and BMPs

Potentially significant adverse impacts to hazardous materials have been identified from the proposed construction and operation of Alternative 1 due to the potential disruption of KCSs, release and/or spread of contaminants, and interference with existing and/or planned site remediation activities within the Project Area. This potential necessitates careful consideration of how the specific flood control features proposed could interact with hazardous materials to reduce the potential impacts where Alternative 1 features intersect with or are in close proximity to hazardous waste/material sites. Additionally, potentially significant adverse impacts were identified due to unacceptable separation distances between ASTs and proposed Alternative 1 components (i.e., the proposed Northern Segment riverwalk). The following mitigation measures and BMPs would be implemented to reduce the identified effects to less-than-significant levels.

- Construction contractors would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations during Alternative 1 construction.
- The proposed construction near Deluxe International Trucks, Inc. includes a floodwall and excavation along the Hackensack River. These actions could require additional pre-construction review of site-specific records, sampling and analysis of materials to be disturbed, precautionary planning, and implementation of BMPs to ensure mitigation, if not prevention, of the release and spread of contamination during construction, operation, use, and maintenance of features in these areas.
- Precautions could be needed near historic fill and the Little Ferry Landfill to ensure that activity does not expose workers, local residents, or ecological receptors to contamination through the release and spread of hazardous materials during construction and operation of proposed features.
- Construction of the Berry's Creek storm surge barrier and closure gate would require work within and in close proximity (i.e., parcels within 200 feet) to UOP and other contaminated sites and waterways, including those within the BCSA. Design and operation of these features would need to consider disturbance to ongoing and planned remedial investigation and action and potential downstream impacts should the surge barrier result in scour and the spread of known contaminants in soil and sediment.
- Coordination with the USEPA and BCSA Cooperating PRP Group would be conducted during the final design process to ensure the Proposed Project does not adversely impact the ongoing BCSA PRP Group remediation project.
- During the design process, HUD would be consulted to design proposed park/recreation features in compliance with HUD ASD requirements. Potential measures include incorporating natural barriers (e.g., constructed hills, earthen elevations, etc.) into site design, constructing a barrier for thermal radiation, reconfiguring the site plan in order to increase the distance between the hazard and the Alternative 1 components, burying the existing ASTs, or diking the existing ASTs (if liquid contents).
- A Materials Management Plan would be developed to address how any contaminated soil, sediment, surface water, groundwater, or waste materials would be handled for off-site disposal or on-site reuse (in the case of soil) during construction. The use of recycled concrete aggregate, alternative fill, and soil from off-site sources would need to be evaluated carefully so as not to introduce new contaminants into the environment.
- Coordination with the NJDEP Division of Solid and Hazardous Waste would be required for any actions that involve work within a landfill. A Landfill Disruption Permit would be required.
- A New Jersey LSRP would oversee those portions of the project considered to be a Linear Construction Project as defined by the NJDEP, and the Proposed Project would comply with these and other provisions of Chapter 16 of the NJDEP Administrative Requirements for the Remediation of Contaminated Sites, NJAC. 7:26C, as necessary. This could occur with linear landscape features that cross more than one property.
- O&M activities would need to address NJ Site Remediation and Reform Act requirements for contaminated sites.
- Parties responsible for completing remediation of properties adjacent to, or within 200 feet of, the Proposed Project would be notified of the design and schedule.

4.20.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would reduce inland flooding within the Project Area that results from heavy precipitation events, but coastal flooding from storm surges would continue to adversely impact the Project Area (see **Section 4.1.2.3**).

Alternative 2 would result in the following **direct** impacts:

- ***Short-term, potentially significant, adverse*** impacts from discharges, or the transfer, sale, or losing of an industrial establishment or property regulated under the ISRA that triggers near-term remediation during the construction phase of Alternative 2.
- ***Long-term, potentially significant, adverse*** impacts from the disruption or mobilization of previously unknown hazardous materials encountered during construction.
- ***Short-term, less-than-significant, adverse*** impacts from subsurface disturbance of hazardous materials at known or suspected contaminated sites during construction.
- ***Short-term, less-than-significant, adverse*** impacts to planned remedial activities being delayed temporarily because they occur within the proposed construction areas for Alternative 2.
- ***Short-term and long-term, less-than-significant, adverse*** impacts from potential spills (e.g., gasoline and diesel fuel) during construction and operational activities.
- ***Long-term, beneficial*** impacts to the Project Area from the removal of potentially contaminated soils during construction, or the capping thereof by Alternative 2 components.

Alternative 2 could result in the following **indirect** impacts:

- ***Long-term, potentially significant, adverse*** impacts from ground-disturbing activities during construction inadvertently creating preferential pathways for methane or VOC-contaminated soil vapor and/or groundwater to migrate off-site, posing a risk to occupants of nearby buildings.
- ***Long-term, potentially significant, adverse*** impacts from mobilization of contaminant plumes in soil or groundwater due to increased stormwater infiltration in the Project Area.
- ***Long-term, potentially significant, adverse*** impacts to people in the proposed Caesar Place Park during construction and operation, due to the increased risk from thermal radiation or blast-overpressure damage.
- ***Long-term, potentially significant, adverse*** impacts to future remedial investigations that are hindered due to the presence of Alternative 2 components.
- ***Long-term, less-than-significant, adverse*** impacts from localized increases in water velocity that could cause scour and mobilize contaminated sediments in East Riser Ditch and Losen Slote.
- ***Long-term, beneficial*** impacts from the protection of KCSs and historic fill from the erosive effects of inland (i.e., stormwater) flooding in the East Riser Ditch and Losen Slote watersheds that could mobilize uncapped contaminated sediments and/or soil to offsite properties, waterways, and/or coastal wetlands.

The following subsections provide greater detail.

Direct Impacts

Table 4.20-5 provides a description of the contaminated sites that would be directly impacted by construction of Alternative 2, and the potential impacts to these sites that could result from construction and operation of Alternative 2. Under Alternative 2, up to 20 contaminated sites could be directly impacted. **Figure 4.20-5** through **Figure 4.20-7** depicts the mapped contaminated sites within and in the vicinity of the Alternative 2 footprint.

Changes in the Potential Spread or Release of Contaminants

Similar to Alternative 1, the construction of Alternative 2 has the potential to impact hazardous materials. Construction activities including excavation, land clearing, dredging, and dewatering would occur in areas, including waterways, suspected or known to contain hazardous materials, and could also potentially occur in areas with undocumented hazards. Potential impacts from disturbing sites with hazardous materials would be similar to those described for Alternative 1. As such, in areas known or suspected to contain these materials, construction activities would result in ***short-term, less-than-significant, adverse*** impacts that would be minimized with appropriate controls in place to prevent the exposure and spread of contamination. Construction activities that encounter and disrupt undocumented hazardous materials could cause ***long-term, potentially significant, adverse*** impacts because they would require reporting and cleanup, and would lead to construction delays.

Potential incidental discharges of hazardous materials commonly used in construction projects and O&M activities (e.g., gasoline or diesel fuel) may also occur during both the construction and operation of Alternative 2, which would potentially result in ***short-term*** and ***long-term, less-than-significant, adverse*** impacts, respectively. These impacts would be minimized because construction contractors and O&M personnel would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations. Because Alternative 2 would include less construction activity than Alternative 1 (i.e., only approximately 8,000 man-days of construction effort, as compared to approximately 20,000 man-days for Alternative 1), there would be a substantially lower risk of incidental discharges occurring during this alternative than under Alternative 1.

Similar to Alternative 1, it is likely that these excavated soils would contain contaminants given the extent of historic fill in the Project Area. Approximately 32,300 CY of soils would be removed under Alternative 2 with the majority of these soils (20,200 CY) being dredged from East Riser Ditch. This would be less than the approximately 84,900 CY that would be exported under Alternative 1. In addition, the Alternative 2 landscape features could act as a cap on existing contaminated soil, which would help contain the contamination by protecting it against erosion during flood events. Export and disposal, or capping in place, of potentially contaminated soils and import of clean fill material would constitute a ***long-term beneficial*** impact by reducing the amount, and potential exposure, of hazardous materials in the Project Area.

Table 4.20-5: Potentially Contaminated Sites and Direct Impacts under Alternative 2

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Potential Short-Term Impacts	Potential Long-Term Impacts
A E&A Service Station Inc.	KCS, CEA, Active UST Remediation Site	Adjacent to green infrastructure on Moonachie Avenue	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Amerada Hess Little Ferry	KCS, CEA	Adjacent to Fluvial Park[1]; across street from green infrastructure along US Route 46	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Caesar Palace Pump Station	KCS, Active UST Remediation Site	Adjacent to East Riser Ditch improvements	Potential temporary exposure during dredging due to proximity to groundwater contamination; could cause conflict with remedial activities addressing sediment.	Could cause conflict with remedial activities addressing sediment, surface water and groundwater to surface water discharges.
Carretta Trucking	KCS, CEA, Spills, Releases	Nearest CEA boundary 40 feet from green infrastructure along Moonachie Avenue	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Con-Way Central Express	KCS, Spills, Releases	Across street from green infrastructure along Moonachie Avenue	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Potential Short-Term Impacts	Potential Long-Term Impacts
Esselte Pendaflex	Releases, LUST, soil contamination	Underlies southwest corner of Caesar Place Park	Potential temporary exposure during construction due to proximity to soil and/or groundwater contamination; could cause conflict with remedial activities.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing soil and/or groundwater contamination.
Foot of Industrial Avenue	KCS	Adjacent to Riverside Park	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
J S Popper Inc.	KCS, Spills, Releases	Across street from green infrastructure along Liberty Street and Little Ferry Municipal Improvements	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Jake & Toms Meadowland Service	KCS, CEA	Adjacent to green infrastructure along Moonachie Avenue	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.

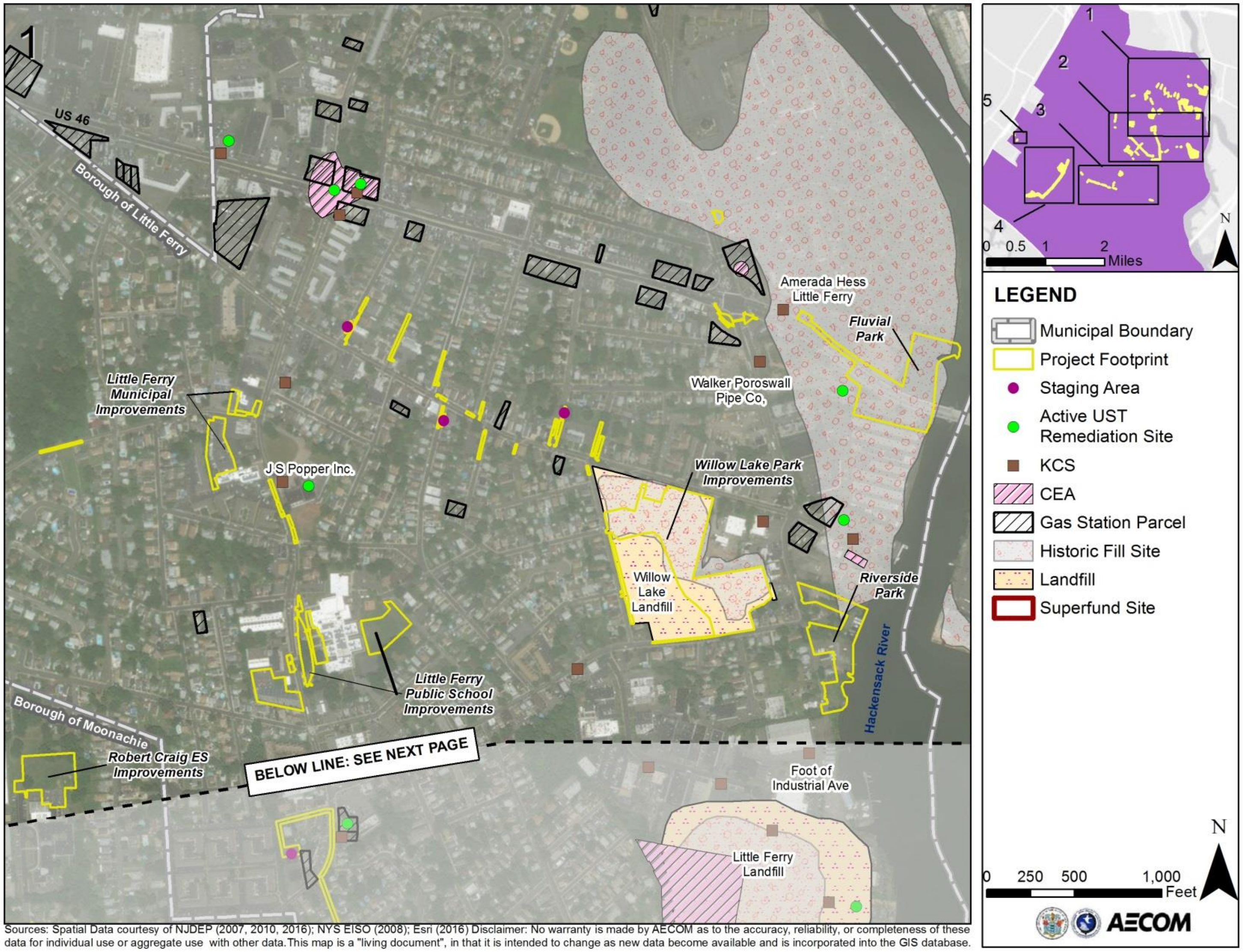
Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Potential Short-Term Impacts	Potential Long-Term Impacts
Martin Picard/Verflex	KCS	Across street from green infrastructure along Moonachie Avenue	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Melnor Industries Incorporated	KCS, CEA	CEA is 650 feet from Avanti Park; KCS parcel is adjacent to Avanti Park	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Moonachie Road Pump Station	KCS	Adjacent to Joseph Street Park improvements	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
President Container Inc.	KCS, CEA, Historic Fill, Spills, Releases	KCS parcel adjacent to East Riser Ditch improvements	Potential temporary exposure during dredging due to proximity to groundwater contamination; could cause conflict with remedial activities addressing sediment.	Could cause conflict with remedial activities addressing sediment, surface water and groundwater to surface water discharges.
Starke Road	KCS, Releases	Adjacent to East Riser Ditch improvements	Potential temporary exposure during dredging due to proximity to groundwater contamination; could cause conflict with remedial activities addressing sediment.	Could cause conflict with remedial activities addressing sediment, surface water and groundwater to surface water discharges.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Potential Short-Term Impacts	Potential Long-Term Impacts
UPS Ground Freight	KCS, Spills, Releases, Active UST Remediation Site	Adjacent to green infrastructure along Moonachie Avenue	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Walker Poroswall Pipe Co.	KCS, Releases, Active UST Remediation Site	Adjacent to Fluvial Park[1]; across street from green infrastructure along US Route 46	Potential temporary exposure during construction due to proximity to groundwater contamination.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants; could cause conflict with remedial activities addressing groundwater contamination.
Esposito / Willow Lake Landfill	Landfill	Underlies Willow Lake Park	Potential temporary exposure to contaminants during construction because the site is an improperly closed historic landfill.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in off-site or future release/transport of contaminants. Alternative 2 landscape features could act as caps over historic fill, substantially reducing or eliminating the risk of exposure from direct contact with contaminants, creating a beneficial impact.
Little Ferry Landfill	Landfill	Partially underlies DePeyster Creek Park[2]	Potential temporary exposure to contaminants during construction because the site is an improperly closed landfill.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in off-site or future release/transport of contaminants. Alternative 2 landscape features could act as caps over historic fill, substantially reducing or eliminating the risk of exposure from direct contact with contaminants, creating a beneficial impact.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Potential Short-Term Impacts	Potential Long-Term Impacts
Morris Park Avenue Corporation	Landfill	Small portion of landfill underlies East Riser Ditch Pump Station construction area	Potential temporary exposure to contaminants during construction because the site is a capped landfill.	N/A
N/A	ISRA	To be determined - should ISRA be triggered during construction	Potential temporary exposure during construction due to proximity to soil and/or groundwater contamination; could cause conflict with remedial activities.	N/A
N/A (historic fill)	Historic fill	Underlies Fluvial Park[1]; Caesar Place Park; Willow Lake Park; Riverside Park; green infrastructure along Bergen Turnpike	Potential temporary exposure to contaminants during construction because historic fill is frequently contaminated with PAHs and metals.	Potential risk of spreading contaminants or introducing contaminants to the environment, resulting in release/transport of contaminants. Alternative 2 landscape features could act as caps over historic fill, substantially reducing or eliminating the risk of exposure from direct contact and mobilization of contaminants, creating a beneficial impact.

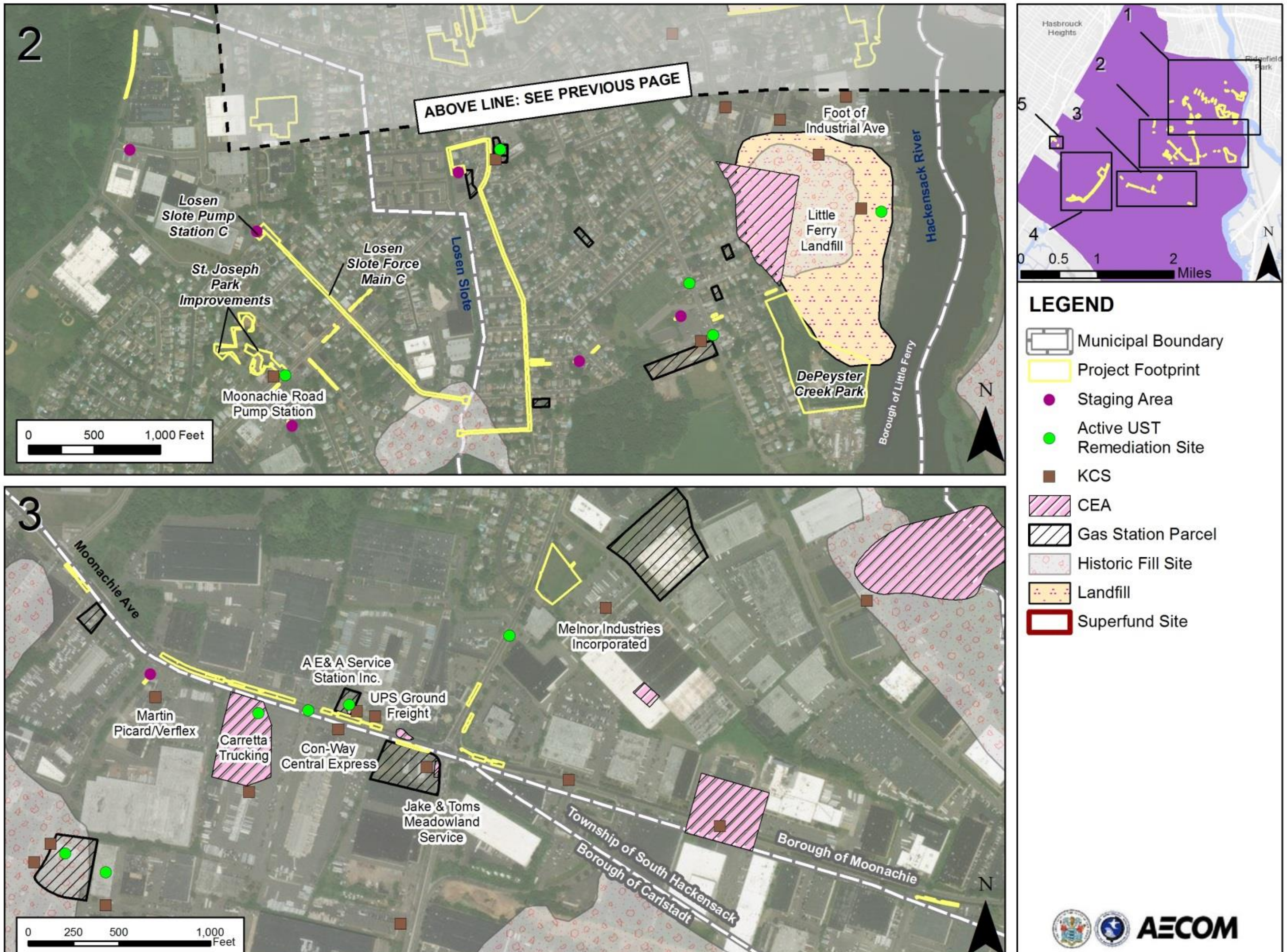
[1] Fluvial Park is not included in Alternative 3; therefore, impacts related to construction or operation of Fluvial Park would not apply for that alternative (see **Section 4.20.4.4**). These contaminated sites could still cause impacts related to construction or operation of other components that would be included under both Alternative 2 and Alternative 3, such as Caesar Place Park.

[2] DePeyster Creek Park is not included in Alternative 3; therefore, impacts related to construction of operation of DePeyster Creek Park would not apply for that Alternative.



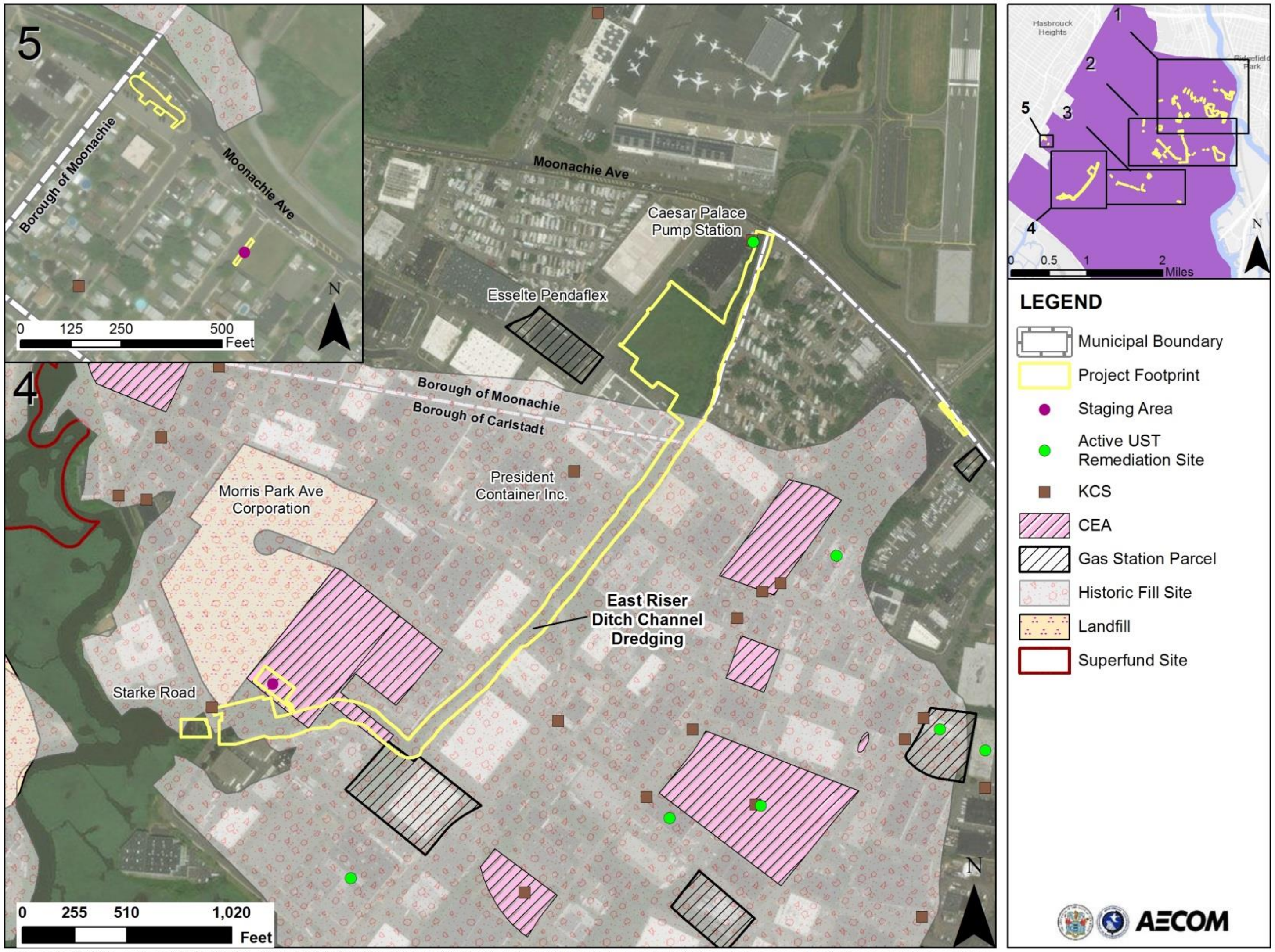
Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-5: Contaminated Sites within the Alternative 2 Footprint (Figure 1 of 3)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-6: Contaminated Sites within the Alternative 2 Footprint (Figure 2 of 3)



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 4.20-7: Contaminated Sites within the Alternative 2 Footprint (Figure 3 of 3)

Potential Conflicts with On-Going or Future Remedial Activities

Some of the construction areas proposed for Alternative 2 would be located on contaminated sites that are not remediated. If the landowner (or responsible entity) plans to remediate those sites during the Alternative 2 construction phase, those plans could be temporarily delayed. Additionally, postponement of site remediation would increase the possibility that contaminants could further spread during that time. This conflict would be a ***short-term, less-than-significant, adverse*** impact, as remediation plans would need to be rescheduled.

Similar to Alternative 1, construction of Alternative 2 could also be impacted by discharges or ISRA-triggering events within the study area. These events could require unplanned, near-term remedial activity, and possibly result in ***short-term, potentially significant, adverse*** impacts due to potential conflicts between construction of Alternative 2 and the necessary remedial actions. Unplanned remediation would require close coordination with the landowners and all applicable Federal, State, and local regulators, and would lead to unexpected Proposed Project delays.

Indirect Impacts

Table 4.20-6 provides a summary of the contaminated sites that would be indirectly impacted by construction of Alternative 2. Under Alternative 2, up to 20 contaminated sites could be indirectly impacted. **Figure 4.20-5** through **Figure 4.20-7** depicts the mapped contaminated sites within and in the vicinity of the Alternative 2 footprint.

Table 4.20-6: Potentially Contaminated Sites and Indirect Impacts under Alternative 2

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Impact Details
A E&A Service Station Inc.	KCS, CEA, Active UST Remediation Site	Adjacent to green infrastructure along Moonachie Avenue	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via preferential pathways and induced stormwater infiltration and groundwater recharge.
Amerada Hess Little Ferry	KCS, CEA	Adjacent to Fluvial Park; across the street from green infrastructure along US Route 46	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Impact Details
Caesar Palace Pump Station	KCS, Active UST Remediation Site	Adjacent to East Riser Ditch dredging	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via remobilization or exposure of contaminants.
Carretta Trucking	KCS, CEA, Spills, Releases	Nearest CEA boundary 40 feet from green infrastructure along Moonachie Avenue	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Con-Way Central Express	KCS, Spills, Releases	Across the street from green infrastructure along Moonachie Avenue	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Esselte Pendaflex	Releases, LUST, soil contamination	Underlies southwest corner of Caesar Place Park	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Foot of Industrial Avenue	KCS	Adjacent to Riverside Park	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
J S Popper Inc.	KCS, Spills, Releases	Across the street from green infrastructure along Liberty Street and Little Ferry Municipal Improvements	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Impact Details
Jake & Toms Meadowland Service	KCS, CEA	Adjacent to green infrastructure along Moonachie Avenue	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Martin Picard/Verflex	KCS	Across the street from green infrastructure along Moonachie Avenue	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Melnor Industries Inc.	KCS, CEA	CEA is 650 feet from Avanti Park; KCS parcel is adjacent to Avanti Park	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Moonachie Road Pump Station	KCS	Adjacent to Joseph Street Park	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
President Container Inc.	KCS, CEA, Historic Fill, Spills, Releases	CEA's nearest boundary approximately 500 feet from Caesar Place Park; KCS parcel adjacent to East Riser Ditch dredging Note: This CEA is not yet included in NJDEP CEA GIS layer	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Impact Details
Starke Road	KCS, Releases	Adjacent to East Riser Ditch dredging	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via remobilization or exposure of contaminants.
UPS Ground Freight	KCS, Spills, Releases, Active UST Remediation Site	Adjacent to green infrastructure along Moonachie Avenue	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Walker Poroswall Pipe Co.	KCS, Releases, Active UST Remediation Site	Adjacent to Fluvial Park; across street from green infrastructure along Bergen Turnpike	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
N/A (historic fill)	Historic fill	Underlies Fluvial Park; Caesar Place Park; Willow Lake Park; Riverside Park; green infrastructure along Bergen Turnpike	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Esposito / Willow Lake Landfill	Landfill	Underlies Willow Lake Park	Potential conflict with future remedial investigation and/or remedial action of this improperly closed landfill to mitigate off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.

Site Name / Location	Site Categories	Location / Distance to Alternative 2 Footprint	Impact Details
Little Ferry Landfill	Landfill	Partially underlies DePeyster Creek Park	Potential conflict with future remedial investigation and/or remedial action of this improperly closed landfill to mitigate off-site contamination; risk of off-site or future mobilization of contaminants via induced stormwater infiltration and groundwater recharge.
Morris Park Avenue Corporation	Landfill	Partially underlies East Riser Ditch Pump Station	Potential conflict with future remedial investigation and/or remedial action of off-site contamination; risk of off-site or future mobilization of contaminants via remobilization or exposure of contaminants.

<u>Induced Changes in the Potential Spread or Release of Contaminants</u>

Construction and operation of certain Alternative 2 components could create preferential pathways for methane and VOC-contaminated soil vapor, and/or groundwater. These contaminants move more readily through permeable pavement and stone aggregate than through finer-grained, native soils. Approximately 9,000 CY of soil and aggregate are estimated to be imported for construction of green infrastructure features. In some areas, these preferential pathways could expand on-site groundwater plumes off-site, or lead to occupied buildings in the case of soil vapor. These ***long-term, potentially significant, adverse*** impacts could occur following construction in the vicinity of landfills (in the case of methane), CEA sites, gasoline/automotive service stations, dry cleaners, and active UST remediation sites. As discussed under Alternative 1, numerous standard construction practices would be implemented to prevent methane and VOC hazards. Because Alternative 2 would create fewer linear structures with porous fill (e.g., scattered green infrastructure systems, as compared to a largely continuous floodwall under Alternative 1), there would be less opportunity for methane and VOCs to migrate along preferential pathways.

Alternative 2 includes numerous green infrastructure features, such as rain gardens, bioswales and storage trenches, and landscape features (e.g., constructed wetlands) that are designed to increase groundwater infiltration. This increased infiltration could lead to increased mobilization of underlying soil and groundwater contaminants, as well as contaminants at nearby hazardous waste sites. Mobilization of existing contaminant plumes would constitute ***long-term, potentially significant, adverse*** impacts to the Project Area. Due to the number of green infrastructure systems, new parks, and improved open spaces that would be constructed to increase stormwater infiltration, Alternative 2 has greater potential to increase the mobilization of contaminants within and into groundwater than Alternative 1.

Operation of the stormwater conveyance improvements in East Riser Ditch and Losen Slote could lead to disruption of bottom sediments in those respective channels. Localized increases in water velocity in East Riser Ditch upstream of Moonachie Avenue and at the discharge locations of the Losen Slote force mains could increase scour of the shoreline or benthic substrate, thereby potentially re-suspending contaminants and transporting them downstream. However, Alternative 2 would be designed to avoid these impacts or minimize them to less-than-significant levels. Therefore, increased scour resulting from Alternative 2 could lead to ***long-term, less-than-significant, adverse*** impacts by mobilizing contaminated sediments in the East Riser Ditch and Losen Slote channels. Detailed analysis of the potential scour effects associated with Alternative 2 is provided in **Section 4.16.4.3**.

Operation of Alternative 2 would likely induce a ***long-term, beneficial*** impact associated with increased flood protection of existing hazardous material sites in the study area. Improvements to East Riser Ditch would reduce flooding in the industrial portion of Carlstadt, where numerous contaminated sites and a high concentration of historic fill are known to exist. Additionally, the new parks and improved open spaces would be designed to retain stormwater onsite, thereby reducing the risk of mobilization of contaminated surface materials at offsite properties, waterways, and/or wetlands. However, the potential benefits of reduced stormwater flooding would likely be less than those of reduced coastal flooding (i.e., under Alternative 1), due to their more localized nature.

Proximity to Existing ASTs

One AST (AST 21) was calculated as having an ASD that intersects proposed Alternative 2 park features. The ASD for AST 21 was calculated to be 162 feet, but it is located only 136 feet east, and in direct line-of-sight, of the proposed location of Caesar Place Park. Caesar Place Park would be constructed in a location that is 136 feet west of AST 21, and would be in the direct line-of-sight of this AST. Similar to Alternative 1, a ***long-term, potentially significant, adverse*** impact would occur from the increased risk to people utilizing this proposed park from thermal radiation or blast-overpressure damage. Mitigation measures would be implemented to reduce effects to less-than-significant levels in accordance with HUD's ASD guidance. For more information on this AST analysis, please refer to **Appendix O**.

Induced Potential Conflicts with On-Going or Future Remedial Activities

Similar to Alternative 1, construction of Alternative 2 could potentially lead to future conflicts with nearby remedial activities at KCS, CEA, and other sites. For example, potential mobilization of existing subsurface contaminant plumes, as discussed previously for features intended to increase stormwater infiltration, could affect the remediation activities necessary at those locations.

Mitigation Measures and BMPs

Both ***short-term*** and ***long-term, potentially significant, adverse*** impacts to hazardous materials have been identified from the proposed construction and operation of Alternative 2 due to the potential disruption of KCS, release and/or spread of contaminants, and interference with existing and/or planned site remediation activities within the Project Area. This potential necessitates careful consideration of how the specific flood reduction features proposed could interact with hazardous materials to reduce the potential impacts to nearby hazardous waste/material sites. Additionally, potentially significant adverse impacts were identified due to unacceptable separation distances between ASTs and proposed Alternative 2 components (i.e., Caesar Place Park). The following mitigation measures would be implemented to reduce identified ***potentially significant adverse*** impacts.

- Construction contractors would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations during Alternative 2 construction.
- The proposed construction at Willow Lake Park includes various green infrastructure features. These actions could require additional pre-construction review of site-specific records, sampling

and analysis of materials to be disturbed, precautionary planning, and implementation of BMPs to ensure mitigation, if not prevention, of the release and spread of contamination during operation, use, and maintenance of these features.

- Precautions could be needed near historic fill, the Little Ferry Landfill, and the Morris Park Avenue Corporation landfill to ensure that activity does not expose workers, local residents, or ecological receptors to contamination through the release and spread of hazardous materials during construction and operation of proposed features.
- Dredging and construction at the East Riser Ditch and Losen Slote would require work within and in close proximity (i.e., parcels within 200 feet) to contaminated sites and waterways. Design and operation of these features would need to consider downstream impacts and disturbance to ongoing and planned remedial investigation should proposed features, such as pump stations, result in scour and the spread of known contaminants in soil and sediment.
- Coordination with the USEPA and BCSA Cooperating PRP Group would be conducted during the final design process to ensure the Proposed Project does not adversely impact the ongoing BCSA PRP Group remediation project.
- During the design process, HUD would be consulted to make proposed park/recreation features in compliance with HUD ASD requirements. Potential measures include incorporating natural barriers (e.g., constructed hills, earthen elevations, etc.) into site design, constructing a barrier for thermal radiation, reconfiguring the site plan in order to increase the distance between the hazard and the Alternative 2 components, burying the existing ASTs, or diking the existing ASTs (if liquid contents).
- A Materials Management Plan would be developed to address how any contaminated soil, sediment, surface water, groundwater, or waste materials would be handled for off-site disposal or on-site reuse (in the case of soil) during construction, along with management, on-site treatment, and discharge of groundwater from dewatering activities. The use of recycled concrete aggregate, alternative fill, and soil from off-site sources would need to be evaluated carefully so as not to introduce new contaminants into the environment.
- Coordination with the NJDEP Division of Solid and Hazardous Waste would be required for any actions that involve work near a landfill. A Landfill Disruption Permit would also be required.
- A New Jersey LSRP would oversee those portions of the project considered to be a Linear Construction Project as defined by the NJDEP, and the Proposed Project would comply with these and other provisions of Chapter 16 of the NJDEP Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C, as necessary. This could occur with linear landscape features that cross more than one property.
- O&M activities would need to address NJ Site Remediation and Reform Act requirements for contaminated sites.
- Parties responsible for completing remediation of properties adjacent to, or within 200 feet of, the Proposed Project would be notified of the design and schedule.

4.20.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint due to the exclusion of Fluvial Park, DePeyster Creek Park, and Losen Slote C pump station and force main. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project could interact with existing hazardous materials onsite or nearby, and thus would not change the impact analysis.

Due to the overall similarity between Alternative 2 and Alternative 3, contaminated sites that would potentially be impacted by Alternative 3 directly are generally the same as those that would be impacted under Alternative 2. Annotations are provided in **Table 4.20-5** to identify those sites that would not be impacted under Alternative 3.Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences.

Direct Impacts

Compared to Alternative 2, Alternative 3 would have less ground-disturbing activities, and therefore would have a reduced risk of:

- Exposing and/or mobilizing existing known, suspected, or undocumented contaminants in soil or groundwater;
- Introducing new contaminants to the Project Area, including spills or releases of contaminants commonly used in construction projects (i.e., gasoline or diesel);
- Conflicting with planned remediation activities at existing contaminated sites within or adjacent to the Alternative 3 footprint; and
- Encountering unplanned remediation requirements associated with ISRA-triggering events.

Additionally, Alternative 3 would have reduced beneficial impacts on the Project Area compared to Alternative 2 by exporting slightly less potentially contaminated soil (i.e., only approximately 28,000 CY, as compared to 32,300 CY under Alternative 2) from the Project Area, and not potentially capping existing contaminants at the proposed Fluvial Park and DePeyster Creek Park sites.

Indirect Impacts

Compared to Alternative 2, Alternative 3 would have a reduced potential risk of:

- Creating preferential pathways that could accelerate the spread of VOC-contaminated soil vapor and/or groundwater. Further, there would be a reduced risk of encountering, or mobilizing, methane gases that could be present near the Little Ferry Landfill;
- Mobilizing existing contaminated groundwater due to increased stormwater infiltration at the Fluvial Park and DePeyster Creek Park locations; and
- Scouring the Losen Slote channel, and therefore a lower risk of potentially disrupting or mobilizing existing contaminants, because the Losen Slote C pump station and force main would not be constructed.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to reduce the identified ***potentially significant, adverse*** impacts under Alternative 3 (see **Section 4.20.4.3**).

4.21 Mineral and Energy Resources

This section analyzes the potential direct and indirect impacts of the three Build Alternatives and the No Action Alternative on mineral and energy resources, as described in **Section 3.21**, in and around the Project Area. Impacts to mineral and energy resources can be either direct or indirect. A direct impact would occur if the Proposed Project's demand for mineral or energy resources would exceed the local available capacity to provide such resources during project construction or operation. An indirect impact would occur if the Proposed Project would preclude future extraction of mineral resources, or would induce other changes that could result in future energy-delivery capacity shortfalls.

This analysis specifically addresses the potential for the Proposed Project's considered alternatives to affect these resources during both construction and operational activities, either by affecting them directly or by causing indirect effects that alter their functionality. This analysis also quantifies the volume of proposed resource usage and, if possible, quantifies potential effects.

4.21.1 Definition of Study Area

As described in **Section 3.21**, the study area for this resource area includes the Project Area and quarries and material supplier locations in the region, extending up to 30 miles from the Project Area. This study area was defined based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to mineral and energy resources (i.e., the locations and sources from which the Proposed Project would draw these resources) in accordance with 40 CFR 1508.27.

4.21.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives to mineral and energy resources are shown in **Table 4.21-1**.

Table 4.21-1: Mineral and Energy Resources Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Mineral/Energy Resource Change	• Would not change the availability of raw minerals • Would not result in an unrecoverable use of energy • Would not affect ongoing mineral extraction or energy resource production
	Indirect Mineral/Energy Resource Change	• Would not induce activities that would change the supply sources or cost of raw minerals • Would not induce activities that would change energy generation sources or the cost of energy • Would not induce activities that would change the supply, availability, capacity, or costs of minerals or energy • Would not affect future ability to extract mineral or energy resources • Would not yield project delays or increased costs due to limited resource availability
	Applies to All Effect Types	• Would result in no discernable changes to or from energy or mineral resources in the Project Area • Would not result in resource shortages; resource availability would be altered for an indiscernible or negligible period
Less-than-Significant	Direct Mineral/Energy Resource Change	• Would temporarily and minimally reduce the availability of raw minerals, but sufficient supply would be available for the Proposed Project • Would result in a temporary unrecoverable use of energy • Would temporarily and minimally disrupt ongoing mineral extraction or energy resource production • Would reduce resource availability from some sources; however, alternate sources are available
	Indirect Mineral/Energy Resource Change	• Would induce activities that would temporarily and minimally reduce the supply sources or increase cost of raw minerals • Would induce activities that would temporarily and minimally decrease energy generation sources or increase cost of energy • Would induce activities that would temporarily and minimally adversely alter the supply, availability, capacity, or costs of mineral or energy resources • Would reduce future ability to extract mineral or energy resources for a short, finite period • Would yield minimal project delays or increased costs due to limited resource availability
	Applies to All Effect Types	• Mineral or energy resources would only be altered/diminished minimally, for a short, finite period of time • Impacts would minimally affect mineral or energy resources throughout the Project Area

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Mineral/Energy Resource Change	• Would substantially reduce the availability of raw minerals, or Proposed Project demand would exceed capacity to deliver • Would result in a substantial or long-term unrecoverable use of energy • Would substantially disrupt ongoing mineral extraction or energy resource production • Would reduce resource availability from some sources and alternate sources are not available
	Indirect Mineral/Energy Resource Change	• Would induce activities that would substantially reduce the supply sources or increase costs of raw minerals • Would induce activities that would substantially decrease energy generation sources or increase the cost of energy • Would induce activities that would adversely alter the supply, availability, capacity, or costs of mineral or energy • Would permanently reduce future ability to extract mineral or energy resources • Would yield project delays or increased costs due to resource shortages
	Applies to All Effect Types	• Mineral or energy resources would be adversely altered for an extended or permanent period • Impacts would substantially affect mineral or energy resources throughout the Project Area
Beneficial	Direct Mineral/Energy Resource Change	• Would increase the availability of raw minerals • Would decrease unrecoverable use of energy • Would enhance ongoing mineral extraction or energy resource production • Would increase resource availability from some sources
	Indirect Mineral/Energy Resource Change	• Would induce activities that would increase supply sources or decrease costs of raw minerals • Would induce activities that would increase energy generation sources or decrease the cost of energy • Would induce activities that would improve the supply, availability, capacity, or costs of minerals or energy • Would enhance future ability to extract mineral or energy resources
	Applies to All Effect Types	• Would result in mineral or energy resource benefits, improvements, and/or enhancements in the Project Area

4.21.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to the existing conditions of mineral and energy resources as described in **Section 3.21**. As mineral and energy resources would be primarily consumed during the construction phase of the Proposed Project, this analysis focuses more heavily on that aspect of the Proposed Project, and more generally on the potential long-term operational effects. Although **Table 4.21-1** does include potential impact descriptions for resource extraction, these are listed for illustrative purposes only. As no existing or planned mineral resource extraction or energy production facilities would be directly affected by any considered alternative, such impacts are not discussed further in this analysis.

The impact assessment also considers on the magnitude of potential direct and indirect effects on mineral and energy resources. Factors such as the availability of materials and supply quantities were considered. To determine the potential requirements for mineral and energy resources during the construction phase of the Proposed Project, the proposed construction requirements, in terms of energy and mineral resource needs, were estimated for each Build Alternative. For example, the land area and volume of crushed stone, soils, sand, gravel, concrete, or other mineral resources were estimated for each Build Alternative. Potential effects were then evaluated based on a quantitative and qualitative analysis of potential demands and use as compared to available supplies and capacities, thereby identifying potential impacts (i.e., shortfalls) on existing mineral and energy sources and supplies.

Regional suppliers of stone, sand, and gravel were identified and secondary impacts to the originating locales of these mineral materials were qualitatively considered. In general, a higher number of suppliers of a particular type of mineral resource equates to a larger volume of available material and a reduction in impact severity. Further, the analysis includes a discussion on the differences in mineral resource commitments among the Build Alternatives and the No Action Alternative and identifies the potential for indirect impacts resulting from separate activities that may be induced by construction of the Proposed Project.

For energy resources, the proximity to and configuration of each considered alternative in relation to energy generation facilities and/or major supply and transmission lines were considered, as well as the likelihood of the Proposed Project construction or operation to affect generation capacity, costs, availability, or delivery ability. In addition to direct project-related impacts, the ability of the Proposed Project to induce other activities that would indirectly affect energy resources was also considered.

Where potential adverse effects to mineral or energy resources were identified, mitigation measures were recommended, as appropriate.

4.21.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to mineral and energy resources associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.21.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be built and no changes attributable to the Proposed Project would occur to the existing mineral and energy resources of the study area. As such, there would be no direct impacts on mineral and energy resources. Further, no indirect impacts would occur to mineral resources within the study area or energy resources outside of the Project Area.

However, continued and increased coastal storm surge, fluvial flooding, and SLR in the Project Area over time, as described in **Section 4.1.2.1**, could have ***indirect, less-than-significant adverse*** impacts on energy resources within the Project Area. No mineral resources occur in the Project Area. Depending upon the magnitude, severity, and frequency of future flooding events and SLR, these effects reasonably could be expected to increase to ***indirect, potentially significant adverse*** impacts to energy resources. Relating to the significance criteria, the No Action Alternative, at a minimum:

- *Could increase long-term risk of energy resources to identifiable hazards, such as flooding*
- *Could induce temporary increases to prices of energy for consumers*
- *Could adversely alter the supply, availability, capacity, or costs of energy resources for a short, finite period of time*
- *Impacts could minimally affect or diminish energy resources throughout the Project Area*

Flooding within the Project Area would be expected to continue to have indirect impacts on energy resources. During coastal storm surge and fluvial flooding events, augmented by climate change and SLR, the supply and availability of energy resources within the Project Area would be repeatedly interrupted, and in turn would increase costs. The magnitude of these indirect effects would be dependent upon the magnitude, frequency, and severity of future flooding events.

The only energy production facility within the Project Area is the NJSEA Borough of Little Ferry Solar Cooperative. Loss or temporary operational disruption of this small (76.5 KW) solar facility due to future flooding events would temporarily and minimally decrease energy generation within the Project Area.

A LNG storage facility is located in the Borough of Carlstadt within the Project Area. This storage facility is owned and operated by Transco and is supplied by a network of pipelines that extend well beyond the Project Area (NJSEA 2004). Additional transmission pipelines operated by PSE&G roughly parallel the western spur of the New Jersey Turnpike, also terminating at the Transco LNG facility (NPMS 2016). The Transco LNG facility is located within the 100-year floodplain and increased flooding could result in substantial damage to above-ground infrastructure. The Project Area also includes electric substations and an extensive overhead electric power transmission and distribution network. Locations and potential impacts to energy (electric and gas) transmission and distribution lines are further discussed along with utilities in **Sections 3.12** and **4.12**.

4.21.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in the following **direct** impacts:

- ***Short-term, less-than-significant, adverse*** impacts to the supply, availability, capacity, or costs of mineral and energy resources during the construction phase of Alternative 1.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects by increasing flood protection against coastal storm surges, which would thereby reduce damage to energy resources, as well as associated impacts to supply, availability, capacity, and cost.

The following subsections provide greater detail.

Direct Impacts

Mineral Resources

The anticipated types and volumes of mineral resources required for the construction of Alternative 1 is presented in **Table 4.21-2**. There are no commercially extracted mineral resources in the Project Area. Materials would be obtained from local sources that are in relatively close proximity to the Project Area, such as those identified in **Section 3.21**. Sources provided in **Section 3.21** are included in the NJDOT database of approved Coarse Aggregate Suppliers, indicating that they likely can conform to anticipated quality control standards to be specified for this Proposed Project. Their proximity and quality standards make them likely suppliers of quarry products or recycled concrete aggregates for the Proposed Project. Final selection of material suppliers would be made by a contractor and would depend on total cost of materials delivered to the Project Area, as well as on the ability of the supplier to meet the contractor's delivery schedule. It is possible that a contractor would select a more distant supplier depending on those circumstances. Use of multiple suppliers is also possible.

Table 4.21-2: Mineral Resources – Required for Construction

Mineral Resource Type	Quantity	Units
Soils and aggregates	82,000	Cubic Yards
Hot mix asphalt	4,100	Tons
Precast concrete	3,800	Cubic Yards
Ready-mix concrete and grout	10,100	Cubic Yards
Reinforcement steel	730	Tons
Structural steel and piling products	7,200	Tons
Other fabricated materials	210	Truckloads

The volume of mineral resources required for the construction of Alternative 1 is of similar magnitude as other recent infrastructure projects in the region, such as those routinely undertaken by the NJDOT. There are adequate supplies of required materials in the region for Alternative 1 and comparably sized projects that are anticipated at this time or in the foreseeable future. **Appendix C** provides a summary of other past, present, and reasonably future actions being undertaken within the same geographic and temporal scope as the Proposed Project.

Consequently, implementation of Alternative 1 would not be expected to significantly change the availability, cost, or production rates of mineral resources in the study area. If construction of Alternative 1 coincided with several other projects of similar magnitude, temporary and minimal changes in availability and cost of raw materials may occur. It is expected that the market would readily adjust to this temporary increase in demand for mineral resources. Therefore, Alternative 1 could result in ***short-term, less-than-significant adverse*** impacts to mineral resources in the study area from acquisition of the necessary quantities and types of materials to be used during construction.

Operation of Alternative 1 is anticipated to require only *de minimus* amounts of mineral resources for maintenance activities. As such, no long-term direct effects to mineral resources would be expected.

Energy Resources

Construction and operation of Alternative 1 would not require relocations of, alterations to, or disruptions to existing sources of energy and associated electric generation facilities within the Project Area. Locations and impacts to electric and gas transmission lines are discussed along with utilities in **Sections 3.12** and **4.12**.

Construction of Alternative 1 would not significantly impact the supply, demand, or capacity of existing energy resources. All construction activities would be completed using diesel-powered equipment. The diesel fuel quantities required for the construction of Alternative 1 is of similar magnitude as other recent construction projects in the region, such as those routinely undertaken by the NJDOT. There are adequate fuel supplies in the region for Alternative 1 and comparably sized projects that are anticipated at this time or in the foreseeable future (see **Appendix C**). Therefore, Alternative 1 could result in ***short-term, less-than-significant adverse*** impacts to energy resources in the study area from acquisition of the necessary quantities and types of energy to be used during construction.

Operation of Alternative 1 would result in a long-term, minor increase in electricity demand in the region. Energy use by Alternative 1 would consist of electric pumps, electric-powered surge gates, and minimal lighting of public realm features, as described in **Section 4.12.4.2**. Adequate capacity exists in the study area to support these proposed operational uses. As such, no long-term direct effects to energy resources would be expected.

Indirect Impacts

Mineral Resources

The Project Area is fully developed; accordingly, construction and operation of Alternative 1 is not expected to induce activities, such as new development, that would substantially increase demands or costs for mineral resources in the region. As such, no adverse indirect impacts on mineral resources are anticipated as a result of implementation of Alternative 1.

Conversely, however, reduction of flood damages within the Project Area due to implementation of Alternative 1 would commensurately reduce the need for reconstruction and rebuilding of facilities damaged by flood events. As such, a ***long-term, beneficial*** effect to mineral resources could be realized.

Energy Resources

As noted above, the NJSEA Borough of Little Ferry Solar Cooperative is located within the Project Area and includes rooftop solar systems. This facility is small in comparison to energy use in the Project Area and energy generation from other regional sources. The Transco LNG facility, in the Borough of Carlstadt, is also within the Project Area. However, Alternative 1 would not provide additional flood protection to these facilities because the NJSEA and Transco LNG facilities occur at elevations greater than 7 feet (NAVD 88). As such, the effects would remain the same as identified under the No Action Alternative.

Overall, the reduction of flood events due to implementation of Alternative 1 would be expected to have a ***long-term, beneficial*** effect to energy resources in the Project Area. This would be due to decreases in flooding effects that would simultaneously decrease effects to energy supply sources, delivery, and distribution networks. Similarly, by decreasing flood-related impacts, the cost for such post-flood repairs would be decreased, resulting in a lower potential to increase the costs for energy provision.

Mitigation Measures and BMPs

No potentially significant adverse impacts to mineral and energy resources have been identified from the proposed construction or operation of Alternative 1. The following mitigation measures and/or BMPs would be implemented to further reduce identified less-than-significant, adverse impacts.

- Demolition and debris cleared during construction of Alternative 1, as well as excavated soils, would be classified and sorted for beneficial re-use, either for Proposed Project construction or for other suitable uses. This material re-use would partially offset and mitigate for the irretrievable use of mineral resources needed for construction of Alternative 1.
- Construction managers would develop and implement a construction energy conservation plan for energy use during construction of Alternative 1. This plan would include the following energy reducing measures: use electricity from established electrical power sources or other energy-efficient supplies, when feasible and safe to do so, instead of generators; shut down equipment when not in use; encourage workers to carpool or use public transportation for travel to and from the construction sites, when possible; use source materials that are near the Project Area to the extent feasible; utilize cleaner and more fuel efficient construction equipment and vehicles; and implement traffic management schemes that minimize delays and idling.

Additional mitigation measures for local utilities would be implemented as discussed in **Section 4.12**.

4.21.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in the following direct impacts:

- ***Short-term, less-than-significant, adverse*** impacts to the supply, availability, capacity, or costs of mineral and energy resources during the construction phase of Alternative 2.

Alternative 2 would result in the following indirect impacts:

- ***Long-term, beneficial*** effects from stormwater improvements that reduce inland flooding, which would thereby reduce damage to energy resources, as well as associated impacts to supply, availability, capacity, and cost.

The following subsections provide greater detail.

Direct Impacts

<u>Mineral Resources</u>

The anticipated types and volumes of mineral resources required for the construction of Alternative 2 are presented in **Table 4.21-3**. As stated in the section above concerning Alternative 1, there are no commercially extracted mineral resources in the Project Area. Materials would be obtained from local sources that are in relatively close proximity to the Project Area, such as those identified in **Section 3.21**.

Table 4.21-3: Mineral Resources – Required for Construction

Mineral Resource Type	Quantity	Units	Quantity as % of Alternative 1
Soils and aggregates	18,657	Cubic Yards	23%
Hot mix asphalt	4,556	Tons	111%
Precast concrete	86	Cubic Yards	2%
Ready-mix concrete and grout	3,531	Cubic Yards	35%
Reinforcement steel	0	Tons	0
Structural steel and piling products	225	Tons	3%
Other fabricated materials	461	Truckloads	220%

The volume of mineral resources required for the construction of Alternative 2 is substantially less than that required for Alternative 1 for most materials. For example, the volume of soils and aggregates required for Alternative 2 would be 23 percent of the quantity required for Alternative 1. However, in some instances, Alternative 2 would require more volume of a particular resource. For example, Alternative 2 would require 11 percent more hot mix asphalt than Alternative 1. The ratios of mineral resources required for the construction of Alternative 2, as compared to Alternative 1, are detailed in **Table 4.21-3**.

The volume of mineral resources required for the construction of Alternative 2 would be of a lesser magnitude than other recent infrastructure projects in the region, such as those routinely undertaken by the NJDOT. As for Alternative 1, there are adequate supplies of required materials in the region for Alternative 2 and comparably sized projects that are anticipated at this time or in the foreseeable future.

Consequently, implementation of Alternative 2 would not be expected to significantly change the availability, cost, or production rates of mineral resources in the study area. Even if construction of Alternative 2 coincided with several other projects of similar magnitude, no change in the availability and cost of raw materials would be expected. Therefore, Alternative 2 could result in ***temporary, less-than-significant adverse*** impacts to mineral resources in the study area and any impacts would be less than Alternative 1.

Operation of Alternative 2 is anticipated to require only *de minimus* amounts of mineral resources for maintenance activities. As such, no long-term direct effects to mineral resources would be expected.

Energy Resources

Construction and operation of Alternative 2 would not require relocations of, alterations to, or disruptions to existing sources of energy and associated electric generation facilities within the Project Area. Locations and impacts to electric and gas transmission lines are discussed along with utilities in **Sections 3.12** and **4.12**.

Construction of Alternative 2 would not significantly impact the supply, demand, or capacity of existing energy resources. All construction activities would be completed using diesel-powered equipment. The diesel fuel quantities required for the construction of Alternative 2 is less than that required for Alternative 1 and is of a lesser magnitude as other recent construction projects in the region, such as those routinely undertaken by the NJDOT. There are adequate fuel supplies in the region for Alternative

2 and comparably sized projects that are anticipated at this time or in the foreseeable future (see **Appendix C**). Although Alternative 2 could result in ***short-term, less-than-significant adverse*** impacts to energy resources in the study area from acquisition of the necessary quantities and types of energy to be used during the construction phase of the Proposed Project, such impacts would be less than Alternative 1.

Operation of Alternative 2 would result in a long-term, minor increase in electricity demand in the region. Energy use by Alternative 2 would consist of electric pumps, and minimal lighting of public realm features, as described in **Section 4.12.4.3**. Adequate capacity exists in the study area to support these proposed operational uses. As such, no long-term direct effects to energy resources would be expected.

Indirect Impacts

Mineral Resources

As stated above, the Project Area is fully developed, and as with Alternative 1, construction and operation of Alternative 2 is not expected to induce activities that would substantially increase demands or costs for mineral resources in the region.

Reduction of flood damages within the Project Area due to implementation of Alternative 2 would reduce the need for reconstruction and rebuilding of facilities damaged by inland flood events. As such, a ***long-term, beneficial*** effect to mineral resources could be realized. However, Alternative 2 would not provide flood protection against coastal storm flooding unlike Alternative 1.

Energy Resources

As noted above, both the NJSEA Borough of Little Ferry Solar Cooperative and the Transco LNG facility are located within the Project Area. Alternative 2 would not provide additional flood protection to these facilities because they are outside of the limit of protection provided by Alternative 2. As such, the effects would remain the same as identified under the No Action Alternative.

Overall, as with Alternative 1, the reduction of flood events due to implementation of Alternative 2 would be expected to have a ***long-term, indirect beneficial*** effect to energy resources in the Project Area. This would be due to decreases in flooding effects that would simultaneously decrease effects to energy supply sources, delivery, and distribution networks. Similarly, by decreasing flood-related impacts, the cost for such post-flood repairs would be decreased, resulting in a lower potential to increase the costs for energy provision.

Mitigation Measures and BMPs

No potentially significant adverse effects to mineral and energy resources have been identified for Alternative 2. The same mitigation measures and BMPs identified under Alternative 1 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 2 (see **Section 4.21.4.2**).

4.21.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes fewer components. Variations in the Willow Lake Park improvements proposed under Alternative 3, as compared to Alternative 2, would not change how the Proposed Project affects mineral and energy resources, and thus would not change the impact analysis. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. Direct and indirect impacts under Alternative 3 would be the same or slightly less than Alternative 2. The following subsections provide greater detail on the differences.

Direct Impacts

Mineral Resources

The anticipated types and volumes of mineral resources required for the construction of Alternative 3 are presented in **Table 4.21-4**. As stated above, there are no commercially extracted mineral resources in the Project Area. Materials would be obtained from local sources that are in relatively close proximity to the Project Area, such as those identified in **Section 3.21**.

Table 4.21-4: Mineral Resources – Required for Construction

Mineral Resource Type	Quantity	Units	Quantity as % of Alternative 1	Quantity as % of Alternative 2
Soils and aggregates	12,547	Cubic Yards	15%	67%
Hot mix asphalt	3,844	Tons	94%	84%
Precast concrete	84	Cubic Yards	2%	--
Ready-mix concrete and grout	3,706	Cubic Yards	35%	105%
Reinforcement steel	0	Tons	0	--
Structural steel and piling products	180	Tons	3%	80%
Other fabricated materials	298	Truckloads	142%	65%

The volume of mineral resources required for the construction of Alternative 3 is similar or of lesser magnitude in comparison to those required for Alternative 2, and substantially less than the amounts required for Alternative 1. For example, Alternative 3 requires 67 percent of the amount of soils and aggregates that Alternative 2 requires, and about 15 percent of the amount required for Alternative 1. The ratios of mineral resources required for construction of Alternative 3, in comparison to Alternatives 1 and 2, are detailed in **Table 4.21-4**. Therefore, Alternative 3 could result in ***short-term, less-than-significant adverse*** impacts to mineral resources in the study area, but impacts would be less than those identified for either Alternative 1 or Alternative 2.

Energy Resources

Construction of Alternative 3 would not significantly impact the supply, demand, or capacity of existing energy resources. All construction activities would be completed using diesel-powered equipment. The diesel fuel quantities required for the construction of Alternative 3 is less than the amount required for both Alternative 1 and Alternative 2, and is of a lesser magnitude than other recent construction projects in the region. Although Alternative 3 could result in ***short-term, less-than-significant adverse*** impacts to energy resources in the study area from acquisition of the necessary quantities and types of energy to be used during the construction phase, these impacts would be less than those identified for either Alternative 1 or Alternative 2.

Indirect Impacts

Under Alternative 3, the Losen Slote pump station C and force main C would not be constructed. Therefore, Alternative 3 would have less ***long-term, beneficial*** effects to mineral and energy resources, in comparison to Alternative 2, from stormwater improvements that reduce inland flooding.

Mitigation Measures and BMPs

The same mitigation measures and BMPs identified under Alternative 2 would be implemented to further reduce the identified ***less-than-significant, adverse*** impacts under Alternative 3 (see **Section 4.21.4.3**).

4.22 Agricultural Resources and Prime Farmlands

This section analyzes the potential direct and indirect impacts of the three Build Alternatives and the No Action Alternative on agricultural resources and prime farmlands, as described in **Section 3.22**, in the Project Area. Impacts to agricultural resources and prime farmlands can be either direct or indirect. An example of a direct impact would be the permanent removal of prime farmland, farmland of unique importance, and/or farmland of statewide importance through filling, grading, earthmoving, and/or permanent inundation that would result in the physical or chemical change of soils and/or preclude agricultural use. An indirect impact would occur if the Proposed Project would induce other changes that could affect prime farmlands, such as future development that would remove such lands from agricultural use.

This analysis specifically addresses the potential for the Proposed Project, under each considered alternative, to affect agricultural resources and prime farmlands during both construction and operation, either by using the areas directly or causing indirect effects. This analysis also identifies the location of impacts and, if possible, quantifies potential effects.

4.22.1 Definition of Study Area

As described in **Section 3.22**, the study area for this resource is limited to within the boundaries of the Project Area. This study area was defined based on the nature of the Proposed Project, as well as the anticipated context and intensity of its effects to agricultural resources and prime farmlands, in accordance with 40 CFR 1508.27.

4.22.2 Thresholds of Significance

The significance criteria used to evaluate potential direct and indirect effects of the alternatives to agricultural resources and prime farmlands are shown in **Table 4.22-1**.

4.22.3 Analysis Methodology

The three Build Alternatives and the No Action Alternative were evaluated to determine the potential for changes to the existing conditions of agricultural resources and prime farmlands within the Project Area; these resources are described in **Section 3.22**.

To conduct this analysis, each considered alternative was overlaid onto the existing environment, and relationships between project components and agricultural resources and prime farmlands were identified. Using these data, potential direct short-term and long-term impacts to resources and corresponding potential indirect impacts, at specific locations, were identified.

Table 4.22-1: Agricultural Resources and Prime Farmlands Impact Significance Criteria

Impact Level	Type of Effect	Impact Description
No Impact	Direct Farmland Change	• Would not change agricultural uses, practices, or functions • Would not alter prime farmland or other important farmlands (i.e., farmland of unique importance or farmland of statewide importance) or the factors contributing to the value of their farmland status
	Indirect Farmland Change	• Would not induce any further changes or activities that would affect agricultural uses, practices, or functions • Would not induce any further changes or activities that would alter prime farmland or other important farmlands or the factors contributing to the value of their farmland status
	Applies to All Effect Types	• Would result in no discernable changes to agricultural resources, prime farmland, or other important farmland in the Project Area •
Less-than-Significant	Direct Farmland Change	• Would minimally or temporarily reduce agricultural uses, practices, or functions • Would minimally or temporarily convert prime farmland or other important farmland to non-farmland uses or reduce factors contributing to the value of the their farmland status
	Indirect Farmland Change	• Would induce further changes or activities that would temporarily/minimally reduce agricultural uses, practices, or functions • Would induce further changes or activities that would temporarily or minimally convert prime farmland or other important farmland to non-farmland uses or reduce factors contributing to the value of their farmland status • Would limit access to prime farmland or other important farmland soils due to physical barriers such as berms, ditches, or flooded areas
	Applies to All Effect Types	• Agricultural resources, prime farmland, or other important farmland would only be altered/diminished for a short, finite period • Short-term impacts would be localized in specific areas and not substantially affect or diminish agricultural resources, prime farmland, or other important farmland throughout the Project Area

Impact Level	Type of Effect	Impact Description
Potentially Significant	Direct Farmland Change	• Would permanently and moderately/substantially reduce agricultural uses, practices, or functions • Would permanently and moderately/substantially convert prime farmland or other important farmland to non-farmland uses or reduce factors contributing to the value of the their farmland status
	Indirect Farmland Change	• Would induce further changes or activities that would permanently and moderately/substantially reduce agricultural uses, practices, or functions • Would induce further changes or activities that would permanently and moderately/substantially convert prime farmland or other important farmland to non-farmland uses or reduce factors contributing to the value of the their farmland status • Would prohibit access to prime farmland or other important farmland soils for future agricultural use due to physical barriers such as berms, ditches, or flooding
	Applies to All Effect Types	• Agricultural resources, prime farmland, or other important farmland would be adversely altered for an extended or permanent period • Impacts would substantially affect agricultural resources, prime farmland, or other important farmland throughout the Project Area
Beneficial	Direct Farmland Change	• Would increase agricultural uses, practices, or functions • Would “daylight” currently covered prime farmland or other important farmland
	Indirect Farmland Change	• Would induce further changes or activities that would increase agricultural uses, practices, or functions • Would induce further changes or activities that would increase use of or access to prime farmland or other important farmland
	Applies to All Effect Types	• Would result in agricultural resources, prime farmland, or other important farmland benefits, improvements, and/or increases in the Project Area

The significance of each potential effect was assessed based on the degree and extent of potential alteration, removal, covering, and/or other change to existing agricultural uses, prime farmland, farmland of unique importance, and/or farmland of statewide importance. Consideration was also given to whether any of the considered alternatives would limit access to farmlands; thus, not allowing them to be utilized to their agricultural potential. In addition, potential effects to residential vegetable gardens are discussed and considered in this analysis. Where potential adverse effects were identified, mitigation measures were recommended, as appropriate.

4.22.4 Impact Analysis

The following subsections assess the potential direct and indirect impacts to agricultural resources and prime farmlands associated with implementation of the Build Alternatives and the No Action Alternative, including proposed construction and operational activities.

4.22.4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not be constructed and no changes attributable to the Proposed Project would occur to the existing agricultural resources and prime farmlands within the Project Area. As discussed in **Section 3.22.3,** the Project Area does not include land that is currently used for agriculture and is exempt from the FPPA definition of farmland under 7 CFR Part 658. As such, there would be no direct or indirect impacts to prime farmlands or other important farmlands.

However, continued and increased flooding in the Project Area over time (see **Section 4.1.2.1**) could have ***indirect, less-than-significant, adverse*** impacts on community or residential gardens within the Project Area. Relating to the significance criteria, the No Action Alternative:

- *Could increase long-term risk of community and residential gardens to identifiable hazards, such as flooding*
- *Could prohibit the use of and access to community and residential gardens for future agricultural use due to physical barriers such as flooding*

4.22.4.2 Alternative 1: Structural Flood Reduction Alternative

Alternative 1 would result in no direct impacts to prime or other important farmlands or community and residential gardens.

Alternative 1 would result in the following **indirect** impacts:

- ***Long-term, beneficial*** effects on residential and community gardens due to a reduction in flooding.

The following subsections provide greater detail.

Direct Impacts

The Project Area does not include land that is currently used for agriculture. Therefore, the construction and operation of Alternative 1 would not convert any existing agricultural land to non-agricultural use. Further, no residential or community gardens were identified to be within the Alternative 1 footprint; therefore, they would not be directly impacted under Alternative 1.

No impact to soils designated by the USDA as prime farmland or farmland of statewide importance would occur under Alternative 1. While approximately 6 acres of soil designated as unique farmland (Westbrook, Ipswich, Sandy hook soils, 0 to 2 percent slopes, very frequently flooded [TrkAv]) occurs within the Alternative 1 footprint, these soils are exempt from FPPA requirements per 7 CFR Part 658. Therefore, no impact to soils designated by the USDA as prime farmland or farmland of statewide importance would occur under Alternative 1.

Indirect Impacts

Operation of Alternative 1 would provide increased flood protection against coastal storm surges within portions of the Project Area. No indirect effects to agricultural land use or lands defined as farmland would occur as a result of Alternative 1. However, ***long-term, beneficial*** effects could occur to residential or community gardens under Alternative 1 due to reduced flooding.

Mitigation Measures and BMPs

No adverse impacts to agricultural resources, prime farmlands, or residential and community gardens have been identified from the proposed construction or operation of Alternative 1. Therefore, no BMPs or mitigation measures would be required.

4.22.4.3 Alternative 2: Stormwater Drainage Improvement Alternative

Alternative 2 would result in no direct impacts to prime or other important farmlands or community and residential gardens.

Alternative 2 would result in the following indirect impacts:

- ***Long-term, beneficial*** effects on residential and community gardens due to stormwater drainage improvements.

The following subsections provide greater detail.

Direct Impacts

As described in **Section 4.22.4.2**, the Project Area does not include land that is currently used for agriculture. Therefore, the construction and operation of Alternative 2 would not convert any existing agricultural land to non-agricultural use. Further, no residential or community gardens were identified to be within the Alternative 2 footprint; therefore, they would not be directly impacted under Alternative 2.

No impact to soils designated by the USDA as prime farmland, farmland of statewide importance, or unique farmland would occur under Alternative 2. These soils are exempt from FPPA requirements per 7 CFR Part 658 and the majority of the land that would be in the proposed Alternative 2 temporary and permanent footprint is classified as Urban Land (USDA NRCS 2016d). Therefore, no impact to soils designated by the USDA as farmland would occur under Alternative 2.

Indirect Impacts

Operation of Alternative 2 would provide stormwater drainage improvements within portions of the Project Area. No indirect effects to agricultural land use or lands defined as farmland would occur as a result of Alternative 2. However, ***long-term, beneficial*** effects could occur to residential or community gardens under Alternative 2 due to the improvements to stormwater drainage.

Mitigation Measures and BMPs

Similar to Alternative 1, no BMPs or mitigation measures would be required.

4.22.4.4 Alternative 3: Hybrid Alternative

As described in **Section 2.5.4**, Alternative 3 is generally the same as Alternative 2, but includes a smaller footprint and fewer stormwater improvement projects. Therefore, impacts under Alternative 3 would be similar in nature to Alternative 2. No direct impacts to prime or other important farmlands or community and residential gardens would occur. ***Long-term, beneficial, indirect*** effects could occur on residential and community gardens due to stormwater drainage improvements, but these effects would be expected to be slightly less than Alternative 2.

Mitigation Measures and BMPs

Similar to Alternative 1 and 2, no BMPs or mitigation measures would be required.

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5.0 Cumulative Impacts

5.1 Introduction

This section analyzes the potential cumulative effects, as defined in 40 CFR § 1508.7, of the Proposed Project (under each considered Alternative) in conjunction with other past, present, and reasonably foreseeable Federal and non-Federal actions within the same Region of Influence (ROI). The technical resource areas assessed in this section are the same as those analyzed in **Section 4.0**.

5.2 Regulatory Context

In accordance with 40 CFR § 1508.7, and as detailed in CEQ guidance entitled *Considering Cumulative Effects Under the National Environmental Policy Act* (1997) and Memorandum: *Guidance on the Considerations of Past Actions in Cumulative Effects Analysis* (24 June 2005), NJDEP must analyze the potential cumulative effects that may occur when considering the Proposed Project "when added to other past, present, and RFF actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Each of these actions has the potential to affect resources in the same time and space as the Proposed Project; as such, these potential combined effects need to be analyzed. The ROI for each technical resource area discussed in this section is the same as that identified for each technical resource area in **Section 4.0**; the ROI for each technical resource area is summarized in **Table 5.3-1**.

Cumulative effects may be accrued over time and/or in conjunction with other pre-existing effects from other activities in the ROI (40 CFR § 1508.25). Therefore, previous impacts and multiple smaller impacts should also be considered. Overall, assessing cumulative effects involves defining the scope of the other actions and their interrelationship with the Proposed Project to determine if they overlap in space and time.

The NEPA, CEQ Regulations, and 24 CFR Part 58 require the analysis of cumulative environmental effects of a Proposed Project on resources that may often be manifested only at the cumulative level, such as traffic congestion, air quality, noise, biological resources, cultural resources, socioeconomic conditions, utility system capacities, and others. Cumulative effects can result from individually minor, but collectively significant, actions occurring at the same location, over time.

5.3 Scope of Cumulative Effects Analysis

This cumulative effects analysis must determine if construction and operation of the Proposed Project, as assessed in this EIS, have the possibility to result in either adverse or beneficial cumulative impacts when considering other past, present, and future projects in the Proposed Project's ROI. The timeframe applied for this analysis covers the next approximately 12 years, or through 2030. This period includes the Proposed Project's construction phase (proposed for completion in September 2022), as well as its early operational phase; this timeframe, therefore, allows for proper consideration of potential cumulative effects associated with both construction and operation of the Proposed Project. This is the most appropriate planning horizon for the Proposed Project and other activities reasonably foreseeable and planned in the ROI.

Table 5.3-1: Geographic Scope of Cumulative Effects Analysis by Technical Resource Area

Technical Resource Area	Region of Influence	Rationale
Land Use and Land Use Planning Socioeconomics, Community/Populations, and Housing Environmental Justice Recreation Public Services Coastal Zone Management Sustainability/Green Infrastructure Geology and Soils Agricultural Resources and Prime Farmlands	Five municipalities that comprise the Project Area	Potential direct and indirect effects to these resource areas from the Proposed Project would be effectively limited by the geo-political boundaries of each of the five involved municipalities or be very localized, including local zoning, land use planning, available recreational resources, census tracts/blocks, provision of public services, and coastal zone effects. Sustainability and green infrastructure changes proposed would affect stormwater management within the affected municipalities, controlling the amount, movement, collection, retention, and release of stormwater locally. Geology, soils, agricultural resources, and prime farmlands effects would be localized, focused on areas of direct effect within the Project Area.
Visual Quality/Aesthetics	Viewshed of Proposed Project	Potential direct and indirect effects to visual quality and aesthetics from the Proposed Project would affect areas from which the Proposed Project could be seen, including topographically and structurally high locations within the general vicinity.
Cultural and Historical Resources Transportation and Circulation Noise and Vibration Biological Resources Utilities and Service Systems Hazards and Hazardous Materials	Project Area and vicinity	Potential direct and indirect effects to these resource areas from the Proposed Project would occur within the Project Area and its immediate vicinity, including areas that could view the Proposed Project (historic resources and viewshed effects); hear the Proposed Project (noise); be served by the same utility providers (utility service area); have habitat connectivity (biological resources); share connections with major arterials (transportation and circulation); and be affected by potential spread of contamination or other effects due to hazardous materials.
Air Quality and Greenhouse Gas Emissions	Regional airshed	Potential direct and indirect effects to air quality from the Proposed Project would affect the regional airshed.
Global Climate Change and Sea Level Change	Global	This resource area is of global concern; the analysis within this EIS addresses how the Proposed Project would respond to potential changes.

Technical Resource Area	Region of Influence	Rationale
Hydrology and Flooding Water Resources, Water Quality, and Waters of the US	Hackensack River watershed downstream of Oradell Dam	Potential direct and indirect effects to these resource areas from the Proposed Project would affect the Hackensack River watershed; therefore, the potential to contribute to cumulative changes to the watershed is analyzed.
Minerals and Energy Resources	Project Area and regional vicinity	Potential direct and indirect effects to mineral and energy resources from the Proposed Project would affect the region of the Project Area from which materials would be supplied and energy generated and provided.

The scope of the cumulative impacts analysis, therefore, includes those activities associated with the construction and operation of the Proposed Project and those projects identified in the ROI that have occurred, are occurring, or are planned through approximately 2030.

Cumulative effects occur when the direct or indirect effects of the Proposed Project are aggregated with the effects of other present and RFF projects. They can also be aggregated with effects of past projects if, for example, a proposed project would fill the last remaining wetlands in an area. This analysis evaluates whether individually minor effects occurring in the same geographic and/or temporal space may be cumulatively significant over a period of time.

The analysis of potential cumulative effects is organized according to technical resource area, in the same order as presented in **Sections 3.0** and **4.0**. As the affected environment section for each technical resource area (see **Section 3.0**) captured the current status of the resource relative to past and present activities, this analysis focuses on evaluating the combined effects of implementing the Proposed Project and other ongoing and RFF actions within the established ROI on that affected environment.

5.4 Methodology

The NJDEP undertook a comprehensive effort to collect available data on recently completed, ongoing, and reasonably foreseeable projects within the identified ROI of the Proposed Project. This effort included a review of various online sources, including news articles, local master plans, local planning documents, redevelopment plans, rezoning initiatives, and other relevant sources; conversations with local government officials; information available from NJDEP; and input provided by CAG members based on local knowledge.

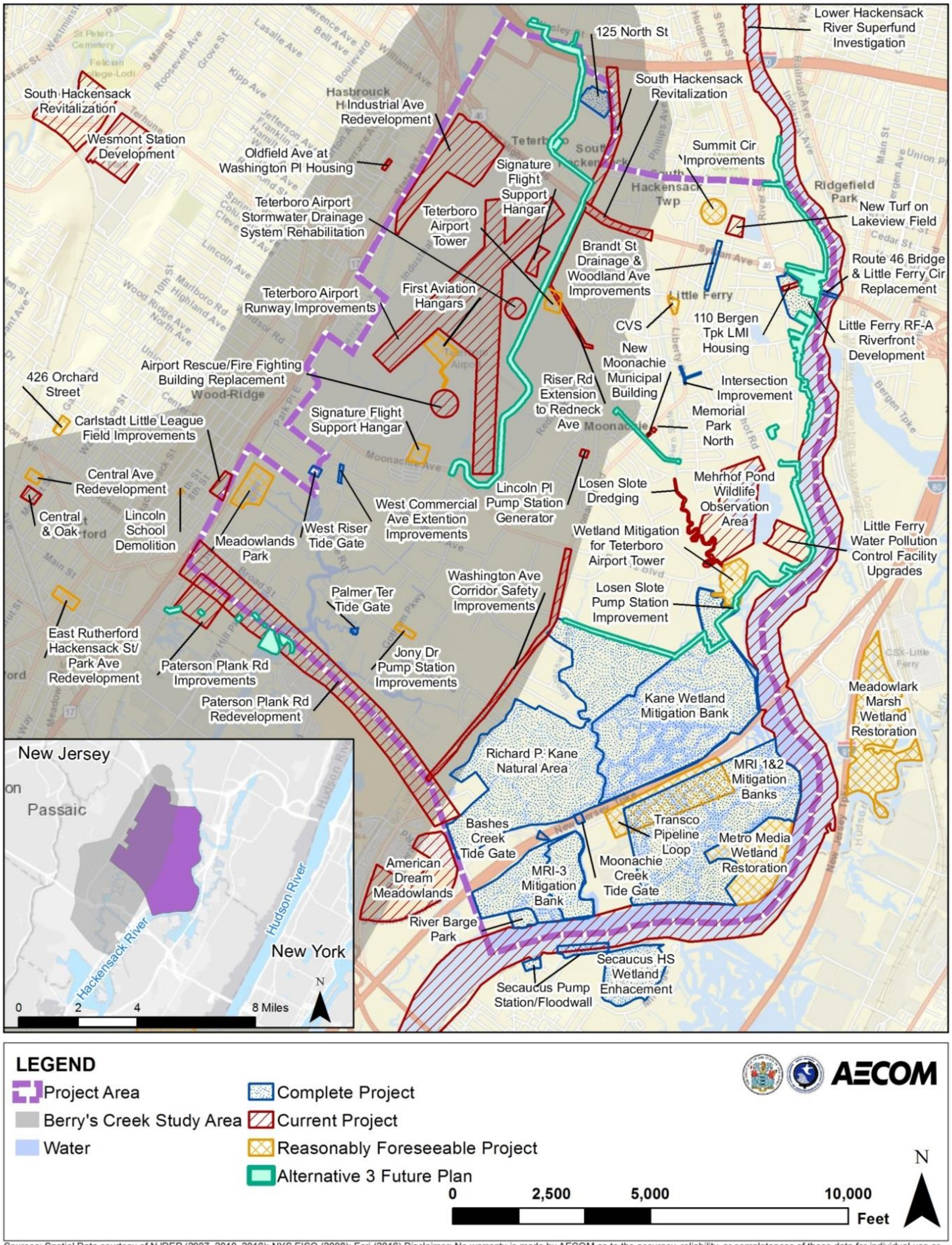
The results of this effort are presented in a table of *Projects Considered for the Cumulative Effects Analysis* (see **Appendix C**). Data presented in this table include project name, proponent/involved parties, project type, timeframe, current status, project summary, and project address/location; these data are depicted on **Figure 5.4-1**, **Figure 5.4-2**, and **Figure 5.4-3** at different levels of scale to facilitate review.

The following criteria were used to identify projects likely to have the potential for contributing to cumulative effects:

- Occurs within the Proposed Project's ROI (see **Table 5.3-1**)
- Has the potential to considerably increase population or development density in and/or around the Project Area
- Relates directly to proposed flooding/stormwater controls that may affect the Project Area
- May affect environmental resources that would be affected by the Proposed Project, as described in **Section 4.0**, at the same time and/or location.

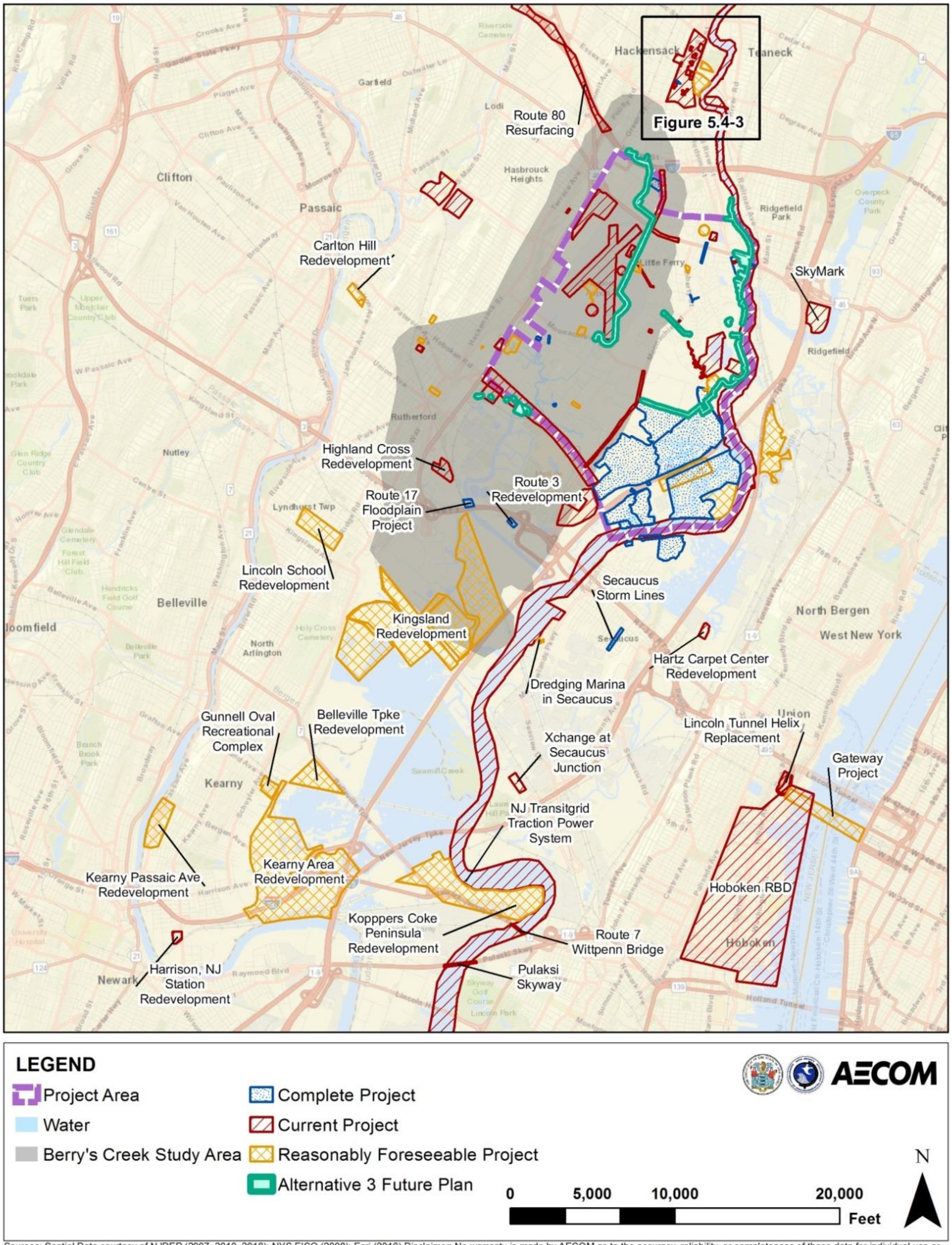
Reasonably foreseeable projects that share common characteristics in the way by which they may contribute to cumulative effects in combination with the Proposed Project are grouped together to facilitate analysis. A summary of key project groupings from the *Projects Considered for the Cumulative Effects Analysis* table is provided below; please refer to **Appendix C** for the full, detailed table. The groupings described in **Section 5.5** in conjunction with the Proposed Project, have the greatest potential to result in cumulative effects within the Proposed Project's ROI:

- RBDM Alternative 3 Future Plan;
- Recent improvements to ditches, tide gates, and pumping stations;
- Environmental improvement projects;
- Transportation projects involving drainage improvements;
- Improvements to utility systems;
- Redevelopment and rezoning local to Project Area;
- Teterboro Airport improvements;
- Industrial building construction;
- Transportation projects without specified drainage improvements;
- Regional transit/transit villages;
- Regional flood control efforts; and
- Improvements to recreational facilities.



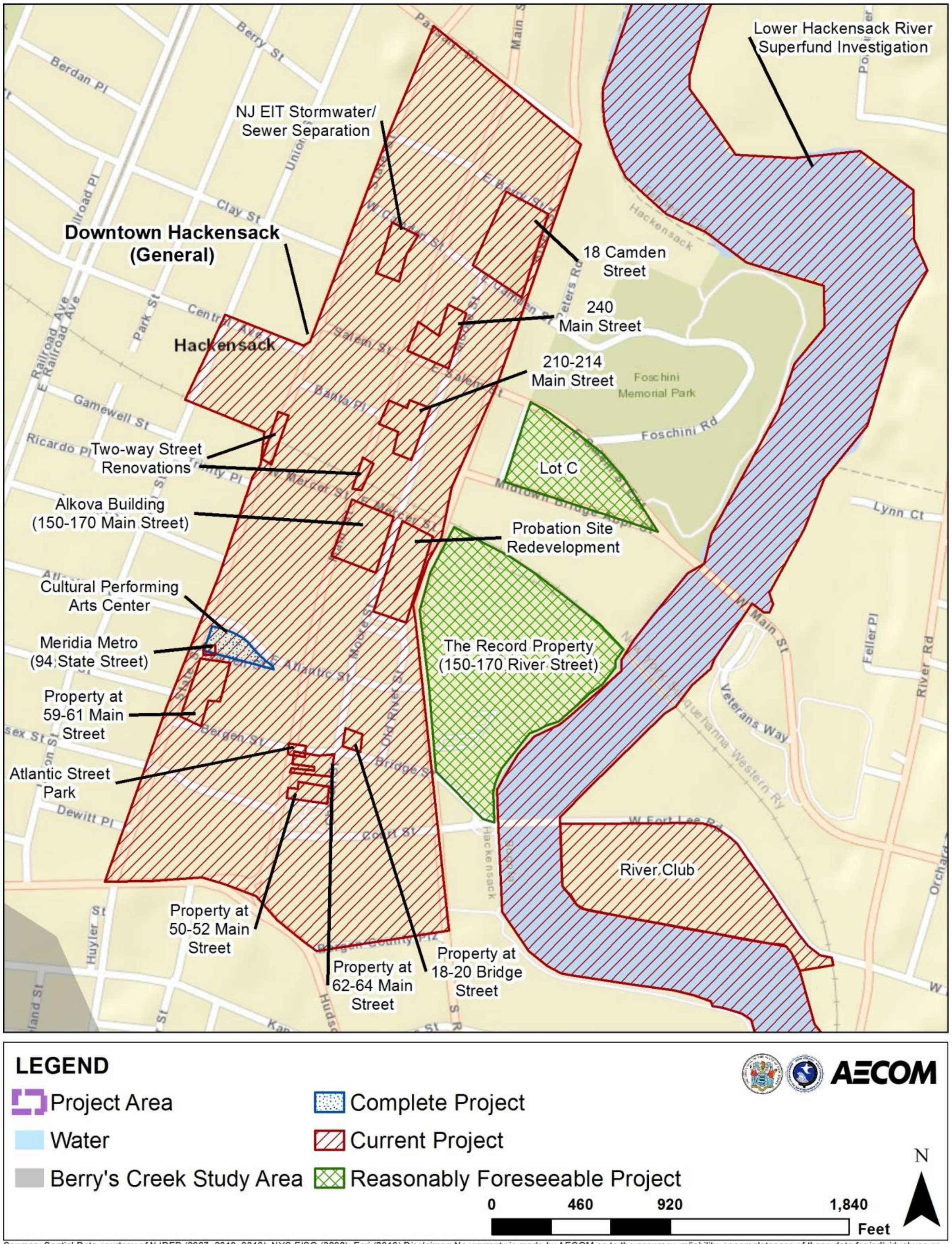
Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 5.4-1: Projects Considered for the Cumulative Effects Analysis



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 5.4-2: Projects Considered for the Cumulative Effects Analysis



Sources: Spatial Data courtesy of NJDEP (2007, 2010, 2016); NYS EISO (2008); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Figure 5.4-3: Projects Considered for the Cumulative Effects Analysis

5.5 Projects Considered for the Cumulative Effects Analysis

The following provides a summary of the past, present, and RFF projects considered for the cumulative effects analysis. Additional detail can be found in **Appendix C**.

- **RBDM Alternative 3 *Future Plan*.** The Alternative 3 *Future Plan*, as shown in **Figure 2.5-33**, **Figure 5.4-1**, and **Figure 5.4-2**, would include all of Alternative 1, as described in **Section 2.5.2**; the Losen Slote pump station C and associated force main, as described in **Section 2.5.3**; and improvements to Upper East Riser Ditch. Please note that the Alternative 3 *Future Plan* would only occur should Alternative 3 be selected by NJDEP and implemented; the Alternative 3 *Future Plan* would ***not*** occur under the No Action Alternative, Alternative 1, or Alternative 2. In addition, development of the Alternative 3 *Future Plan* is contingent upon future funding availability and would not be implemented if funding is not acquired.

  Upper East Riser Ditch Improvements – Under the Alternative 3 *Future Plan*, the upstream portions of East Riser Ditch (i.e., from Moonachie Avenue to Wesley Street) would receive improvements, including dredging of the entire channel (approximately 3 miles) and six culvert replacements. These improvements would occur within the Boroughs of Moonachie, Teterboro, and Little Ferry, and the Township of South Hackensack. Approximately 35 parcels would be impacted, and approximately 17 acres of permanent easements and approximately 9 acres of temporary easements would be required. The construction of the Upper East Riser Ditch improvements would be anticipated to be conducted in one phase. However, if necessary, these improvements could be implemented in two phases with the downstream portion (Moonachie Ave to US Route 46) completed first, and the upstream portion (US Route 46 to Wesley Street) completed at a later date. The Upper East Riser Ditch improvements, if conducted as one phase, would be expected to take approximately 18 months. Construction and operational activities for these improvements would be similar to those required to complete the East Riser Ditch channel improvements under the Alternative 3 *Build Plan* (see **Sections 2.5.3.2** and **2.5.3.3**). Staging would be anticipated to occur primarily within existing industrial parking lots, with permission from the property owners. The proposed O&M access road/easement under the Alternative 3 *Build Plan* would be extended to facilitate O&M along the upstream portions of the East Riser Ditch.

  The Alternative 3 *Future Plan* would complement the *Build Plan* by providing additional stormwater drainage improvements in the East Riser Ditch and Losen Slote drainage basins, in addition to providing structural protection against coastal storm surges. As described in **Section 2.5.2**, the Alternative 1 LOP would provide surge protection to a height of 7 feet (NAVD 88), which would be sufficient to protect against approximately the 50-year flood under existing conditions. By incorporating both coastal and inland flood reduction, in the form of additional stormwater drainage improvements, new open spaces, and a structural LOP against coastal storm surges, implementation of the Alternative 3 *Future Plan* in addition to the *Build Plan* would constitute the most holistic flood reduction strategy for the Project Area and provide numerous co-benefits, including new recreational opportunities, water quality improvements, new and enhanced habitats, and aesthetic benefits.

  At this time, it is not known if the components of the *Future Plan* would be constructed as a single project or as multiple projects because a funding source(s) has not been identified. Therefore, no overall schedule or phasing plan for these components is currently available. However, the construction, operation, and maintenance activities for the proposed *Future Plan* components, as well as transportation and utility implications thereof, would be anticipated to remain similar to those described under Alternatives 1 and 2 (see **Sections 2.5.2** and **2.5.3**).

While the Future Plan would contribute to reduced flood risk, improved public safety, and improved health and overall quality of life, it would not likely induce additional development and associated potential impacts.

- **Recent improvements to ditches, tide gates, and pumping stations.** The Losen Slote Creek is currently being dredged, and the Losen Slote Tide Gate received a new self-cleaning grate to prevent trash build-up. Additionally, four new tide gates have been installed in the Project Area in recent years, including the Moonachie Creek, Bashes Creek, and Palmer Terrace Tide Gates in the Borough of Carlstadt, and the West Riser Tide Gate replacement in the Borough of Moonachie. Also, the Borough of Moonachie recently installed a generator at the Lincoln Place Pumping Station. These projects are located within the Project Area and seek to alleviate flooding.

  Drainage improvements are proposed to an area of Main Street (from Charles Street to Bergen Turnpike) in the Borough of Little Ferry. Improvements include installing larger pipes, upgrading the existing drainage system to follow grade, and rerouting the existing drainage configuration. The Hazard Mitigation Grant Program Backflow Preventer Project is being implemented throughout the Boroughs of Carlstadt, Little Ferry, and Moonachie. Backflow preventers are being installed on existing storm drain outfalls to help reduce flooding caused by storm surges.

- **Environmental improvement projects.** As part of various mitigation efforts, over 1,000 acres of wetlands have been restored in the Project Area in the Boroughs of Carlstadt and Little Ferry and in the Township of South Hackensack. These include the Richard P. Kane Natural Area, Kane Wetland Mitigation Bank, MRI Mitigation Bank, and the ongoing wetland mitigation associated with the proposed new Teterboro Airport Tower project. These wetlands comprise much of the southeast portion of the Project Area.

  Further, the Metro Media tract in the Borough of Carlstadt and Meadowlark Marsh across the Hackensack River in the Borough of Ridgefield are considered by the USACE to be priority sites for future wetland restoration projects. These two sites encompass approximately 164 acres. Wetland mitigation projects serve to reduce both inland and coastal storm surge flooding while providing additional biological diversity and habitat. As such, the net beneficial environmental effects to the Project Area and its vicinity provided by these projects must be considered within this analysis.

  Three USEPA Superfund sites are located near the Project Area: SCP, UOP, and Ventron/Vesicol. The SCP site is currently vacant and contains potential contaminants of concern in soil and groundwater. Final RODs have been issued and remediation is ongoing. The UOP site has potential soil, surface water, and groundwater contamination. No ROD has been finalized and remediation is still ongoing. The Ventron/Vesicol site contains the BCSA, which is currently being investigated; a restoration plan is expected to be completed in the next several years.

  The lower Hackensack River is under study to determine if it qualifies for designation as a Superfund site. If it does receive this designation, targeted clean-up efforts will be designed for the lower Hackensack River, as well. These projects are located within and adjacent to the Project Area, and could contribute to water quality improvement and environmental restoration. Finally, the Borough of Carlstadt is restoring street trees throughout the municipality, which could improve air quality, aesthetics, and habitats.

- **Transportation projects involving drainage improvements.** In the Borough of Little Ferry, drainage improvements have recently been incorporated into Brandt Street, Woodland Avenue, the Little Ferry Circle replacement, and the intersection improvement at Washington Avenue and

Liberty Road. The Borough of Little Ferry is also considering extending Riser Road south to connect with Redneck Avenue near Union Avenue. In the Borough of Carlstadt, drainage projects include improvements to Kero Road, Jomike Court, Barell Avenue, Eastern Way, Starke Road, 16th Street, Marsan Drive, Broad Street, and Paterson Plank Road. In the Borough of Moonachie, drainage improvements will be incorporated into improvements of West Commercial Avenue and potentially other streets. These projects are located within the Project Area and seek to alleviate flooding.

- **Improvements to utility systems.** The BCUA Little Ferry Water Pollution Control Facility is planned to undergo numerous improvements, including black starting and island capabilities, a new 175,000 cubic foot biogas storage tank, rising of substations above Federal flood elevation levels, and appropriate relocations of conduits and transformers. Finally, the Jony Drive pumping station (used for sanitary wastewater) in the Borough of Carlstadt is planned for improvements. These projects represent a hardening of several critical infrastructure systems in the Project Area against future flooding. Further, Williams Partners L.P. plans to construct a loop on an existing natural gas pipeline in the Borough of Carlstadt to increase capacity. Outside the Project Area, the City of Hackensack and Village of Ridgefield Park are upgrading existing sewer infrastructure to reduce or eliminate combined sewer overflows, and NJ Transit plans to construct an electric microgrid in Kearny to enhance electricity supply to NJ Transit and Amtrak facilities. These projects have the potential to support increased energy demand in the region and improve water quality.
- **Redevelopment and rezoning local to Project Area.** The Project Area is the subject of several rezoning and redevelopment plans that may result in additional development over time. Any redevelopment from RFF projects would occur on currently developed areas. Development plans that have been submitted or approved are considered reasonably foreseeable for the purposes of this analysis.

  The Paterson Plank Road redevelopment effort seeks to transform the portion of Paterson Plank Road adjacent to the Meadowlands Racetrack into a mixed-use commercial gateway center, incorporating commercial, retail, and light industry uses. The existing wetlands nearby would be preserved as an environmental area. The Teterboro Landing redevelopment project includes two new large retail sites and numerous smaller stores, restaurants, and light industrial buildings. A new CVS and an LMI housing site are planned in the Borough of Little Ferry; the Borough of Moonachie is reconstructing their municipal building following its destruction from Hurricane Sandy. Similarly, the Washington Elementary School, a Little Ferry public school, is planned for renovation or replacement, as the existing school has been closed due to storm damage and extensive deteriorated conditions. Some of these projects have the potential to increase the use and density of the Project Area.
- **Teterboro Airport improvements**. Proposed improvements include multiple new hangars, an air traffic control tower, rehabilitation of the stormwater drainage system, replacement of the airport rescue and fire-fighting building, installation of a wildlife exclusionary fence, rehabilitation of the lighting circuits, and replacement of the deicing fluid storage tanks at Teterboro Airport. Renovations to runways and taxiways have been proposed and are currently under regulatory agency (i.e., permitting) review. These projects are located within the Project Area, are anticipated to create new impervious surfaces, and are anticipated to fill approximately 11 acres of jurisdictional wetlands within the Project Area.

  In compliance with Section 438 of the EISA, FAA would implement stormwater BMPs to maintain the pre-development hydrology and ensure that changes in runoff temperature, volumes, durations, and rates do not negatively impact receiving waters or off-site areas, resulting in no net change to other portions of the Project Area. In addition, requirements in the NJAC 7:8 regulations state that no increase in downstream runoff may occur; therefore, major developments, such as the Teterboro Airport improvements, are required to incorporate stormwater management measures and strategies.

In accordance with Federal and State regulations, all jurisdictional wetland impacts would require mitigation to ensure “no net loss” of wetland acreage, value, or functions. However, under current proposals, mitigation would occur outside of the Project Area, potentially at some distance. As such, these proposed projects could result in a net loss of wetland acreage and associated biological values within the Project Area and within the ROI.

- **Industrial building construction**. Industrial building construction within the Project Area includes a recently completed building at 125 North Street in the Borough of Teterboro, as well as a proposed building in the Borough of Carlstadt along State Route 17 at 12th Street. These projects are located within the Project Area.
- **Transportation projects without specified drainage improvements.** Improvements are proposed for Summit Circle in the Borough of Little Ferry, Commercial Avenue and various unspecified streets in the Borough of Moonachie, Washington Avenue in the Borough of Carlstadt, and Malcolm Avenue and Industrial Avenue in the Borough of Teterboro. Renovations to the intersection of Moonachie Road/Washington Avenue and Moonachie Avenue/Empire Boulevard are planned to improve traffic volume capacity. Other planned road improvements near the Project Area include portions of the New Jersey Turnpike and Wesley Street in the Township of South Hackensack, and I-80 in the City of Hackensack. Additionally, the MASSTR project is underway, which includes improvements to 31 traffic signals and pedestrian crossings in the Project Area to enhance traffic flow. These projects are located within the Project Area.
- **Regional transit/transit villages.** A transit village is being constructed in the Borough of Wood-Ridge, which will include a new train station, 1,200 new residential units, 125,000 SF of retail space, a park, and a school. Additionally, the Xchange is being built in the Town of Secaucus, which will include nearly 1,400 residential units and upgraded public transportation (bus) infrastructure. Finally, the Gateway project is underway, which will eventually lead to a significant increase in transit capacity between northern New Jersey and Manhattan. This latter project has an expected completion date around 2030. These projects, although located outside the Project Area, have the potential to increase use and density near the Project Area.
- **Regional flood control efforts.** Numerous efforts have been made in nearby municipalities to reduce flooding and future efforts are planned, such as another RBD flood protection project being designed for the City of Hoboken. These projects seek to address similar issues as the Proposed Project, and thus could produce cumulative effects in conjunction with the Proposed Project. While regional flood control projects would contribute to reduced flood risk and improved public health and safety, they would not likely induce additional development and associated impacts. However, construction and operation of the regional flood control projects, in combination with the Proposed Project, could result in cumulative effects, both beneficial and adverse, as discussed in greater detail below.
- **Improvements to recreational facilities.** Several recreational facilities are undergoing and/or planning for renovations, which generally consist of improvements to playing fields and support structures (fences, dugouts, security cameras, etc.). These include Lakeview Field in the Borough of Little Ferry and Little League Park in the Borough of Carlstadt. Additionally, River Barge Park

was recently opened in the Borough of Carlstadt, Mehrhof Pond Wildlife Observation Area was opened in the Borough of Little Ferry, and Memorial Park North in the Borough of Moonachie is in design with the new municipal building. Outside the Project Area, a marina is being dredged in the Town of Secaucus to improve use, and the Gunnell Oval Recreational Complex in the Town of Kearny is being renovated.

There are several regional projects proposed that would alter the region of the Proposed Project. However, these projects are located outside of the Project Area and, due to their nature, effect-producing potential, and location, would have a lower potential for producing cumulative effects in conjunction with the Proposed Project. These proposed regional projects are summarized below.

- **Regional transportation-related capital improvements.** The Township of Lyndhurst and the Boroughs of Rutherford and East Rutherford have identified several streets to be improved in the coming years. Additionally, construction efforts on the Pulaski Skyway and the State Route 7 Wittpenn Bridge replacement are expected to be completed within the next five years. Finally, rehabilitation of the Lincoln Tunnel helix is currently underway as planning continues for its eventual complete replacement.
- **Regional large-scale development.** Large-scale redevelopment efforts currently planned or underway include the following: American Dream Meadowlands in the Borough of East Rutherford, Highland Cross Redevelopment in the Borough of Rutherford; Kingsland Redevelopment and Lincoln School area redevelopment in the Township of Lyndhurst; Koppers Coke Peninsula Redevelopment, Kearny Passaic Avenue Redevelopment, and Keegan Landfill Redevelopment in the Town of Kearny; Harrison Redevelopment in the Town of Harrison; Belleville Turnpike Redevelopment in the Borough of North Arlington; Hartz Carpet Center Redevelopment in the Town of Secaucus; and SkyMark in the Village of Ridgefield Park. These developments will focus on new residential, commercial, light industrial, and recreational uses within areas that are already highly developed. Redevelopment of these areas would not be expected to have a notable effect.
- **Housing and small redevelopment projects outside the Project Area.** There are four redevelopment projects planned in the Borough of East Rutherford: Hackensack Street/Park Avenue, Central Avenue, Carlton Hill, and State Route 3. These mixed-use projects focus on ratables. Additionally, several independent residential projects are underway in the Boroughs of East Rutherford, Carlstadt, and Hasbrouck Heights. These projects are located within areas that are already highly developed.
- **Redevelopment and housing in/near the City of Hackensack.** Downtown City of Hackensack, particularly around Main Street, has been designated as a large redevelopment zone with many properties involved (see **Figure 5.4-3**). Overall, preference is given to those projects that create large (i.e., 400,000 SF and over) mixed-use residential buildings. The City's vision is to create a thriving, transit-oriented downtown area. In addition, a new large housing complex (River Club) is being constructed directly across the Court Street bridge from the City of Hackensack's downtown area. These efforts may substantially change the use and density of the City of Hackensack.

5.6 Cumulative Effects Assessment

The cumulative effects analysis overlays the Proposed Project in time and space (i.e., within the resource-specific ROIs through 2030, which is the timeline for which proposed, RFF actions are known) with past, present, and RFF projects.

Past and present projects have been assessed in the establishment of the environmental baseline (i.e., Affected Environment) presented in **Section 3.0** of this EIS, and are already considered as part of the baseline impact analysis of the Build Alternatives (see **Section 4.0**); therefore past and present projects have been considered and the projects discussed in this analysis focus only on those that are reasonably foreseeable in the future.

RFF projects[76] were geographically identified and then evaluated for overlap with each technical resource area's ROI. If a RFF project's effects would overlap with the ROI of a considered alternative within the same timeframe, then it is further evaluated for cumulative impacts. If a RFF project's effects have no spatial or temporal overlap with the ROI of a considered alternative, there would be no cumulative impact for that resource area because the effects would not occur within the same context (40 CFR § 1508.27(a)). These RFF projects were then dismissed from further evaluation.

The analysis is presented by technical resource area for clarity, thereby focusing on areas for which the combination of effects from the Proposed Project, and from one or more RFF projects, could potentially result in greater effects than in the case of each project separately. Each discussion defines the ROI specific to that technical resource area, examines the contributions of RFF projects on the technical resource area, and analyzes the significance of the potential effects of the Proposed Project in combination with RFF projects within that resource-specific ROI.

The thresholds for significance of cumulative effects are the same as for the direct and indirect effects analysis as described throughout **Section 4.0**. Please refer to that section for a discussion of the significance criteria developed and applied for this EIS's analysis. For the purposes of this analysis, cumulative effects are considered to be potentially significant if they meet either of the following criteria:

- Effects of RFF projects without the Proposed Project are not potentially significant, but the Proposed Project's additional impact is substantial enough, when added to the cumulative effects, to result in a potentially significant cumulative impact.
- Effects of RFF projects without the Proposed Project are already potentially significant and the Proposed Project contributes measurably to the cumulative effect. The term "measurably" is generally defined as being noticeable to a reasonable person.

Cumulative effects associated with the *Future Plan* component of Alternative 3 were analyzed only in combination with Alternative 3 and not in combination with the No Action Alternative and Alternatives 1 and 2. The *Future Plan*, as described in **Section 2.5.4**, is not a reasonably foreseeable project unless Alternative 3 is implemented.

[76] For consistency with **Appendix C** and **Section 5.5**, RFF projects are identified by their greater groupings in the cumulative analysis, unless otherwise stated.

5.7 Summary of Cumulative Impacts

Cumulative impacts were determined based on the Proposed Project's impacts on technical resource areas when combined with impacts from RFF projects. A summary of direct and indirect impacts from the No Action Alternative and Alternatives 1, 2, and 3 under the Proposed Project (as discussed in detail in **Section 4.0**) is presented in **Table 2.6-1**. A summary of the anticipated cumulative effects, when considering the contribution and interaction of RFF projects and Build Alternatives on each technical resource area, is presented below.

While the Proposed Project and RFF projects would cumulatively contribute to reduced flood risk from certain events and improved quality of life within the ROI, overall and perceptible increases in property values in the ROI would not be expected, as flood events would not be eliminated entirely under the Proposed Project; for example, widespread protection against a 100-year flood event or reduction in FEMA flood insurance rates would not be expected. However, the Proposed Project and RFF projects may help to stabilize existing housing prices by decreasing the risk of fluctuations in housing and property values resulting from some future flood events. In addition, because the Proposed Project and RFF projects would be implemented on existing developed land and projects are generally in the form of enhancement or redevelopment projects, these projects would not be expected to cumulatively induce population growth or substantial land use change within the ROI. For example, the ROI is highly developed and the majority of undeveloped land is currently protected under a conservation easement or restriction that must be permanently preserved in its natural state. Thus, RFF projects do not generally include new development projects on vacant land, but rather improvements to existing infrastructure (e.g., stormwater, transportation, and utilities) and redevelopment projects. As such, neither cumulative population growth nor increases in property values would be anticipated.

5.7.1 Cumulative Impacts under the No Action Alternative

The No Action Alternative would allow increased and continued flooding to inundate resources within the ROI. Long-term or permanent inundation of resources would limit the accessibility, use, and/or productivity of each resource. Under the No Action Alternative, RFF projects would produce additional effects on certain technical resource areas; however, these effects would likely be overwhelmed by the largely unabated future flooding conditions in the Project Area.

Although some level of adverse impact would be alleviated by the long-term beneficial impacts of RFF projects involving drainage improvements and flood protection, such as *Recent Improvements to Ditches, Tide Gates, and Pumping Stations*; *Transportation Projects involving Drainage Improvements*; and, *Regional Flood Control Efforts*, these RFF projects would not provide the same level of flood protection as the Proposed Project and would not be substantial enough to entirely offset the effects of increased coastal flooding and heavy precipitation.

Concurrent with continued global climate change and SLR, the No Action Alternative would result in more frequent flooding in the ROI, leading to cumulative flood damages to developments in the ROI over time. Therefore, under the No Action Alternative, cumulative impacts to all technical resource areas would be the same as or similar to anticipated baseline impacts of the No Action Alternative alone (**Section 4.0**), which has been generally determined to be ***potentially significant and adverse***. As this analysis is already provided in **Section 4.0**, this cumulative analysis does not include a separate discussion of cumulative effects under the No Action Alternative.

5.7.2 Cumulative Impacts under Alternative 1

Alternative 1 includes various infrastructure-based solutions intended to provide structural protection against coastal storm surges.

In general, RFF projects could contribute impacts to the same resource areas impacted by Alternative 1, although there would likely be fewer adverse impacts as the majority of RFF projects are redevelopments or improvements planned on previously disturbed sites and existing developed land. RFF projects are also more contained and only focus on one or two types of development (e.g., commercial, residential, industrial, infrastructure, transportation, environmental, etc.). Comparatively, Alternative 1 proposes multi-faceted development requiring different types of improvements and infrastructure changes, requiring more varied construction activities.

An exception is the *Teterboro Airport Improvements* RFF project group -- the reasonably foreseeable First Aviation Services Hangar project and Teterboro Airport Hangar project would fill 11 acres of wetlands that would adversely impact water resources within the Project Area. Mitigation would occur outside of the Project Area, potentially at some distance, resulting in a net loss of wetland acreage and associated biological values within the Project Area and within the ROI.

Overall, adverse cumulative impacts to resources under Alternative 1 would mostly be less-than-significant, resulting from short-term construction activities. As Alternative 1 is not spatially or temporally co-located with any of the RFF projects during construction, construction impacts would occur to the general ROI, as opposed to site-specific cumulative construction conflicts or impacts. As such, there would be potentially significant adverse cumulative impacts to Transportation and Circulation; Noise and Vibration; Biological Resources; and Water Resources, Water Quality, and WOUS during construction of Alternative 1. Potential mitigation measures to reduce potentially significant adverse cumulative impacts are discussed in **Section 5.9**. Due to the nature of Alternative 1, no adverse cumulative effects would occur during operation.

In conjunction with RFF projects that include flood protection efforts (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations and Regional Flood Control Efforts*), operation of Alternative 1 would provide cumulative benefits by reducing coastal flooding damages in the ROI and minimizing the effects of coastal storm surges.

5.7.3 Cumulative Impacts under Alternative 2

Alternative 2 includes various grey and green infrastructure-based solutions, as well as new parks and improved open spaces, intended to improve stormwater management in key locations throughout the Project Area.

In general, RFF projects could contribute impacts to the same resources impacted by Alternative 2. RFF projects would generally result in fewer adverse impacts to these resources, as the majority of RFF projects are redevelopments or improvements planned on previously disturbed sites and existing developed land; however, as noted in the Alternative 1 discussion, the *Teterboro Airport Improvements* project group could result in a net loss of wetland acreage and associated biological values within the Project Area and within the ROI.

Overall, adverse cumulative impacts to resources under Alternative 2 would mostly be less-than-significant, resulting from short-term construction activities. As Alternative 2 is not spatially or temporally co-located with any of the RFF projects during construction, construction impacts would occur to the general ROI, as opposed to site-specific cumulative construction conflicts or impacts. As such, there would be potentially significant adverse cumulative impacts to Transportation and Circulation; Noise and Vibration; and Water Resources, Water Quality, and WOUS during construction of Alternative 2. Potential mitigation measures to reduce these potentially significant adverse cumulative impacts are discussed in **Section 5.9**. Due to the nature of Alternative 2, no adverse cumulative effects would occur during operation.

Operation of Alternative 2 would contribute cumulative benefits from stormwater drainage improvements, rather than from coastal flood protection efforts under Alternative 1. *Transportation Projects involving Drainage Improvements* would provide additional benefits to almost all technical resource areas by reducing inland flooding damages and minimizing the effects of heavy precipitation events, concurrent with grey infrastructure proposed under Alternative 2. *Improvements to Recreational Facilities* and *Redevelopment* and *Rezoning Projects Local to the Project Area* would contribute to the green infrastructure-based solutions (e.g., bioswales, storage/tree trenches, and rain gardens), new parks, and improved open spaces under Alternative 2.

5.7.4 Cumulative Impacts under Alternative 3 (*Build Plan*)

Similar to Alternative 2, the Alternative 3 *Build Plan* includes various grey and green infrastructure-based solutions, as well as new parks and improved open spaces, intended to improve stormwater management in key locations throughout the Project Area.

Overall, RFF projects could contribute impacts to the same resources impacted by Alternative 3. As noted in the Alternative 2 discussion, the *Teterboro Airport Improvements* project group could result in a net loss of wetland acreage and associated biological values within the Project Area and within the ROI, while beneficial effects to resources could be realized through stormwater management measures associated with the *Transportation Projects involving Drainage Improvements; Improvements to Recreational Facilities;* and *Redevelopment* and *Rezoning Projects Local to the Project Area* RFF project groups.

Implementation of Alternative 3 would notably allow for development of the Alternative 3 *Future Plan,* which would provide coastal flood protection in addition to stormwater drainage improvements. The Alternative 3 *Future Plan* would reduce impacts to resources that would occur during coastal flooding events through structural flood protection, similar to the direct and indirect effects associated with Alternative 1. Although the Alternative 3 *Future Plan* is contingent upon future funding availability, the cumulative effects analysis under Alternative 3 considers the *Future Plan* as an RFF project. If funding is not acquired for the *Future Plan*, then the *Future Plan* would not be implemented in conjunction with Alternative 3; thus cumulative impacts under Alternative 3 without the *Future Plan* would be the same as those identified under Alternative 2 (i.e., potentially significant adverse cumulative impacts to Transportation and Circulation; Noise and Vibration; and Water Resources, Water Quality, and WOUS during construction).

As the Alternative 3 *Future Plan* would provide structural flood protection similar to Alternative 1, development of the *Future Plan* and RFF projects in conjunction with Alternative 3 could result in potentially significant adverse cumulative impacts to Transportation and Circulation; Noise and Vibration; Biological Resources; and Water Resources, Water Quality, and WOUS during construction. Potential mitigation measures to reduce these potentially significant adverse cumulative impacts are discussed below. Overall, adverse cumulative impacts to resources under Alternative 3 would mostly be less-than-significant, resulting from short-term construction activities. In addition, Alternative 3 and RFF projects (including the *Future Plan*) would collectively provide the most substantial strategy for mitigating inland and coastal flooding damages to technical resource areas and contribute ***long-term, beneficial*** cumulative impacts in the ROI as compared to the No Action Alternative, Alternative 1, and Alternative 2.

Although short-term adverse impacts from construction activities would still occur in the ROI, all technical resource areas (except for Noise and Vibration and Air Quality and Greenhouse Gas Emissions) would experience long-term, beneficial cumulative impacts under Alternative 3 from both inland flood protection and coastal flood protection. As a result, this cumulative analysis does not include detailed discussions of the potential cumulative effects to each resource under Alternative 3.

5.7.5 Comparison of Cumulative Impacts associated with the Build Alternatives

Construction of any of the Build Alternatives and the RRF projects would be likely to result in no cumulative impact or less-than-significant cumulative impacts to the following resources:

- Land Use and Land Use Planning
- Visual Quality / Aesthetics
- Socioeconomics, Community / Populations, and Housing
- Environmental Justice
- Cultural and Historic Resources
- Air Quality and GHG Emissions
- Global Climate Change and Sea Level Change
- Recreation
- Utilities and Service Systems
- Public Services
- Geology and Soils
- Hydrology and Flooding
- Coastal Zone Management
- Sustainability / Green Infrastructure
- Hazards and Hazardous Materials
- Mineral and Energy Resources
- Agricultural Resources and Prime Farmlands

Regardless of Build Alternative chosen, cumulative construction impacts to Transportation and Circulation, Noise and Vibration, and Water Resources, Water Quality, and Waters of the US would be potentially significant and adverse. In addition, cumulative construction impacts to biological resources under Alternatives 1 and 3 are anticipated to be potentially significant and adverse.

Post-construction, operation of any of the Build Alternatives is not anticipated to contribute to adverse cumulative impacts to resources within the ROI. All three Build Alternatives would contribute beneficial cumulative impacts to most of the resources within the ROI through increased flood protection; however, Alternative 3 would contribute greater potential long-term cumulative beneficial effects to the resources through the inclusion of inland *and* coastal flooding protection measures. An overview of cumulative impacts from the Build Alternatives is summarized in **Table 5.7-1**.

Table 5.7-1: Summary of Cumulative Impacts from Construction and Operation of the Proposed Project

Technical Resource Area	Alternative 1	Alternative 2	Alternative 3*
Land Use and Land Use Planning	C: No impact	C: No impact	C: No impact
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Visual Quality / Aesthetics	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Socioeconomics, Community / Populations, and Housing	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Environmental Justice	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Cultural and Historic Resources	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Transportation and Circulation	C: Potentially significant, adverse	C: Potentially significant, adverse	C: Potentially significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Noise and Vibration	C: Potentially significant, adverse	C: Potentially significant, adverse	C: Potentially significant, adverse
	O: No impact	O: No impact	O: No impact
Air Quality and Greenhouse Gas Emissions	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: No impact	O: No impact	O: No impact
Global Climate Change and Sea Level Change	C: No impact	C: No impact	C: No impact
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial

Technical Resource Area	Alternative 1	Alternative 2	Alternative 3*
Recreation	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Utilities and Service Systems	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Public Services	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Biological Resources	C: Potentially significant, adverse	C: Less-than-significant, adverse	C: Potentially significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Geology and Soils	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Water Resources, Water Quality, and Waters of the US	C: Potentially significant, adverse	C: Potentially significant, adverse	C: Potentially significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Hydrology and Flooding	C: No impact	C: No impact	C: No impact
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Coastal Zone Management	C: No impact	C: No impact	C: No impact
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Sustainability / Green Infrastructure	C: No impact	C: No impact	C: No impact
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial

Technical Resource Area	Alternative 1	Alternative 2	Alternative 3*
Hazards and Hazardous Materials	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Mineral and Energy Resources	C: Less-than-significant, adverse	C: Less-than-significant, adverse	C: Less-than-significant, adverse
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial
Agricultural Resources and Prime Farmlands	C: No impact	C: No impact	C: No impact
	O: Long-term, beneficial	O: Long-term, beneficial	O: Substantial long-term, beneficial

Key:
C= Construction
O=Operation
*Note: The cumulative impact analysis of Alternative 3 includes the *Future Plan* as a RFF project. Cumulative impacts under Alternative 3 without the *Future Plan* would be the same as those under Alternative 2.

5.8 Analysis of Cumulative Impacts

This cumulative analysis focuses primarily on potentially significant, adverse cumulative impacts, as well as potential beneficial impacts. Less-than-significant, adverse cumulative impacts are not discussed in depth; mitigation measures and BMPs proposed in **Section 4.0** would generally be implemented to maintain the Proposed Project's contribution to these cumulative impacts at negligible levels. In addition, less-than-significant, adverse cumulative impacts are generally associated with cumulative construction activities (see **Table 5.7-1**), which would be short-term and only last for the duration of the construction phase.

Due to the nature of the Proposed Project, which is to reduce flood risk and increase the resiliency of the communities and ecosystems within the Project Area, benefits resulting from inland and coastal flood reduction would occur across almost all technical resource areas. RFF projects improving flood control (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations;* and *Regional Flood Control Efforts*) and stormwater drainage (i.e., *Transportation Projects Involving Drainage Improvements*) would contribute beneficial impacts to resource areas in the ROI by implementing green and grey infrastructure and structural improvements to mitigate and reduce inland and coastal flooding damages in the long term. Thus, the Proposed Project would result in similar beneficial cumulative impacts from inland and coastal flood protection to almost all technical resource areas[77]. As a result, cumulative benefits resulting from inland and coastal flood protection are not discussed in the cumulative analysis.

The analysis of cumulative impacts for each technical resource area under each alternative is presented in the following subsections.

[77] With the exception of Noise and Vibration and Air Quality and Greenhouse Gas Emissions, all technical resource areas would experience similar cumulative beneficial impacts from flood protection efforts proposed under Alternatives 1, 2 ,and 3.

5.8.1 Land Use and Land Use Planning

As described in **Table 5.3-1**, the ROI for cumulative effects on land use and land use planning is the five municipalities that comprise the Project Area, as well as the Borough of East Rutherford and City of Hackensack. The ROI contains multiple land uses and zoning districts, as described in **Section 3.2**.

5.8.1.1 Contribution of RFF Projects

RFF projects would adversely impact land use and land use planning through permanent and temporary easements in the ROI. Specifically, the Alternative 3 *Future Plan*, an RFF project, includes improvements to Upper East Riser Ditch, which would involve dredging of the entire channel and six culvert replacements. Approximately 17 acres of permanent easements and nine acres of temporary easements would be required, altering land use in the short- and long-term. The balance of RFF projects considered would generally be consistent with the developed nature of the ROI and current land use and land use planning, or would result in beneficial effects as discussed below.

RFF projects would improve land utility through new zoning efforts, flood control, and drainage improvements. The proposal of new zoning ordinances by *Redevelopment and Rezoning Local to Project Area* projects to create and merge districts through rezoning efforts would make the area more aesthetically appealing and neighborhood-friendly; therefore, improving land utility. In addition, RFF projects involving flood control efforts and drainage improvements (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations* group and the *Transportation Projects Involving Drainage Improvements*) would provide increased flood protection in the long-term and benefit existing land uses by decreasing flooding and enhancing inland and coastal sustainability.

5.8.1.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on land use and land use planning are discussed in detail in **Section 4.2.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to land use and land use planning in the ROI when added to the contribution of RFF projects, as land in the ROI is already highly developed. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.1.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on land use and land use planning are discussed in detail in **Section 4.2.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to land use and land use planning in the ROI when added to the contribution of RFF projects, as land in the ROI is already highly developed. In addition, Alternative 2 would not contribute any additional cumulative beneficial impacts to land use within the ROI, aside from inland flood protection benefits. Implementation of Alternative 2 would not conflict with land uses proposed or associated with any RFF projects.

5.8.1.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on land use and land use planning are discussed in detail in **Section 4.2.4.4**. As described in **Section 5.7**, cumulative impacts to land use and land use planning under Alternative 3 would be the same as those anticipated under Alternative 1 (see **Section 5.8.1.2**) and Alternative 2 (see **Section 5.8.1.3**). Implementation of Alternative 3 would allow for the future development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to land use and land use planning and contribute ***long-term, beneficial*** cumulative impacts. Implementation of Alternative 3 would not conflict with land uses proposed or associated with any RFF projects.

5.8.2 Visual Quality/Aesthetics

As described in **Table 5.3-1**, the ROI for cumulative impacts on visual quality and aesthetics is the Proposed Project viewshed, which represents the area visible from the Project Area. Visual character and quality of the viewshed is discussed in **Section 3.3**.

5.8.2.1 Contribution of RFF Projects

The primary collective adverse impacts of RFF projects during construction on visual quality and aesthetics are interruptions to the visual landscape in the ROI. RFF projects planned for future construction would introduce construction equipment and partially constructed or demolished structures on a periodic, short-term basis. Additionally, vessel barges used for dredging activities required of RFF projects within the *Recent Improvements to Ditches, Tide Gates, and Pumping Stations* and *Improvements to Recreational Facilities* groups would affect aesthetic quality of waterfront properties in a similar manner. However, construction would be short-term and consistent with construction activities typical of an urban and suburban environment.

Collective long-term benefits of RFF projects include visual improvements to the ROI through redevelopment and facility updates. RFF projects would enhance the appearance and visual quality of neighborhoods within the ROI, whether directly through beautification efforts, or indirectly by encouraging future aesthetic developments. For example, the Carlstadt Tree-lined Streets 5-year Program project within the *Environmental Improvement Projects* RFF project group would contribute beneficial impacts through the creation of canopy-lined streets. Restored and remediated industrial sites and Superfund sites would contribute some visual benefits as well by turning waste sites into visually cohesive lots compatible with surrounding areas. In addition, *Redevelopment and Rezoning Local to Project Area* RFF projects would allow for more updated permitted uses and aesthetic improvements, such as the installation of outdoor lighting.

5.8.2.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on visual quality and aesthetics are discussed in detail in **Section 4.3.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to visual quality and aesthetics in the ROI when added to the contribution of RFF projects. Alternative 1 would not conflict with the aesthetic quality of any RFF project.

In addition to cumulative benefits from flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts to visual quality and aesthetics within the ROI by beautifying surrounding areas and providing new access to visual resources. Collectively, Alternative 1 and RFF projects within the *Environmental Improvement Projects* group and the *Redevelopment and Rezoning Projects Local to the Project Area* group would enhance the appearance and visual quality of the waterfront and restore ecological habitats, improving overall visual resources in the ROI. In addition, Alternative 1 and RFF projects would cumulatively promote or contribute future changes that would beautify and/or improve access to and visibility of visual resources within the ROI. For example, Kearny Area Redevelopment and Belleville Turnpike Redevelopment projects (within the *Regional Large-scale Development* group) propose to remediate and repurpose landfills; while Alternative 1 proposes waterfront improvements. Collectively, these actions could lead to increased incentive to further improve and enhance the visual character and quality of the ROI over the long term.

5.8.2.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on visual quality and aesthetics are discussed in detail in **Section 4.3.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to visual quality and aesthetics in the ROI when added to the contribution of RFF projects. In addition, Alternative 2 would not conflict with the aesthetic quality of any RFF project.

Cumulative benefits on visual quality and aesthetics from operation of Alternative 2 would be similar to those discussed under Alternative 1 and related to creation of parks and open space, as well as the improvement of access to public spaces (see **Section 5.8.2.2**).

5.8.2.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on visual quality and aesthetics are discussed in detail in **Section 4.3.4.4**. As described in **Section 5.7**, cumulative impacts to visual quality under Alternative 3 would be the same as those anticipated under Alternative 1 (**Section 5.8.2.2**) and Alternative 2 (**Section 5.8.2.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to visual quality and aesthetics and contribute ***long-term, beneficial*** cumulative impacts.

5.8.3 Socioeconomics, Community/Populations, and Housing

As described in **Table 5.3-1**, the ROI for cumulative effects on socioeconomics, community/populations, and housing is the five municipalities that comprise the Project Area. The ROI contains diverse socioeconomic environments, as discussed in **Section 3.4**.

5.8.3.1 Contribution of RFF Projects

Collective potential adverse impacts of RFF projects include local impacts on businesses and residents from construction activities; these effects would be periodic and short term. RFF projects planned for future construction would temporarily increase dust, noise, vibration, and traffic congestion on surrounding businesses and communities within the ROI. These short-term cumulative effects would be reduced through coordinating construction activities, implementing routine construction BMPs, and complying with local requirements and ordinances. Based on an analysis of current planning, concurrent construction activities by multiple projects in the same construction area would be unlikely.

RFF projects would collectively benefit the economy, employment, and taxes and revenue due to project-related spending, job generation during construction and operation, and workforces generating sales and using taxes at local and state levels. In addition, RFF projects within the *Improvements to Recreational Facilities* group would increase and improve social amenities through the creation of green space and access to waterfront areas. Rezoning projects within the *Redevelopment and Rezoning Projects Local to the Project Area* group would provide the future opportunity to create appealing mixed-use spaces and user-friendly green spaces, while redevelopment projects, such as the Washington Elementary School, would lead to general area improvements. In addition, RFF projects involving drainage improvements (i.e., *Transportation Projects Involving Drainage Improvements*) and flood protection (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations*) would provide benefits by increasing flood protection in the long-term and helping to stabilize property values that would otherwise be affected by increased flooding events.

5.8.3.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on socioeconomic resources are discussed in detail in **Section 4.4.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to socioeconomic resources in the ROI when added to the contribution of RFF projects. Based on the proposed timing of future construction projects and an abundant available workforce, adverse cumulative effects to socioeconomics are not anticipated.

Construction of Alternative 1 would contribute ***short-term, beneficial*** cumulative impacts on temporary employment, and the economy. Construction associated with large-scale development projects frequently create large construction workforces and employment opportunities, as well as increase spending in local communities. For example, the American Dream Meadowlands project within the *Regional Large-scale Development* group is located in the Borough of East Rutherford where the surge barrier is proposed; that project is anticipated to create 16,000 construction jobs over a two-year period. Cumulatively, construction of Alternative 1 and RFF project groups could create socioeconomic benefits through short-term employment in the local community.

5.8.3.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on socioeconomic resources are discussed in detail in **Section 4.4.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to socioeconomic resources in the ROI when added to the contribution of RFF projects. Construction and operation of Alternative 2 would contribute the same cumulative benefits on socioeconomic resources as Alternative 1 (see **Section 5.8.3.2**).

5.8.3.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on socioeconomic resources are discussed in detail in **Section 4.4.4.4**. As described in **Section 5.7**, cumulative impacts to socioeconomic resources under Alternative 3 would be the same as those anticipated under Alternative 1 (see **Section 5.8.3.2**) and Alternative 2 (see **Section 5.8.3.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages and contribute ***long-term, beneficial*** cumulative socioeconomic impacts.

5.8.4 Environmental Justice

As described in **Table 5.3-1**, the ROI for cumulative impacts on EJ is the five municipalities that comprise the Project Area. The entire Project Area is considered an EJ community of concern given that the percentage of LMI persons in the Project Area is 39.9 percent and exceeds the Bergen County LMI exception threshold of 39.6 percent. Detailed discussion of minority and low-income populations within the Project Area can be found in **Section 3.5**.

5.8.4.1 Contribution of RFF Projects

The major collective adverse impacts of RFF projects on EJ populations within the ROI are elevated levels of noise, dust, and vibration from construction of RFF projects. Projects requiring construction efforts, especially large-scale development projects such as *Teterboro Airport Improvements*, would potentially cause excess noise and dust during construction, as well as traffic congestion and potential effects to public transportation services resulting from construction work that may disproportionately affect EJ populations. However, potential EJ impacts would be periodic and short-term, lasting only for the duration of construction. Based on currently available data, no RFF projects would displace or result in long-term adverse impacts to EJ populations within the ROI.

RFF projects would cumulatively benefit EJ communities in the ROI, primarily through an increase in employment opportunities. Construction of RFF projects would seek to use the local workforce which may benefit surrounding EJ communities. Construction associated with large-scale projects frequently create large construction workforces and employment opportunities, while construction of commercial, residential, and non-major transportation activities typically generates relatively smaller-scale workforces. In addition, RFF projects providing flood protection (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations*; and *Regional Flood Control Efforts*) and heavy precipitation protection (i.e., *Transportation Projects Involving Drainage Improvements*) would help to stabilize EJ community satisfaction and fluctuations in housing and property values.

5.8.4.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on EJ populations are discussed in detail in **Section 4.5.2.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to EJ communities in the ROI when added to the contribution of RFF projects.

Alternative 1 would contribute to ***short-term, beneficial*** cumulative construction-related economic impacts on EJ by providing employment opportunities in combination with RFF projects. As required under Section 3 of the Housing and Urban Development Act of 1968 (Public Law [PL] 90-448), recipients of HUD funding would direct new employment and contracting opportunities to low-income residents within the local community, thereby benefitting EJ communities. EJ communities would also experience the socioeconomic and community-related beneficial cumulative effects as outlined in **Section 5.8.4.1**. In addition, operation of Alternative 1 and RFF projects would cumulatively contribute long-term improvement of quality of life by reducing vulnerability of EJ populations to flooding effects.

5.8.4.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on EJ populations are discussed in detail in **Section 4.5.2.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to EJ communities in the ROI when added to the contribution of RFF projects. Cumulative benefits under Alternative 2 would the same as those discussed under Alternative 1 (see **Section 5.8.4.2**).

5.8.4.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on EJ populations are discussed in detail in **Section 4.5.2.4**. As described in **Section 5.7**, cumulative impacts to EJ under Alternative 3 would be the same Alternative 1 (see **Section 5.8.4.2**) and Alternative 2 (see **Section 5.8.4.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to EJ and contribute ***long-term, beneficial*** cumulative impacts to EJ concerns.

5.8.5 Cultural and Historical Resources

As described in **Table 5.3-1**, the ROI for cumulative effects on cultural and historical resources is the Project Area and the surrounding vicinity (one-mile radius). The ROI contains cultural resources and historic properties, as discussed in **Section 3.6**.

5.8.5.1 Contribution of RFF Projects

The cumulative adverse impacts from RFF projects on cultural and historical resources would result primarily from construction activities; as such, these effects would be periodic and short term. RFF projects planned for future construction would potentially present visual impacts to historic resources. Specifically, *Improvements to Recreational Facilities* (i.e., Dredging Marina in Secaucus project) and the Alternative 3 *Future Plan* require the use of vessel barges that may impact the visual quality of nearby waterfront historic resources. Construction activities would also produce dust, noise, and vibrations, which may impact the physical and acoustic environment of historic properties during the construction periods. Per Section 106 requirements, consultation on any federal action is required to determine: (1) historic resources in the APE prior to approval and (2) a resolution or avoidance of any potential adverse impacts. Therefore, activities that are required to comply with Section 106 would include a construction monitoring plan and other mitigation measures designed to avoid or minimize impacts on archaeological and historic resources. In addition, if impacts are unavoidable, recovery of the resources would occur prior to construction. Based on the nature and scope of RFF projects, long-term cumulative adverse impacts to cultural resources would not be anticipated.

The major beneficial impact of collective RFF projects is the protection of cultural and historical resources from future flood events. RFF projects involving flood control improvements (i.e., *Transportation Projects Involving Drainage Improvements; Recent Improvements to Ditches, Tide Gates, and Pumping Stations;* and *Regional Flood Control Efforts*) would construct floodwalls, dikes, and tide gates to protect architectural resources and historic buildings from flood events, in addition to implementing drainage improvements.

5.8.5.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on cultural and historical resources are discussed in detail in **Section 4.6.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to cultural and historical resources in the ROI when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.5.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on cultural and historical resources are discussed in detail in **Section 4.6.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to cultural and historical resources in the ROI when added to the contribution of RFF projects. In addition, Alternative 2 would not contribute any additional cumulative beneficial impacts aside from inland flood protection benefits.

5.8.5.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on cultural and historical resources are discussed in detail in **Section 4.6.4.4**. As described in **Section 5.7**, cumulative impacts to cultural and historical resources under Alternative 3 would be the same as Alternative 1 (see **Section 5.8.5.2**) and Alternative 2 (see **Section 5.8.5.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to cultural and historical resources and would result in ***long-term, beneficial*** cumulative impacts to these resources through flood reduction.

5.8.6 Transportation and Circulation

As described in **Table 5.3-1**, the ROI for cumulative effects on transportation and circulation is the Project Area and the surrounding vicinity (one-mile radius). **Section 3.7** discusses the roadway network and operations within the Project Area.

5.8.6.1 Contribution of RFF Projects

The primary collective potential adverse impacts of RFF projects on transportation and circulation include changes in the volume and distribution of vehicular traffic in the ROI. Collectively, RFF projects planned for future construction would introduce large workforces to the ROI, commuting to and from construction sites. For example, the American Dream Meadowlands project (within the *Regional Large-scale Development* group) estimates a total of 16,000 workers within a two-year period. Potential traffic delays and interference with public parking availability would be expected. In addition, transportation-related RFF projects involving street resurfacing and intersection improvements would require road/lane closures and realignments during construction efforts, which would further contribute to adverse impacts on traffic and circulation. Further, operation of RFF projects providing public amenities would potentially generate increased traffic congestion in the ROI due to increased demand and usage.

Collective benefits of RFF projects on transportation and circulation would include improvements to road conditions and transportation facilities. Transportation-related RFF projects (i.e., *Transportation Projects Involving Drainage Improvements; Transportation Projects without Specified Drainage Improvements;* and *Regional Transportation-related Capital Improvements*) propose to implement measures, such as street resurfacing and traffic light synchronization to reduce congestion, travel delays, and fuel emissions. RFF projects that would increase flood protection against coastal storm surges (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations;* and *Regional Flood Control Efforts*) and heavy precipitation events (i.e., *Transportation Projects Involving Drainage Improvements*) would prevent or reduce flooding-related damages to existing transportation services, facilities, and infrastructure in the ROI.

5.8.6.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on transportation and circulation are discussed in detail in **Section 4.7.4.2**. Construction impacts of Alternative 1 could contribute to ***short-term, potentially significant, adverse*** cumulative impacts to roadway traffic and circulation, concurrent with construction of RFF projects within the LOP work areas. Increased construction vehicle and worker trips in the ROI from nearby RFF projects (i.e., Little Ferry Water Pollution Control Facility Upgrades and Washington Avenue Corridor Safety Improvements) and proposed road/lane closures, realignments, and/or raisings under Alternative 1 may cause significant cumulative impacts on traffic congestion and circulation in specific portions of the Project Area.

Although, implementation of transportation improvement RFF projects are designed to alleviate overall congestion and adverse road conditions in the ROI, benefits would be mostly localized and adverse impacts would occur during construction of these RFF projects as well. However, construction efforts are temporary in nature and construction-related delays and interruptions would cease once construction is completed.

Potentially significant adverse impacts to transportation and circulation would be minimized to the extent practicable with the implementation of mitigation measures and BMPs under Alternative 1 (see **Section 4.7.4.2**) and the cumulative mitigation measures discussed in **Section 5.9**.

In addition to cumulative benefits from coastal flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative effects to pedestrian transportation and circulation along the Hackensack River. Currently, public access to the Hackensack River waterfront is limited for both pedestrians and boats. Alternative 1, in conjunction with RFF projects (i.e. *Redevelopment and Rezoning Local to Project Area* and *Improvements to Recreational Facilities*), would improve pedestrian accessibility in the area through the implementation of new paths, walkways, and docks.

5.8.6.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on transportation and circulation are discussed in detail in **Section 4.7.4.3**. Similar to Alternative 1, construction of Alternative 2 could contribute to ***short-term, potentially significant, adverse*** cumulative impacts to roadway traffic and circulation, concurrent with construction of RFF projects (i.e. South Hackensack Revitalization; Roadway Improvements to Summit Circle; Lincoln Place Pumping Station Generator; and Washington Avenue Corridor Safety Improvements). Alternative 2 would create fewer overall peak hour construction trips than Alternative 1, but would lead to a greater number of construction trips at the most utilized intersection; therefore, contributing to a potentially significant adverse cumulative impact on traffic congestion and circulation in the ROI.

Potentially significant adverse impacts to transportation and circulation would be minimized to the extent practicable with the implementation of mitigation measures and BMPs under Alternative 2 (see **Section 4.7.4.3**) and the cumulative mitigation measures discussed in **Section 5.9**.

In addition to cumulative benefits from inland flood protection, operation of Alternative 2 would contribute additional ***long-term, beneficial*** cumulative effects to pedestrian and boat transportation and circulation along the Hackensack River. Under Alternative 2, the creation of three new waterfront parks along with pedestrian and boating opportunities would contribute to improved accessibility options in the ROI in conjunction with RFF projects (i.e. *Redevelopment and Rezoning Local to Project Area* and *Improvements to Recreational Facilities*).

5.8.6.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on transportation and circulation are discussed in detail in **Section 4.7.4.4**. As described in **Section 5.7**, cumulative impacts to transportation and circulation under Alternative 3 would be the same as Alternative 1 (see **Section 5.8.6.2**) and Alternative 2 (see **Section 5.8.6.3**).

Potentially significant adverse impacts to transportation and circulation would be minimized to the extent practicable with the implementation of mitigation measures and BMPs under Alternative 3 (see **Section 4.7.4.4**) and the cumulative mitigation measures discussed in **Section 5.9**.

Implementation of Alternative 3 would allow for development of the *Alternative 3 Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to transportation and circulation resources and would contribute ***long-term, beneficial*** cumulative impacts.

5.8.7 Noise and Vibration

As described in **Table 5.3-1**, the ROI for cumulative effects on noise and vibration is the Project Area and the surrounding vicinity (one-mile radius). Sources of noise in the Project Area, as well as sensitive noise receptors, are discussed in **Section 3.8**.

5.8.7.1 Contribution of RFF Projects

Collective adverse impacts of RFF projects would include elevated levels of noise and vibration during construction efforts; as such, these effects would be periodic and short term. RFF projects planned for future construction would increase noise and vibration through the use of equipment for site grading, clearing, and grubbing. It is expected that noise levels would be highest at the beginning stages of construction, during which excavation activities and HDD activities (i.e., Transco Pipeline Loop project within the *Improvements to Utility Systems* group) would take place and heavy truck traffic for material deliveries would occur. Noise from construction activities is typically less-than-significant due to the temporary nature of construction and the consistency with the surrounding urban and suburban soundscape. Further, the majority of RFF projects would be constructed on existing, disturbed land or existing streets and, therefore, would not contribute to potentially significant vibrations compared to new development projects occurring on undisturbed land. However, depending on the distance from the construction site to nearby sensitive noise receptors, noise and vibration impacts could vary.

In addition, RFF projects proposed near the banks of the Hackensack River and Berry's Creek (i.e., *Redevelopment and Rezoning Projects Local to the Project Area; Improvements to Utility Systems; Teterboro Airport Improvements;* and *Regional Large-scale Development*) would contribute noise impacts to nearby aquatic life during construction. Pile-driving activities near these bodies of water would cause changes in sound pressure levels and vibrations that may disrupt or disturb aquatic organisms. In addition, RFF projects involving in-water dredging would cause underwater noise, potentially impacting aquatic species during construction.

5.8.7.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on noise and vibration are discussed in detail in **Section 4.8.2.2**. Construction of Alternative 1 could contribute to ***short-term, potentially significant, adverse*** cumulative impacts on noise and vibration within the ROI, when considered in combination with RFF projects. Sensitive noise and vibration receptors would perceive elevated levels of noise during construction of Alternative 1 and RFF projects. Construction of Alternative 1 would presumably occur Monday through Saturday. In the Borough of East Rutherford, any construction on Saturdays would violate local regulations. *Regional Large-scale Development*; *Redevelopment and Rezoning Local to Project Area;* and *Housing and Small Redevelopment Projects Outside the Project Area* RFF projects are located in East Rutherford. If the construction schedules for these RFF projects also include Saturdays, collectively, Alternative 1 and RFF projects would contribute potentially significant adverse cumulative noise impacts in the area. However, as previously noted, construction efforts are temporary in nature and construction noise would cease once construction is completed. Further, noise impacts from construction equipment are generally limited to a 0.25-mile buffer surrounding the construction site because noise attenuates quickly within developed environments.

Potentially significant adverse noise and vibration impacts would be minimized to the extent practicable with the implementation of mitigation measures and BMPs under Alternative 1 (see **Section 4.8.4.2**) and the cumulative mitigation measures discussed in **Section 5.9**.

5.8.7.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on noise and vibration are discussed in detail in **Section 4.8.2.3**. Construction of Alternative 2 would result in the same cumulative impacts as construction of Alternative 1 (see **Section 5.8.7.2**).

Potentially significant adverse noise and vibration impacts would be minimized to the extent practicable with the implementation of mitigation measures and BMPs under Alternative 2 (see **Section 4.8.2.3**) and the cumulative mitigation measures discussed in **Section 5.9**.

5.8.7.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on noise and vibration are discussed in detail in **Section 4.8.2.4**. As described in **Section 5.7**, cumulative impacts to noise and vibration under Alternative 3 would be the same as those anticipated under Alternative 1 (see **Section 5.8.7.2**) and Alternative 2 (see **Section 5.8.7.3**).

Potentially significant adverse noise and vibration impacts would be minimized to the extent practicable with the implementation of mitigation measures and BMPs under Alternative 3 (see **Section 4.8.2.4**) and the cumulative mitigation measures discussed in **Section 5.9**.

5.8.8 Air Quality and Greenhouse Gas Emissions

As described in **Table 5.3-1**, the ROI for cumulative effects on air quality and GHG emissions is the regional airshed. **Section 3.9** discusses the existing air quality within the Project Area.

5.8.8.1 Contribution of RFF Projects

RFF projects would contribute adverse impacts on air quality and GHG emissions from construction activities. The handling and transportation of excavated and imported materials during construction, as well as the use of heavy-duty, diesel-powered trucks traveling to and from the construction sites, would generate direct and indirect criteria pollutant emissions. Construction activities would also produce fugitive dust, while stationary equipment would generate HAP emissions. In addition, emissions from construction activities would potentially affect public health and sensitive populations in the ROI. However, emissions are not expected to contribute adverse effects to overall air quality or human health in the regional airshed. Per the NJDEP, permits are required for stationary sources of air pollution, including major facilities and non-major facilities. Facilities must annually certify compliance with applicable requirements and renew permits to adhere with NJDEP standards. RFF projects that require air permits would be in compliance with NJDEP air quality standards, and projects that do not require air permits would not contribute to adverse air quality impacts.

Collective benefits of RFF projects on air quality and GHG emissions would result from projects alleviating traffic congestion in the ROI (i.e., *Transportation Projects Involving Drainage Improvements; Transportation Projects without Specified Drainage Improvements; Regional Transportation-related Capital Improvements;* and *Regional Transit/Transit Village*). Reduced traffic congestion would lead to an overall reduction in vehicular emissions. Similarly, RFF projects involving drainage improvements and flood protection would reduce flood damages to transportation facilities and services in the long-run, further decreasing future vehicular congestion and associated emissions.

5.8.8.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on air quality and GHG emissions are discussed in detail in **Section 4.9.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to air quality and GHG emissions within the ROI when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.8.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on air quality and GHG emissions are discussed in detail in **Section 4.9.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to air quality and GHG emissions in the ROI when added to the contribution of RFF projects. In addition, Alternative 2 would not contribute any additional cumulative beneficial impacts aside from inland flood protection benefits.

5.8.8.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on air quality and GHG emissions are discussed in detail in **Section 4.9.4.4**. As described in **Section 5.7**, cumulative impacts to air quality and GHG emissions under Alternative 3 would be the same as anticipated under Alternative 1 (**Section 5.8.8.2**) and Alternative 2 (**Section 5.8.8.3**).

5.8.9 Global Climate Change and Sea Level Change

As described in **Table 5.3-1**, the ROI for cumulative effects of global climate change and sea level change is the larger global context. Existing conditions for global climate change and sea level change are discussed in **Section 3.10**.

5.8.9.1 Contribution of RFF Projects

RFF projects proposing drainage improvements (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations*) and long-term flood protection benefits (i.e., *Regional Flood Control Efforts*) would address potential impacts of precipitation events and sea level change in the Project Area. Flood protection efforts associated with these RFF projects would mitigate local effects of climate change and SLR in the short term. In addition, the Alternative 3 *Future Plan* would contribute benefits through structural flood protection and minimize adverse effects from sea level change. However, RFF projects would not be able to prevent or mitigate the regional effects of global climate change and sea level change, especially as flood events become more frequent, resulting in incremental damages and more frequent flooding events in the long term.

5.8.9.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on global climate change and sea level change are discussed in detail in **Section 4.10.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to global climate change and sea level change when added to the contribution of RFF projects.

Operation of Alternative 1 would not result in any additional cumulative beneficial impacts on global climate change and sea level change aside from coastal flood protection benefits. However, given the nature of global climate change, it is important to note that Alternative 1 and RFF projects would only protect against an approximately 50-year storm surge, and only against an approximately 10-year storm surge under the 2.4-foot SLR scenario. In the long-term, global climate change and sea level change would cause increased flooding and increased precipitation, contributing to cumulative inundation and damage to the ROI over time.

5.8.9.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on global climate change and sea level change are discussed in detail in **Section 4.10.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to global climate change and sea level change when added to the contribution of RFF projects.

Alternative 2 would not result in any additional cumulative beneficial impacts on global climate change and sea level change aside from inland flood protection benefits. However, given the nature of global climate change with precipitation events becoming more intense over time, Alternative 2 and RFF projects may not be able to provide sufficient inland flood control to account for the increase in flooding attributable to climate change events. In the long-term, global climate change and sea level change would cause increased flooding and increased precipitation, contributing to cumulative inundation and damage to the ROI over time.

5.8.9.4 Alternative 3

Direct and indirect impacts of Alternative 3 on global climate change and sea level change are discussed in detail in **Section 4.10.4.4**. As described in **Section 5.7**, cumulative impacts on and from global climate change and sea level change under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.9.2**) and Alternative 2 (see **Section 5.8.9.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding from global climate change and sea level change and contribute ***long-term, beneficial*** cumulative impacts. However, in the long-term, global climate change and sea level change would continue to cause increased flooding and increased precipitation, leading to cumulative inundation and damage to the ROI over time.

5.8.10 Recreation

As described in **Table 5.3-1**, the ROI for cumulative effects on recreation is the five municipalities that comprise the Project Area. The ROI contains numerous public recreation areas and open spaces, as discussed in **Section 3.11**.

5.8.10.1 Contribution of RFF Projects

The major collective impacts of RFF projects on recreational resources are changes in use and access. RFF projects planned for future construction would adversely impact usage of and access to recreational facilities due to construction disturbance near recreational areas, including noise and dust from construction activities, and visual interruptions from demolished and partially constructed sites. In addition, temporary traffic delays when construction equipment is being moved would affect public access to recreational facilities.

However, RFF projects would collectively benefit the ROI through the creation and improvement of new and existing recreational areas and facilities. For example, the Mehrhof Pond Wildlife Observation Area (within the *Improvements to Recreational Facilities* group) will be developed into a publicly accessible passive recreation area. In addition, the Paterson Plank Road Redevelopment project would develop a 194,763 SF indoor recreational facility. RFF projects would also provide increased flood protection against future coastal flooding and heavy precipitation events. In the long-run, these projects would reduce the frequency of road closures and improve access to recreational areas and facilities, while also reducing flood-related closures of recreational areas.

5.8.10.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on recreation are discussed in detail in **Section 4.11.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to recreational resources in the ROI when added to the contribution of RFF projects.

In addition to cumulative benefits from flood protection, operation of Alternative 1 would contribute additional cumulative ***long-term, beneficial*** impacts on recreation through the creation of new recreational areas and facilities. Alternative 1 would convert land in the ROI into accessible, public recreation land (i.e., Fluvial Park, K-Town Park, Riverside Park, and DePeyster Creek Park) contributing to the cumulative creation of new parks in the ROI. RFF projects within the *Redevelopment and Rezoning Projects Local to the Project Area* group and the *Improvements to Recreational Facilities* group would also build new recreation space and public facilities. In addition, Alternative 1 and RFF projects from these groups would collectively improve the accessibility of recreational areas by creating walkways, paths, and parking facilities.

5.8.10.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on recreation are discussed in detail in **Section 4.11.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to recreational resources in the ROI when added to the contribution of RFF projects.

In addition to cumulative benefits from flood protection, operation of Alternative 2 would contribute additional cumulative ***long-term, beneficial*** impacts on recreation through the creation of new recreational areas and facilities. Alternative 2 would create five new parks (i.e. Fluvial Park, Avanti Park, Riverside Park, DePeyster Creek Park, and Caesar Place Park) that would provide varied recreational opportunities. RFF projects within the *Redevelopment and Rezoning Projects Local to the Project Area* group and the *Improvements to Recreational Facilities* group would also build new recreation space and public facilities. Alternative 2 and RFF projects would collectively improve recreational areas in the ROI.

5.8.10.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on recreation are discussed in detail in **Section 4.11.4.4**. As described in **Section 5.7**, cumulative impacts to recreation under Alternative 3 would be the same as Alternative 1 (see **Section 5.8.10.2**) and Alternative 2 (see **Section 5.8.10.3**). Implementation of Alternative 3 would allow for development of the *Alternative 3 Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages that would occur to recreational resources and contribute ***long-term, beneficial*** cumulative impacts to these resources.

5.8.11 Utilities and Service Systems

As described in **Table 5.3-1**, the ROI for cumulative effects on utilities and service systems is the Project Area and the surrounding vicinity (one-mile radius). Existing utilities and service systems in the Project Area (i.e., sanitary wastewater collection and treatment systems, water supply and distribution, electricity, natural gas, solid waste, stormwater infrastructure and drainage, and communication systems) are discussed in **Section 3.12**.

5.8.11.1 Contribution of RFF Projects

Collective adverse impacts of RFF projects on utilities and service systems would result from construction activities that could cause interruptions to the electrical, natural gas distribution, and drinking water distribution networks. Construction activities may require the removal or relocation of existing lines. There may also be impacts to stormwater drainage and management from construction-related erosion. In addition, construction contractors using local utilities (e.g., electricity or water) for localized construction activities may increase demand on existing utility services. However, changes in utility demand and any potential service disruptions from construction activities would be temporary and only cause short-term interference, if any, for the duration of the construction phase.

Specific RFF projects would contribute beneficial impacts on utilities and service systems in the ROI by increasing utility supply. Specifically, the NJ Transitgrid Traction Power System project (within the *Improvements to Utility Systems* group) proposes to enhance the electricity supply to NJ Transit and Amtrak systems by constructing an electrical micro-grid to supply reliable power during storm events. Similarly, the Transco Pipeline Loop project would increase natural gas transport capacity in the ROI by upgrading pipelines. Operation of these RFF projects would contribute long-term beneficial impacts on utilities and service systems by providing additional support and capacity. In addition, RFF projects involving flood control efforts and stormwater drainage improvements would decrease the risk of power outages and increase flood protection against damages to utilities and service systems from heavy precipitation events and coastal storm surges.

5.8.11.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on utilities and service systems are discussed in detail in **Section 4.12.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to utilities and service systems in the ROI when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative benefits aside from coastal flood protection benefits.

5.8.11.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on utilities and service systems are discussed in detail in **Section 4.12.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to utilities and service systems in the ROI when added to the contribution of RFF projects. In addition, Alternative 2 would not contribute any additional cumulative benefits aside from inland flood protection benefits.

5.8.11.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on utilities and service systems are discussed in detail in **Section 4.12.4.4**. As described in **Section 5.7**, cumulative impacts to utilities and service systems under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.11.2**) and Alternative 2 (see **Section 5.8.11.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to utilities and service systems and contribute ***long-term, beneficial*** cumulative impacts.

5.8.12 Public Services

As described in **Table 5.3-1**, the ROI for cumulative effects on public services is the five municipalities that comprise the Project Area. Existing public services in the Project Area, including police departments, fire departments, EMS, schools, municipal buildings, community facilities, institutional residences, and healthcare facilities, are discussed in **Section 3.13**.

5.8.12.1 Contribution of RFF Projects

Potential collective adverse impacts of RFF projects on public services primarily include changes in demand and access during construction activities. RFF projects planned for future construction could increase demand for emergency services, as construction activities can be sources of accidents, safety hazards, theft, and vandalism. These incidents could increase the number of emergency service calls for fire and police responders, as well as increase visitation to medical facilities. In addition, transportation-related RFF projects involving street resurfacing and intersection improvements would require road/lane closures and realignments, causing delays in emergency response times of police and fire departments. Construction efforts that would contribute to roadway traffic and congestion would also interfere with emergency vehicle access.

RFF projects would benefit public services over the long term through the creation of new amenities and improved accessibility to existing services. For example, the New Moonachie Municipal Building (within the *Redevelopment and Rezoning Local to Project Area* group) would consist of a new courtroom, court office, police department, and other public services, while the Washington Elementary School would be redeveloped to replace the existing nonfunctional building, providing new facilities for students and faculty. In addition, the Carlstadt Tree-lined Streets 5-year Program (within the *Environmental Improvement Projects* group) and Washington Avenue Corridor Safety Improvements (within the *Transportation Projects without Specified Drainage Improvements* group) would increase accessibility of public services by creating and renovating sidewalks, crosswalks, and streets. Further, RFF projects that would increase flood protection (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations*) and implement stormwater drainage improvements (i.e., *Transportation Projects Involving Drainage Improvements*) would reduce interruptions to operations of public services from flood damage and increase the reliability of public services. RFF projects that provide flood protection would also indirectly reduce the frequency of emergency calls during flood hazard events and provide manageable demand for emergency responders.

5.8.12.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on public services are discussed in detail in **Section 4.13.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to public services in the ROI when added to the contribution of RFF projects. In addition, there would be no additional cumulative beneficial impacts on public services in the ROI aside from coastal flood protection benefits.

5.8.12.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on public services are discussed in detail in **Section 4.13.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to public services in the ROI when added to the contribution of RFF projects. In addition, there would be no additional cumulative beneficial impacts on public services in the ROI aside from inland flood protection benefits.

5.8.12.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on public services are discussed in detail in **Section 4.13.4.4**. As described in **Section 5.7**, cumulative impacts to public services under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.12.2**) and Alternative 2 (see **Section 5.8.12.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to public services and contribute ***long-term, beneficial*** cumulative impacts to these services.

5.8.13 Biological Resources

As described in **Table 5.3-1**, the ROI for cumulative effects on biological resources is the Project Area and the surrounding vicinity (one-mile radius). Biological resources include terrestrial habitats and wildlife; aquatic habitats and wildlife; and special status species and species of conservation concern. There are no federally-listed species in the Project Area and vicinity, although state-listed species are potentially present. Additional discussion of biological resources is provided in **Section 3.14**.

5.8.13.1 Contribution of RFF Projects

Potential collective adverse impacts to biological resources from RFF projects would result from construction activities near the banks of the Hackensack River and Berry's Creek (i.e., *Transportation Projects Involving Drainage Improvements; Improvements to Utility Systems; Teterboro Airport Improvements; Redevelopment and Rezoning Projects Local to the Project Area; Improvements to Recreational Facilities;* and *Regional Large-scale Development*). Pile driving would cause changes in noise levels and vibrations that may disrupt or disturb aquatic organisms, while excavation and fill work would increase turbidity and sedimentation in nearby bodies of water. Dredging activities would also cause underwater noise, sedimentation, and turbidity impacts on aquatic habitats. In addition, the construction of *Teterboro Airport Improvements* projects would fill approximately 11 acres of wetlands to create new impervious surface, resulting in a loss of freshwater forested wetlands, freshwater scrub/shrub wetlands, and freshwater emergent wetlands. A permanent loss of these wetlands would result in changes to plant composition, particularly the red maple, blackgum, sweetgum, and pin oak communities that typically dominate forested wetlands.

The major collective benefits of RFF projects on biological resources would include habitat protection and restoration. Specific RFF projects (i.e., *Environmental Improvement Projects; Redevelopment and Rezoning Projects Local to the Project Area; Improvements to Recreational Facilities;* and *Regional Flood Control Efforts*) would restore, enhance, or create habitat. In addition, Superfund clean-up efforts would remediate contaminated areas in and near the Berry's Creek watershed, providing long-term benefits to aquatic species. RFF projects that involve flood control efforts and stormwater drainage improvements would reduce impacts on existing aquatic and terrestrial habitats from flooding events. Other RFF projects would help to prevent shoreline erosion and improve ecological function through flood protection efforts and drainage improvements, resulting in decreased associated downstream turbidity, sedimentation, and nutrient/contaminant inputs.

5.8.13.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on biological resources are discussed in detail in **Section 4.14.4.2**. Construction of Alternative 1 would result in ***potentially significant, adverse*** cumulative impacts to aquatic habitats concurrent with RFF projects within the *Teterboro Airport Improvements* group. Under Alternative 1, approximately 2.2 acres of wetlands would be permanently impacted in the

Central Segment and the proposed location of the Berry's Creek storm surge barrier. In addition, *Teterboro Airport Improvements* RFF projects would permanently affect 11 acres of wetlands in the ROI. Collectively, there would be adverse impacts to aquatic habitats in the ROI from fill and dredge activities and permanent loss of habitat. However, mitigation measures and BMPs under Alternative 1 would be implemented to minimize potentially significant adverse impacts to the extent practicable (see **Section 4.14.4.2**), in addition to the cumulative mitigation measures proposed in **Section 5.9**.

In addition to cumulative benefits from coastal flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts to aquatic species in the ROI. Implementation of Alternative 1 would include the creation of new wetlands and riparian habitats as part of the proposed Fluvial Park. RFF projects within *Environmental Improvement Projects; Redevelopment and Rezoning Projects Local to the Project Area; Improvements to Recreational Facilities;* and *Regional Flood Control Efforts* groups also involve efforts to restore, enhance, or create wetland habitats. Alternative 1, in conjunction with RFF projects, would ultimately result in more wetland habitat within the ROI, which would lead to a long-term cleaner, higher-quality natural environment, benefitting native aquatic species.

5.8.13.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on biological resources are discussed in detail in **Section 4.14.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to biological resources in the ROI when added to the contribution of RFF projects.

In addition to cumulative benefits from inland flood protection, operation of Alternative 2 would contribute ***long-term, beneficial*** cumulative impacts to terrestrial and aquatic habitats in the ROI. Implementation of Alternative 2 would result in habitat enhancements through a net decrease in impervious surface and creation of wetlands within proposed new parks and open space areas along East Riser Ditch. Alternative 2 and RFF projects would ultimately result in more vegetated habitat within the ROI, which would improve the quality of the natural environment and benefit terrestrial and aquatic species over the long term.

5.8.13.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on biological resources are discussed in detail in **Section 4.14.4.4**. As described in **Section 5.7**, cumulative impacts to biological resources under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.13.2**), including ***potentially significant, adverse*** cumulative impacts to aquatic habitats in the ROI from fill and dredge activities and permanent loss of habitat, and Alternative 2 (see **Section 5.8.13.3**). However, potentially significant adverse impacts to biological resources would be minimized to the extent practicable with the implementation of mitigation measures and BMPs identified under Alternative 3 (see **Section 4.14.4.4**), in addition to the cumulative mitigation measures proposed in **Section 5.9**.

Implementation of Alternative 3 and the *Future Plan* collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to biological resources and contribute ***long-term, beneficial*** cumulative impacts to these resources in the ROI.

5.8.14 Geology and Soils

As described in **Table 5.3-1**, the ROI for cumulative effects on geology and soils is the five municipalities that comprise the Project Area. The Project Area, located within the Meadowlands District, is part of the lower Hackensack Valley, which is prone to chronic flooding due to geological setting. Additional discussion of existing geological conditions of the Project Area is included in **Section 3.15**.

5.8.14.1 Contribution of RFF Projects

Potential cumulative adverse impacts of RFF projects on geological resources would result directly from construction disturbance. RFF projects planned for future construction may require extensive excavation and fill work, potentially impacting the underlying geology of the ROI. In addition, construction activities would cause increased erosion and sediment runoff through changes in impervious surface and existing infrastructure. However, the majority of RFF projects would be developed on previously disturbed sites, and large-scale construction activities would implement site-specific erosion and sedimentation control plans to minimize impacts on soils.

RFF projects would contribute benefits to geology and soils in the ROI through contamination clean-up and remediation efforts (i.e., *Environmental Improvement Projects*). Several RFF projects involve the remediation of Superfund sites (i.e., SCP, UOP, and BCSA) or propose to identify and designate Superfund sites for future clean-up activities (i.e., Lower Hackensack River Superfund Investigation). These ongoing projects would remove soil and groundwater contaminants from the ROI. Other RFF projects would decrease erosion and runoff through the increased planting of trees along streets, and develop long-term plans for reducing/eliminating sewage spills. Fewer sewage spills would lead to decreased runoff and turbidity. In addition, RFF projects providing flood protection efforts would protect against future coastal storm surges, thereby stabilizing geologic conditions and soils in the ROI.

5.8.14.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on geology and soils are discussed in detail in **Section 4.15.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to geology or soils in the ROI when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.14.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on geology and soils are discussed in detail in **Section 4.15.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to geology or soils in the ROI when added to the contribution of RFF projects. In addition, Alternative 2 would not contribute any additional cumulative beneficial impacts aside from inland flood protection benefits.

5.8.14.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on geology and soils are discussed in detail in **Section 4.15.4.4**. As described in **Section 5.7**, cumulative impacts to geology and soils under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.14.2**) and Alternative 2 (see **Section 5.8.14.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would provide the best available strategy for substantially mitigating inland and coastal flooding damages to geology and soils in the ROI and contribute ***long-term, beneficial*** cumulative impacts to these resources.

5.8.15 Water Resources, Water Quality, and Waters of the US

As described in **Table 5.3-1**, the ROI for cumulative effects to water resources, water quality, and WOUS is the Hackensack River Watershed, downstream of Oradell Dam. The ROI is an urbanized watershed that was, and continues to be, impacted by ongoing residential, commercial, and industrial development. **Section 3.16** presents the existing conditions for the water resources within the Project Area.

5.8.15.1 Contribution of RFF Projects

Potential cumulative adverse impacts of RFF projects on water resources in the ROI would occur primarily through construction activities. RFF projects proposed for future construction would disrupt groundwater flow due to foundation installations and dewatering; while construction activities requiring the removal of sheet piling and installation of drainage systems and tide gates would affect surface water quality and flow. Construction sites would also be sources of soil and sediment disturbance, which would lead to sediment and contaminant transport and runoff into nearby waterbodies. *Teterboro Airport Improvements* projects would fill 11 acres of wetlands to create new impervious surface, resulting in a loss of wetlands in the ROI. A permanent loss of wetlands would result in changes to sediment/nutrient retention, flood flow attenuation, and shoreline protection. In addition, RFF projects that involve flood reduction efforts would reduce surface water area, as tide gates and floodwalls would permanently reduce daily tidal flow; thus, affecting upstream and downstream hydraulics.

RFF projects that would increase flood and stormwater protection would benefit water resources through an overall reduction in the frequency and magnitude of turbidity and pollutant-loading events. For example, the NJ Combined Sewer Overflow Improvements project (within the *Improvements to Utility Systems* group) proposes to develop long-term measures to reduce and eliminate sewage spills. New drainage and sewage systems would prevent high-intensity storm surges and reduce runoff. In addition, RFF projects that reduce contaminated sediment would improve overall surface water quality. For example, the Dredging Marina in Secaucus project (within the *Improvements to Recreational Facilities* group) would dredge approximately 2,400 CY in the three ditches that empty into the Hackensack River. Similarly, RFF projects in the *Environmental Improvement Projects* group involving Superfund site and industrial site cleanup efforts would also minimize contaminant flow into the Berry's Creek watershed.

In addition, RFF projects that include developments of trees, green space, open space, and recreational facilities would contribute to a reduction of impervious surfaces in the ROI; thereby increasing stormwater infiltration capacity and reducing the velocity of stormwater runoff. Mixed-use development projects within the ROI also plan to incorporate open space and green infrastructure. These projects would trap solids before entering surface waters. RFF projects that restore and create wetlands (i.e., *Environmental Improvement Projects* and *Wetland Mitigation Projects*) would reduce flooding intensity by temporarily storing stormwater and reducing flow.

5.8.15.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on water resources are discussed in detail in **Section 4.16.4.2**. Impacts from construction of Alternative 1 when added to impacts of RFF projects within the *Teterboro Airport Improvements* group would result in ***long-term, potentially significant, adverse*** cumulative impacts to wetlands. Under Alternative 1, a total of approximately 2.2 acres of wetlands would be permanently impacted through the loss of area or function. Along with the loss of 11 acres of wetlands under implementation of RFF projects within the *Teterboro Airport Improvements* group, Alternative 1 and RFF projects would collectively result in a net loss of wetlands in the ROI.

However, mitigation measures and BMPs under Alternative 1 would be implemented to minimize potentially significant adverse impacts to the extent practicable (see **Section 4.16.4.2**), in addition to the cumulative mitigation measures proposed in **Section 5.9**.

In addition to cumulative benefits from coastal flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts to surface water quality. Proposed green space and native plantings under Alternative 1 and RFF projects would reduce velocity of stormwater runoff and trap solids before entering surface waters. Alternative 1 would also create a tidal wetland as part of the proposed Fluvial Park. RFF projects that restore or create wetlands (i.e., *Environmental Improvement Projects* and *Regional Flood Control Efforts*) would help to reduce flooding intensity by naturally filtering water, temporarily storing stormwater and reducing flow. Collectively, Alternative 1 and RFF projects would improve water quality.

5.8.15.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on water resources are discussed in detail in **Section 4.16.4.3**. Impacts from construction of Alternative 2 when added to impacts of RFF projects within the *Teterboro Airport Improvements* group would result in ***long-term, potentially significant, adverse*** cumulative impacts to wetlands. Under Alternative 2, a total of approximately 0.8 acre of wetlands would be permanently impacted through the loss of area or function. In addition, the loss of 11 acres of wetlands under implementation of RFF projects would result in a net loss of wetlands in the ROI.

However, mitigation measures and BMPs under Alternative 2 would be implemented to minimize potentially significant adverse impacts to the extent practicable (see **Section 4.16.4.3**), in addition to the cumulative mitigation measures proposed in **Section 5.9**.

In addition to cumulative benefits from inland flood protection, operation of Alternative 2 would contribute ***long-term, beneficial*** effects to wetlands. The conversion of impervious surfaces to pervious surfaces, and wetland restoration/creation would provide downstream and off-site water quality and flow benefits. Under Alternative 2, approximately 7.2 acres of wetlands would be created or enhanced, while RFF projects that restore or create wetlands (i.e., *Environmental Improvement Projects* and *Regional Flood Control Efforts*) would help reduce flooding intensity by naturally filtering water, temporarily storing stormwater, and reducing flow. Collectively, Alternative 2 and RFF projects would improve water quality through the creation and/or restoration of wetlands in the ROI.

5.8.15.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on water resources are discussed in detail in **Section 4.16.4.4**. As described in **Section 5.7**, cumulative impacts to water resources under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.15.2**) and Alternative 2 (see **Section 5.8.15.3**).

Potentially significant adverse water resources impacts would be minimized to the extent practicable with the implementation of mitigation measures and BMPs identified under Alternative 3 (see **Section 4.16.4.4**), in addition to the cumulative mitigation measures proposed in **Section 5.9**.

Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to water resources and contribute ***long-term, beneficial*** cumulative impacts.

5.8.16 Hydrology and Flooding

As described in **Table 5.3-1**, the ROI for cumulative effects on hydrology and flooding is the Hackensack River watershed, downstream of Oradell Dam. **Section 3.17** discusses existing hydrology, coastal water surface elevations, stormwater runoff, and storm surge elevations within the Project Area.

5.8.16.1 Contribution of RFF Projects

Potential cumulative adverse impacts of RFF projects on hydrology and flooding in the ROI include a potential increase in flooding due to large-scale development. RFF projects focusing on major development in commercial, industrial, and residential sectors (i.e., *Transportation Projects Involving Drainage Improvements; Redevelopment and Rezoning Local to the Project Area; Teterboro Airport Improvements; Industrial Building Construction; Transportation Projects without Specified Drainage Improvements; Regional Transportation-related Capital Improvements; Regional Transit/Transit Village*; and *Regional Large-scale Development*) would increase local impervious surface area and potentially contribute to inundation of floodwaters during coastal storm surges and heavy precipitation events. However, these projects are located within areas that are already highly developed; therefore, any changes in impervious surface would be negligible and may, in fact, achieve a net reduction in impervious surface and stormwater runoff due to current stormwater management regulations.

RFF projects would benefit hydrology and flooding by developing additional green space, open space, and recreational facilities. RFF projects (i.e., *Redevelopment and Rezoning Local to the Project Area; Regional Transit/Transit Village; Improvements to Recreational Facilities; Transportation Projects involving Drainage Improvements; Environmental Improvement Projects;* and *Improvements to Utility Systems*) would create additional pervious surface in the ROI. Pervious surfaces would increase stormwater infiltration and reduce runoff during rainfall and storm events. In addition, RFF projects would increase flood protection against future coastal storm surges in the long-term through drainage improvements (i.e., *Transportation Projects Involving Drainage Improvements*) and flood control (e.g., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations;* and *Regional Flood Control Efforts*). New drainage systems would improve hydrological function and reduce runoff.

5.8.16.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on hydrology and flooding are discussed in detail in **Section 4.17.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to hydrology and flooding when added to the contribution of RFF projects.

In addition to cumulative benefits from coastal flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts through a net decrease of impervious surface through new open spaces, which would increase stormwater infiltration capacity. Collectively, RFF projects in the ROI from the *Redevelopment and Rezoning Local to the Project Area; Regional Transit/Transit Village; Improvements to Recreational Facilities; Transportation Projects Involving Drainage Improvements; Environmental Improvement Projects;* and *Improvements to Utility Systems* groups would develop additional green space, open space, and recreational facilities in the ROI, overall increasing long-term drainage improvements concurrent with Alternative 1.

5.8.16.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on hydrology and flooding are discussed in detail in **Section 4.17.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to hydrology and flooding when added to the contribution of RFF projects. In addition, Alternative 2 would not contribute any additional cumulative beneficial impacts aside from inland flood protection benefits.

5.8.16.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on hydrology and flooding are discussed in detail in **Section 4.17.4.4**. As described in **Section 5.7**, cumulative impacts to hydrology and flooding under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.16.2**) and Alternative 2 (see **Section 5.8.16.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to hydrology and flooding and contribute ***long-term, beneficial*** cumulative impacts.

5.8.17 Coastal Zone Management

As described in **Table 5.3-1**, the ROI for cumulative effects on coastal resources is the five municipalities that comprise the Project Area. The Project Area is located within the tidally-influenced and surge-prone areas along the Hackensack River. **Section 3.18** discusses the coastal zone regulated areas within the Project Area.

5.8.17.1 Contribution of RFF Projects

Collective benefits of RFF projects include improved coastal health and changes in access and use of coastal resources. RFF projects involving efforts to restore and enhance wetlands and waterbodies would benefit coastal resources. Specifically, RFF projects within the *Environmental Improvement Projects* group would implement native revegetation efforts to create low marsh, high marsh, scrub-shrub, and maritime upland habitats, contributing to better functioning tidal channels. In addition, several RFF projects would also address tidal surges and benefit marshes surrounding the Hackensack River. RFF projects would also benefit public open space areas and public use of coastal resources through increased flood protection. RFF projects involving drainage improvements (i.e., *Transportation Projects Involving Drainage Improvements*) and flood control (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations*) would protect coastal areas against future coastal storm surges, which would increase public open space and recreational opportunities in coastal areas.

5.8.17.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on CZM are discussed in detail in **Section 4.18.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to coastal resources when added to the contribution of RFF projects.

In addition to cumulative benefits from coastal flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts to public utility and access of coastal resources. Collectively, Alternative 1 and RFF projects would increase public open space and recreational opportunities in coastal areas through the addition of public parks, a public boat ramp, and waterfront paths and walkways.

5.8.17.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on CZM are discussed in detail in **Section 4.18.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to coastal zone resources in the ROI when added to the contribution of RFF projects. Cumulative benefits of Alternative 2 would be the same as discussed under Alternative 1 (see **Section 5.8.17.2**).

5.8.17.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on CZM are discussed in detail in **Section 4.18.4.4**. As described in **Section 5.7**, cumulative impacts to coastal zone resources under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.17.2**) and Alternative 2 (see **Section 5.8.17.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to coastal zone resources and contribute ***long-term, beneficial*** cumulative impacts.

5.8.18 Sustainability/Green Infrastructure

As described in **Table 5.3-1**, the ROI for cumulative effects on sustainability and green infrastructure is the five municipalities comprising the Project Area. No green infrastructure features currently exist in the five municipalities. Therefore, Proposed Project conditions and impacts are specific to current drainage networks (sustainability), including sewers and surface waterways, impervious surface coverage and rainfall events that generate runoff rates within these networks, and volumes from impervious surfaces. Additional discussion of existing sustainability features can be found in **Section 3.19**.

5.8.18.1 Contribution of RFF Projects

Collective benefits on sustainability from RFF projects would include improved drainage systems and potential future development of green infrastructure. RFF projects involving development of trees, green space, open space, and recreational facilities (i.e., *Environmental Improvement Projects; Redevelopment and Rezoning Local to the Project Area;* and *Improvements to Recreational Facilities*) would convert impervious surfaces in the ROI and aid in stormwater infiltration and drainage. In addition, these projects would demonstrate the overall benefits of green space and green infrastructure, potentially leading to future development of green infrastructure in the ROI. RFF projects in the *Redevelopment and Housing in/near the City of Hackensack; Housing and Small Redevelopment Projects outside the Project Area; Transportation Projects Involving Drainage Improvements;* and *Improvements to Recreational Facilities* groups would also implement stormwater management practices to improve runoff quality and reduce overall runoff volume in the ROI.

5.8.18.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on sustainability are discussed in **Section 4.18.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to sustainability when combined with the contribution of RFF projects.

In addition to cumulative benefits from coastal flood protection, operation of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts by indirectly increasing the future potential for green infrastructure development. Collectively, Alternative 1 and RFF projects involving development of green space and open space (i.e., *Environmental Improvement Projects; Redevelopment and Rezoning Local to the Project Area;* and *Improvements to Recreational Facilities*) would provide positive examples of beneficial, sustainable, and resilient practices that may promote and encourage future green infrastructure initiatives.

5.8.18.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on sustainability are discussed in **Section 4.18.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to sustainability in the ROI when added to the contribution of RFF projects. Cumulative benefits from inland flood protection under Alternative 2 would be the same as discussed under Alternative 1 (see **Section 5.8.18.1**).

5.8.18.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on sustainability are discussed in **Section 4.18.4.4**. As described in **Section 5.7**, cumulative impacts to sustainability and green infrastructure under Alternative 3 would be the same as anticipated under Alternative 1 (**Section 5.8.18.2**) and Alternative 2 (**Section 5.8.18.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to sustainability and green infrastructure and contribute ***long-term, beneficial*** cumulative impacts.

5.8.19 Hazards and Hazardous Materials

As described in **Table 5.3-1**, the ROI for cumulative effects on hazards and hazardous materials is the Project Area and the surrounding vicinity (one-mile radius). The Project Area includes parcels of land and surface waterbodies having confirmed or suspected presence of hazardous materials, hazardous substances, or other contaminants. **Section 3.20** discusses the hazards and hazardous materials within the Project Area.

5.8.19.1 Contribution of RFF Projects

The major potential cumulative adverse impacts of RFF projects on hazards and hazardous materials include discharge, spills, and contamination during construction efforts. Any RFF projects requiring ground-disturbing construction activities would potentially cause subsurface disturbance of hazardous materials and contribute to the spread of contaminants into the environment, leading to runoff of contaminated soil and groundwater. In addition, RFF projects located within BCSA may require excavation activities which would cause soil and sediment disturbance, potentially resulting in the spread and transport of contaminants in Berry's Creek. However, it is expected that appropriate controls, as well as proper permitting and compliance, would be in place to prevent exposure and the spread of contamination.

Collectively, RFF projects would benefit the ROI by removing potentially contaminated soils during excavation and other construction activities. In addition, *Environmental Improvement Projects* (i.e., the Lower Hackensack River Superfund Investigation, BCSA, SCP, and UOP projects) would implement remediation efforts at designated or candidate Superfund sites and industrial sites. These ongoing projects would help reduce further transport and spread of contaminants downstream, as well as removing contaminants from these sites completely.

5.8.19.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on hazards and hazardous materials are discussed in detail in **Section 4.20.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to hazards and hazardous materials when combined with the contribution of RFF projects.

In addition to cumulative benefits resulting from coastal flood protection, construction of Alternative 1 would contribute ***long-term, beneficial*** cumulative impacts to the ROI from the removal of potentially contaminated soils. Alternative 1 requires the export of large volumes of soils that would likely contain contaminants. Concurrent with construction of RFF projects that would also potentially require the transport of soils and the projects involving Superfund and industrial site remediation efforts (within the *Environmental Improvement Projects* group), Alternative 1 would contribute cumulative benefits due to the elimination or reduction of existing contaminants in the ROI.

5.8.19.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on hazards and hazardous materials are discussed in detail in **Section 4.20.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to hazards and hazardous materials in the ROI when added to the contribution of RFF projects. Cumulative beneficial impacts of Alternative 2 on hazards and hazardous materials would be the same as those discussed under Alternative 1 (see **Section 5.8.19.2**).

5.8.19.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on hazards and hazardous materials are discussed in detail in **Section 4.20.4.4**. As described in **Section 5.7**, cumulative impacts to hazards and hazardous materials under Alternative 3 would be the same as anticipated under Alternative 1 (see **Section 5.8.19.2**) and Alternative 2 (see **Section 5.8.19.3**). Implementation of Alternative 3 would allow for development of the Alternative 3 *Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages to hazards and hazardous materials and contribute ***long-term, beneficial*** cumulative impacts.

5.8.20 Mineral and Energy Resources

As described in **Table 5.3-1**, the ROI for cumulative effects on mineral and energy resources is the Project Area and the surrounding vicinity (one-mile radius). There are no commercial mineral resources in the Project Area, nor are there any non-renewable energy sources, production facilities, or electric generating stations. **Section 3.21** discusses sand and gravel quarries within a 30-mile radius of the Project Area, in addition to generating stations, LNG storage facilities, and solar projects.

5.8.20.1 Contribution of RFF Projects

The potential cumulative impacts of RFF projects on mineral and energy resources within the ROI include changes in supply and demand during construction of RFF projects. Construction activities would require extraction of mineral resources, such as soils, asphalt, concrete, and steel. However, there are multiple local and regional suppliers of mineral resources, indicating sufficient supply and capacity for construction of RFF projects. In addition, the amount of mineral resources needed for construction activities would be consistent with other development projects in the region.

RFF projects would collectively benefit mineral and energy resources through drainage improvements (i.e., *Transportation Projects Involving Drainage Improvements*) and coastal flood protection (i.e., *Recent Improvements to Ditches, Tide Gates, and Pumping Stations* and the *Regional Flood Control Efforts*). RFF projects would provide increased flood protection to prevent any potential damage to energy resources, as well as preventing any associated impacts to supply, availability, capacity, and cost. RFF projects would also improve energy resources in the ROI. Specifically, the Transco Pipeline Loop (within the *Improvements to Utility Systems* group) would increase natural gas transport capacity and upgrade underutilized pipelines; while the NJ Transitgrid Traction Power System project would enhance electricity supply to the NJ Transit and Amtrak systems by constructing an electrical microgrid that can supply reliable power during storms. In addition, other RFF projects would upgrade or replace existing electric facilities to support long-term flood damage resistance.

5.8.20.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on mineral and energy resources are discussed in detail in **Section 4.21.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to mineral and energy resources when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.20.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on mineral and energy resources are discussed in detail in **Section 4.21.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to mineral and energy resources when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.20.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on mineral and energy resources are discussed in detail in **Section 4.21.4.4**. As described in **Section 5.7**, cumulative impacts to mineral and energy resources under Alternative 3 would be the same as Alternative 1 (see **Section 5.8.20.2**) and Alternative 2 (see **Section 5.8.20.3**). Implementation of Alternative 3 would allow for development of the *Alternative 3 Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages that would occur to mineral and energy resources and contribute ***long-term, beneficial*** cumulative impacts.

5.8.21 Agricultural Resources and Prime Farmlands

As described in **Table 5.3-1**, the ROI for cumulative effects on agricultural resources and prime farmlands is the five municipalities comprising the Project Area. Agricultural resources and prime farmlands do not exist within and/or adjacent to the Project Area, although community gardens are present. **Section 3.22** discusses existing agricultural conditions within the Project Area.

5.8.21.1 Contribution of RFF Projects

Potential cumulative impacts of RFF projects on community gardens include primarily increased flood protection and stormwater drainage. RFF projects from the *Recent Improvements to Ditches, Tide Gates, and Pumping Stations* group and *Regional Flood Control Efforts* group would reduce flood damages and improve drainage systems. New drainage systems and stormwater pumping stations would help to alleviate flooding issues in the area. Additionally, newly installed tide gates in the area would help to better manage tidal flow. Collectively, these projects would reduce flood risks to community gardens, leading to decreased damages and increased accessibility and utilization of community gardens.

5.8.21.2 Cumulative Impacts of Alternative 1

Direct and indirect impacts of Alternative 1 on community gardens are discussed in detail in **Section 4.22.4.2**. Incremental impacts of Alternative 1 would not result in significant adverse cumulative impacts to community gardens when added to the contribution of RFF projects. In addition, Alternative 1 would not contribute any additional cumulative beneficial impacts aside from coastal flood protection benefits.

5.8.21.3 Cumulative Impacts of Alternative 2

Direct and indirect impacts of Alternative 2 on community gardens are discussed in detail in **Section 4.22.4.3**. Incremental impacts of Alternative 2 would not result in significant adverse cumulative impacts to community gardens when added to the contribution of RFF projects. In addition, Alternative 2 would not contribute any additional cumulative beneficial impacts aside from inland flood protection benefits.

5.8.21.4 Cumulative Impacts of Alternative 3

Direct and indirect impacts of Alternative 3 on community gardens are discussed in detail in **Section 4.22.4.4**. As described in **Section 5.7**, cumulative impacts to community gardens under Alternative 3 would be the same as Alternative 1 (see **Section 5.8.21.2**) and Alternative 2 (see **Section 5.8.21.3**). Implementation of Alternative 3 would allow for development of the *Alternative 3 Future Plan*, which would collectively provide the best available strategy for substantially mitigating inland and coastal flooding damages that would occur to community gardens and contribute ***long-term, beneficial*** cumulative impacts.

5.9 Mitigation of Cumulative Effects

Potentially significant adverse cumulative impacts to Transportation and Circulation; Noise and Vibration; Biological Resources; and Water Resources, Water Quality, and Waters of the US, have been identified in association with the construction of the Proposed Project and RFF projects under each of the three alternatives considered, and for Biological Resources under Alternatives 1 and 3. Project-specific mitigation measures and BMPs for each technical resource area, under each considered alternative, are discussed in **Section 4.0**; they are also summarized in **Table 2.6-1**. Potentially significant adverse impacts would be minimized to the extent practicable with the implementation of Project-specific mitigation measures and BMPs, and the following recommended cumulative mitigation measures.

- The NJDEP and RFF project sponsors/proponents should collaboratively participate in meetings and coordination with local planning boards to assess cumulative impacts related to Transportation and Circulation, and Noise and Vibration and discuss individual and collective mitigation measures and responsibilities, if needed. In addition, this collaboration would allow for the coordination of construction schedules, road/lane closures, and street realignments to avoid conflicts and reduce cumulative transportation and circulation effects.

- The NJDEP and RFF project sponsors should coordinate with local municipalities and service providers concerning potential monitoring needs (i.e., construction, traffic, and noise) for construction of RFF projects, and implement required monitoring and adaptive management to reduce cumulative effects to the extent possible.

- For wetland and biological resource mitigation, the NJDEP and RFF project sponsors should coordinate with the MIMAC to develop a compensatory mitigation plan that would compensate for any unavoidable cumulative impacts, with the responsibility apportioned based on potential impact contribution of each project, in terms of quality and quantity of resource affected.

- In accordance with the Citizen Outreach Plan dated June 17, 2016, community stakeholders should be engaged during all phases of the project. The NJDEP and RFF project sponsors should conduct regular public outreach/informational efforts during the construction period of the Proposed Project to solicit input from those who are interested in, potentially affected by, and/or have regulatory jurisdiction over the Proposed Project and RFF projects; thus, allowing opportunities to share concerns and provide input.

6.0 Other Required Disclosures

This section discusses the relationship between short-term uses of the environment and potential long-term productivity of the Proposed Project; the irreversible and irretrievable commitments of resources associated with implementation of the Proposed Project; and the significant and non-significant potential impacts of the Proposed Project as identified in **Section 4.0**.

6.1 Relationship between Short-term Use of the Environment and the Maintenance and Enhancement of Long-term Productivity

The NEPA requires consideration of the relationship between short-term uses of the environment and long-term productivity associated with Federal actions (42 USC § 4223). This comparison is generally understood to recognize that a short-term (temporary) use of the environment may enable the advancement of long-term community needs. For example, construction of a school would adversely affect traffic and air quality in the short-term, but would fulfill a long-term community need to provide sufficient educational facilities. A community might be willing to accept this trade-off. Within the context of this EIS, "short-term" refers to the construction period, while "long-term" refers to the operational life of the Proposed Project.

As discussed in **Section 4.0**, the Proposed Project would result in both short-term and long-term adverse impacts in the Project Area. Construction of the Proposed Project would lead to several temporary impacts, including interference with local traffic and freight, increased ambient noise and dust levels, changes to visual resources, park closures, utility relocations, and disruption of contaminated sites. The Proposed Project is scheduled to be completed by 2022; as such, construction-related effects would be temporary, and would not be expected to alter the long-term productivity of the Project Area or its adjacent uses. Long-term adverse impacts anticipated from the Proposed Project would include changes to visual resources, increased ambient noise levels, increased use of utilities, removal or disturbance of habitat, disruption of water resources, and disruption or mobilization of hazardous materials. These impacts would generally be minimized through the implementation of mitigation measures and/or BMPs, such that they would not substantially affect the long-term productivity of the Project Area.

Upon completion of the Proposed Project, the productivity of the Project Area would be enhanced foremost through increased coastal and/or inland flood reduction, but also through numerous co-benefits provided by the Proposed Project. Based on the existing threat of coastal and inland flooding to the Project Area, and projections of more frequent and intense flood events in the future, the Proposed Project would increase the resiliency of the communities and ecosystems within the Project Area, thereby protecting critical infrastructure and facilities, residences, businesses, cultural resources, and ecological resources from future adverse impacts anticipated under the No Action Alternative. Additionally, each Build Alternative of the Proposed Project would increase recreational opportunities in the Project Area by creating new parks and providing public access to the Hackensack River. Each Build Alternative would also create or enhance wetlands in the Project Area, and Alternatives 2 and 3 would implement extensive green infrastructure along roadways, thereby providing water quality benefits. Therefore, it is anticipated that despite having several short-term and long-term adverse impacts on the Project Area, the Proposed Project would substantially enhance the long-term productivity of the Project Area.

6.2 Irreversible and Irretrievable Commitment of Resources and Energy Consumption

The NEPA requires that an environmental analysis include identification of "…any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented" (42 USC § 4332). Irreversible and irretrievable commitments are related to the use of nonrenewable resources and the effect that this use could have on future generations.

Within the context of this EIS, 'irreversible' commitments refer to those resources which are either destroyed or otherwise altered such that they can never be recovered. Examples of irreversible commitments include the consumption of fossil fuel energy resources or the filling of wetlands. 'Irretrievable' commitments refer to those resources which are depleted for the foreseeable future, but could be recovered eventually with varying levels of effort. Examples of irretrievable commitments include the closure of recreational areas during construction of the Proposed Project that would be re-opened following construction, or the build-up of available land that could eventually be reused once existing development is removed.

Implementation of Alternatives 1, 2, and 3 would result in the irreversible or irretrievable commitment of energy and material resources during the construction and operation of the Proposed Project, including the following:

- Construction materials (e.g., soils, lumber, concrete, gravel, asphalt, metals, and water)
- Land area committed to Proposed Project components (e.g., parks, pump stations, LOP, etc.)
- Energy expended in the form of electricity, gasoline, and diesel for construction, operation, and maintenance of the Proposed Project (e.g., construction equipment, vehicles, pump stations, etc.)
- Existing habitats (e.g., wetlands) displaced by Proposed Project

Fossil fuel energy, certain construction materials (e.g., concrete), and existing habitats would be irreversibly committed to the Proposed Project, as they would materially change during use. Other construction materials (e.g., metals or soils) and land area would be irretrievably committed to the Proposed Project, as they could be recycled or reused for other purposes only if the Proposed Project was dismantled.

The use of these nonrenewable resources would be expected to account for only a small portion of the region's resources and would not affect the availability of these resources for other needs within the region. Construction activities would not result in inefficient use of energy or natural resources. Construction contractors selected would use the best available engineering techniques, construction and design practices, and equipment operating procedures. Long-term operation of Alternatives 1, 2, and 3 would not result in substantial long-term consumption of energy or natural resources.

6.3 Impacts Found Not to Be Significant

Each of the Build Alternatives would have beneficial impacts on all technical resource areas except for *Noise and Vibration* and *Air Quality and Greenhouse Gas Emissions*. Additionally, with the exception of *Sustainability/Green Infrastructure* and *Agricultural Resources and Prime Farmlands*, all technical resource areas would experience ***less-than-significant, adverse*** impacts from construction and/or operation of either Alternative 1, Alternative 2, or Alternative 3 (*Build Plan*). The No Action Alternative would be expected to have ***less-than-significant, adverse*** impacts on *Noise and Vibration* and *Air*

Quality and Greenhouse Gas Emissions. All impacts anticipated under each Build Alternative and the No Action Alternative of the Proposed Project are summarized in **Table 6.4-1**, and detailed in **Section 4.0** of this EIS.

6.4 Significant and Unavoidable Adverse Impacts

Implementation of the Proposed Project would result in ***potentially significant and unavoidable adverse*** impacts to multiple technical resource areas. Technical resource areas that could experience potentially significant adverse impacts are listed by Build Alternative below:

Alternative 1

- Land Use and Land Use Planning
- Cultural and Historical Resources
- Noise and Vibration
- Biological Resources
- Water Resources, Water Quality, and WOUS
- Hydrology and Flooding
- Hazards and Hazardous Materials

Alternative 2 and Alternative 3 (*Build Plan*)

- Cultural and Historical Resources
- Noise and Vibration
- Water Resources, Water Quality, and WOUS
- Hazards and Hazardous Materials

Additionally, it should be noted that the No Action Alternative would result in ***potentially significant, adverse*** impacts to all technical resource areas except for *Noise and Vibration* and *Air Quality and Greenhouse Gas Emissions* due to the anticipated continuation of coastal flooding during severe coastal storm events, inland flooding during heavy rainfall events, and increased exposure to the effects of climate change and sea level change. As discussed in **Section 4.10.4**, climate change would also have ***potentially significant, adverse*** impacts on the ability of the Proposed Project to provide flood reduction to the Project Area.

Impacts to these technical resource areas are summarized in **Table 6.4-1**, and detailed in **Section 4.0** of this EIS. Potentially significant adverse impacts would be minimized with implementation of appropriate mitigation measures and BMPs, as summarized in **Table 6.4-2**.

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Table 6.4-1: Impact Summary and Comparison

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Land Use and Land Use Planning	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** impacts from future flooding to existing land use (conflicts or restrictions on land use patterns or options) and zoning (zoning changes that could substantially decrease development intensity).	*Direct:* Long-term, ***potentially significant adverse*** impacts due to the displacement of 1 business; Short-term, less-than-significant adverse impacts to existing land uses during construction from temporary easements on 8.3 acres (63 parcels); Long-term, less-than-significant adverse impacts to existing land uses from permanent land easements (26.6 acres over 63 parcels, including 6 full parcel acquisitions) and potential zoning changes (12.2 acres); Long-term, beneficial impacts due to the improved utility of land use types. *Indirect:* Long-term, beneficial impacts to existing land uses from increased coastal flood protection.	*Direct:* Short-term, less-than-significant adverse impacts to existing land uses during construction from temporary easements on 5.6 acres (36 parcels); Long-term, less-than-significant adverse impacts to existing land uses from permanent land easements (45.2 acres over 61 parcels, including 3 full parcel acquisitions) and potential zoning changes (20.4 acres); Long-term, beneficial impacts due to the improved utility of land use types. *Indirect:* Long-term, beneficial impacts to existing land uses from increased inland flood protection. Additionally, short-term, less-than-significant adverse impacts to adjacent land uses (275 parcels) during construction in public rights-of-way; Long-term, less-than-significant adverse impacts on land use compatibility with Teterboro Airport and on aviation safety from increased wildlife hazards.	*Direct:* Same as Alternative 2, except there would be fewer temporary easement impacts (5.6 acres on 34 parcels), fewer permanent easement impacts (31.8 acres over 55 parcels, including 2 full parcel acquisitions), and fewer zoning changes (8.0 acres). *Indirect:* Beneficial impacts would be the same as Alternative 2, but adverse impacts would be slightly less than Alternative 2 due to fewer impacted adjacent land uses (242 parcels) and a decrease in proposed habitat improvements (i.e., fewer wildlife hazards).
Visual Quality / Aesthetics	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** impacts from degradation of, or loss of access to, a high-value visual resource due to future flooding.	*Direct:* Short-term, less-than-significant adverse impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 4a (Commercial/Industrial Area) and Landscape Unit 5 (Hackensack River Waterfront Area) during construction; Long-term, less-than-significant adverse impacts to the natural harmony, cultural order, and visual quality of Landscape Unit 4a from proposed LOP elements; Long-term, beneficial impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 5 from proposed waterfront improvements. *Indirect:* Long-term, beneficial impacts to the visual sensitivity of the viewing population to visual resources within Landscape Unit 4a and Landscape Unit 5, and to visual resources within all landscape units due to increased flood protection against coastal storm surges.	*Direct:* Short-term, less-than-significant adverse impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 2 (Residential Area), Landscape Unit 4a, and Landscape Unit 5 during construction; Long-term, beneficial impacts to the natural harmony, cultural order, and visual quality within Landscape Unit 2, Landscape Unit 4a, and Landscape Unit 5 from proposed waterfront improvements. *Indirect:* Long-term, beneficial impacts to the visual sensitivity of the viewing population to visual resources within Landscape Unit 2, Landscape Unit 4a, and Landscape Unit 5, and to visual resources within all landscape units due to increased flood protection against inland flooding.	*Direct:* Impacts would be the same as Alternative 2 in Landscape Unit 4a, but adverse and beneficial impacts in Landscape Unit 2 and Landscape Unit 5 would be slightly less because Fluvial Park, DePeyster Creek Park, and Losen Slote pump station C and its force main would not be constructed. *Indirect:* Alternative 3 would not include Fluvial Park and DePeyster Park within Landscape Unit 5 and Losen Slote pump station C and its force main in Landscape Unit 2; therefore, the beneficial impacts to visual sensitivity and increased flood protection would be slightly less than Alternative 2.
Socioeconomics, Community / Populations, and Housing	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** impacts from future flooding to public safety; business finances, employment, access, and services; demographic composition; and/or journey-to-work times.	*Direct:* Short-term and long-term, less-than-significant adverse impacts to businesses and residents in the Project Area from land acquisition, traffic/limited access, dust, noise, and vibration during construction; Long-term, less-than-significant adverse impacts to vacant buildings that would be demolished during construction; Short-term and-long term, beneficial impacts from created jobs during construction (990 job-years) and operation (20 annual jobs); Long-term, beneficial impacts on social amenities due to increased access to greenspace and the Hackensack River waterfront. *Indirect:* Long-term, beneficial effects to sense of safety, community infrastructure, property values, employment, and resident/visitor perceptions from increased coastal storm surge protection.	*Direct:* Short-term and long-term, less-than-significant adverse impacts to businesses, schools, municipal facilities, and residents in the Project Area from land acquisition, traffic/limited access, dust, noise, and vibration during construction; Short-term and long-term, beneficial impacts from created jobs during construction (1,000 job-years) and operation (22 annual jobs); Long-term beneficial effects on social amenities due to increased access to greenspace and the Hackensack River waterfront. *Indirect:* Long-term beneficial effects to community infrastructure, property values, and resident/visitor perception from increased protection against inland flooding.	*Direct:* Same as Alternative 2, except there would be approximately 640 job-years created during construction and 16 annual jobs during operation. *Indirect:* Slightly less beneficial effects than Alternative 2 since there would be fewer stormwater drainage improvements constructed, thereby providing less protection against inland flooding.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Environmental Justice	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts from future flooding to housing, public/community safety, long-term employment, short-term and/or long-term access to community facilities, and/or demographic composition.	*Direct:* Short-term, <u>less-than-significant</u> adverse impacts to EJ populations from dust, noise, vibration, traffic/access restrictions during construction (there are 13 residential units within 100 feet of the proposed LOP; all 13 units occur in areas where the percentage of EJ populations exceeds County thresholds); Short-term, <u>beneficial</u> impacts from created jobs during construction and operation. *Indirect:* Long-term, <u>beneficial</u> effects to EJ community infrastructure, sense of safety, housing and property values, and long-term employment from increased coastal flood protection.	*Direct:* Same as Alternative 1, except there are 385 residential units within 100 feet of the proposed footprint, and some of these units occur in areas where the percentage of EJ populations exceeds County thresholds: 219 units are in areas where the percentage of persons in poverty is higher; 287 units are in areas where the percentage of minority persons is higher, and 383 units are in areas where the percentage of LMI persons is higher. *Indirect:* Long-term, <u>beneficial</u> effects from reduced damages to EJ community infrastructure from reduced inland flooding.	*Direct:* Same as Alternatives 1 and 2, except there are 339 residential units within 100 feet of the proposed features in areas where the percentage of EJ populations exceeds County thresholds: 204 units are in areas where the percentage of persons in poverty is higher; 264 units are in areas where the percentage of minority persons is higher, and 337 units are in areas where the percentage of LMI persons is higher. *Indirect:* Slightly less beneficial effects than Alternative 2 since there would be fewer stormwater drainage improvements constructed, thereby providing less protection against inland flooding.
Cultural and Historical Resources	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts from future flooding to the character-defining features, viewshed, acoustic environment, or other environmental component of historic resources.	*Direct:* Long-term, ***<u>potentially significant adverse</u>*** impacts to known or unanticipated archaeological sites (5 high archaeological sensitivity areas), and to the US Route 46 Bascule Bridge; Short-term, <u>less-than-significant</u> adverse effects to the US Route 46 Bascule Bridge from dust, noise, and vibration during construction. *Indirect:* Long-term, ***<u>potentially significant adverse</u>*** impacts to the viewshed of the US Route 46 Bascule Bridge; Short-term, <u>less-than-significant</u> adverse effects to the physical and acoustic environment of the US Route 46 Bascule Bridge and 4 potentially NRHP-eligible historic architectural resources within the indirect APE during construction; Long-term, <u>less-than-significant</u> adverse effects to the viewshed of 4 potentially NRHP-eligible historic architectural resources in the Project Area; Long-term <u>beneficial</u> effects to the protection of archaeological and historic architectural resources from increased coastal flood protection.	*Direct:* Same as Alternative 1, including the long-term, ***<u>potentially significant adverse</u>*** impacts, except there are only 3 high archaeological sensitivity areas associated with Alternative 2. *Indirect:* Same as Alternative 1, including the long-term, ***<u>potentially significant adverse</u>*** impacts, except there is only 1 potentially NRHP-eligible historic architectural resource (besides the US Route 46 Bascule Bridge) that would experience short-term, <u>less-than-significant</u> adverse effects to the physical and acoustic environment during construction and long-term, <u>less-than-significant</u> adverse effects to the viewshed. Additionally, beneficial effects would be associated with reduced inland flooding instead of reduced coastal flooding.	*Direct:* Slightly less long-term, ***<u>potentially significant adverse</u>*** impacts than Alternative 2 since there are only 2 high archaeological sensitivity areas associated with Alternative 3, and the US Route 46 Bascule Bridge would not be impacted. *Indirect:* Slightly less adverse impacts than Alternative 2 since there would be no indirect impacts to the US Route 46 Bascule Bridge (and therefore no potentially significant indirect impacts), and slightly less beneficial effects since there would be fewer stormwater drainage improvements constructed.
Transportation and Circulation	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts from future flooding to traffic, safety, available parking, pedestrian and bicycle facilities, transit demand, and/or freight operations.	*Direct:* Short-term, <u>less-than-significant</u> adverse impacts to traffic and circulation (87 additional vehicles projected in the AM peak hour in the peak month), on-street parking supply, and transit and freight services during construction; Long-term, <u>less-than-significant</u> adverse impacts to traffic (6 additional vehicle trips are projected in the weekday AM and PM peak hours) and the NJ Transit railroad track (suspended service during major flood events) during operation; Long-term, <u>beneficial</u> effects to pedestrian transportation and circulation from proposed paths, walkways, and boat dock/kayak launch. *Indirect:* Long-term, <u>beneficial</u> effects to the sustainability of existing transportation and circulation from increased coastal flood protection.	*Direct:* Generally the same as Alternative 1, except only 59 additional vehicles are projected in the AM peak hour in the peak month during construction, and only 5 additional vehicle trips are projected in the weekday AM and PM peak hours during operations. Additionally, there would be short-term, <u>less-than-significant</u> adverse impacts to the Seaman Lead due to the removal and replacement of a railroad bridge, and to pedestrian circulation due to sidewalk closures, during construction; however, there would be no impacts to the NJ Transit railroad track under this alternative. *Indirect:* Same as Alternative 1, except <u>beneficial</u> effects would be associated with inland flooding instead of coastal flooding.	*Direct:* Slightly less than Alternative 2, as only 54 additional vehicles are projected in the AM peak hour in the peak month during construction, and only 3 additional vehicle trips are projected in the weekday AM and PM peak hours during operation; impacts to road/lane closures and parking during construction would be slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed, but impacts to transit and freight services and pedestrian circulation would be the same as Alternative 2. *Indirect:* Slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed, thereby providing less protection against inland flooding.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Noise and Vibration	*Direct:* No direct impacts. *Indirect:* Less-than-significant adverse impacts due to increased vibration and noise levels from traffic congestion and the diversion of vehicles in flooded areas.	*Direct:* Short-term, ***potentially significant adverse*** impacts to properties and buildings from noise and vibration due to construction activities; Short-term, less-than-significant adverse impacts to marine life from noise during construction, Long-term, less-than-significant adverse impacts to properties due to increased noise during operation from generators at one pump station. *Indirect:* No indirect impacts.	*Direct:* Impacts would be similar to, but slightly greater than, those under Alternative 1, including the short-term, ***potentially significant adverse*** impacts, since more properties and buildings have the potential to be impacted by noise and vibration during construction, and there would be generators at three pump stations during operations. *Indirect:* No indirect impacts (same as Alternative 1).	*Direct:* Impacts from noise and vibration during construction, including the short-term, ***potentially significant adverse*** impacts, would be slightly less than under Alternative 2, but greater than under Alternative 1, and there would be generators at two pump stations during operations. *Indirect:* No indirect impacts (same as Alternatives 1 and 2).
Air Quality and Greenhouse Gas Emissions	*Direct:* No direct impacts. *Indirect:* Less-than-significant adverse impacts on regional air quality due to traffic congestion and diversion of vehicles in flooded areas, fugitive dust from flooding carrying fine sediments into the Project Area, and to human health of sensitive populations due to negligible emissions of criteria pollutants and HAPs within an attainment area.	*Direct:* Short-term and long-term, less-than-significant adverse impacts to air quality and human health of sensitive populations in the Project Area due to criteria pollutant and HAP emissions; criteria pollutant emissions would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans; HAP emissions would not would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans. *Indirect:* Short-term, less-than-significant adverse impacts outside the Project Area due to criteria pollutant and HAP emissions; criteria pollutant emissions would not cause a NAAQS exceedance, change the category of non-attainment status, or conflict with applicable air quality plans; HAP emissions would not would not exceed major source thresholds or health benchmarks, or conflict with applicable air quality plans.	*Direct:* Impacts would be similar to Alternative 1, except criteria pollutant and GHG emissions would be slightly less, and HAP emissions would be slightly greater. *Indirect:* Impacts would be similar to Alternative 1, except criteria pollutant and GHG emissions would be slightly less, and HAP emissions would be slightly greater.	*Direct:* Impacts would be similar to Alternatives 1 and 2, except criteria pollutant, HAP, and GHG emissions would be slightly less than both Alternatives 1 and 2. *Indirect:* Impacts would be similar to Alternatives 1 and 2, except criteria pollutant, HAP, and GHG emissions would be slightly less than both Alternatives 1 and 2.
Global Climate Change and Sea Level Change	***Potentially significant adverse*** impacts on the study area from future coastal and inland flooding, and because the effects of climate change and SLR would not be addressed.	***Potentially significant adverse*** impacts from climate change and SLR to the overall performance of Alternative 1 over time, and from future increased precipitation and inland flooding; Beneficial impacts through increased coastal flood protection.	***Potentially significant adverse*** impacts from future coastal flooding in the Project Area over time, and from climate change and SLR on the overall performance of Alternative 2 over time; Beneficial impacts to the Project Area through increased flood protection against inland flooding.	Same as Alternative 2, including the ***potentially significant adverse*** impacts, except benefits would be slightly less since Losen Slote pump station C and its force main would not be constructed, thereby providing less protection against inland flooding.
Recreation	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** impacts from damage, reduced visitation, and/or reduced accessibility to recreational resources due to future flooding.	*Direct*: Short-term, less-than-significant adverse impacts to the accessibility of recreational resources (i.e., public access to Riverside Boat Works and boat access at the Riverside Boat Works Marina and Little Ferry Marina) during construction; Long-term, beneficial effects due to the creation of new recreational resources (10.1 acres of new public recreational land) and improved accessibility (approximately 9,270 LF of new public paths and walkways, 0.2 acre of parking areas, and a new boat dock/kayak launch). *Indirect:* Long-term, beneficial effects to supply, capacity, and access to recreational resources from increased coastal flood protection.	*Direct:* Short-term, less-than-significant adverse impacts to the accessibility of recreational resources during construction due to lane closures and the establishment of staging areas in the parking lots and driveways of Little Ferry Public Schools, Robert Craig Elementary School, Joseph Street Park, and Willow Lake Park; Beneficial effects would be greater than under Alternative 1 since more land (20.0 acres) would be converted to accessible, public recreational land and there would be more accessibility improvements (9,900 LF of new trails and walkways, the conversion of existing private boat docks and a boat launch into public use, and a new kayak launch). *Indirect:* Same as Alternative 1, except beneficial effects would be associated with inland flooding instead of coastal flooding.	*Direct:* Adverse impacts to accessibility would be the same as Alternative 2; Beneficial effects would be less than both Alternatives 1 and 2 since less land would be converted to accessible, public recreational land (7.6 acres) and there would be less accessibility improvements (6,400 LF of new trails and walkways and the conversion of existing private boat docks and a boat launch into public use). *Indirect:* Slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed, thereby providing less protection against inland flooding.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Utilities and Service Systems	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts on utility services by damaging infrastructure, increasing utility prices, and/or increasing service disruptions due to future flooding.	*Direct:* Short-term, <u>less-than-significant</u> adverse impacts to the supply, demand, capacity, and availability of utility services during construction; Long-term, <u>less-than-significant</u> adverse impacts to existing demand for electricity (from public lighting features and the Berry's Creek storm surge barrier), solid waste (from public parks and pathways), and telecommunication services (from a landline telephone at the Berry's Creek storm surge barrier). *Indirect:* Long-term, <u>beneficial</u> effects from increased coastal flood protection, which would reduce damages to utilities infrastructure and service disruptions, and decrease utility prices.	*Direct:* Same as Alternative 1, except electricity demands would be from public lighting features and the three proposed pump stations, and there would be no long-term demand for telecommunication services. Additionally, there would be long-term, <u>beneficial</u> impacts on stormwater drainage due to the proposed East Riser Ditch improvements and three new pump stations. *Indirect:* Same as Alternative 1, except <u>beneficial</u> effects would be associated with inland flooding instead of coastal flooding.	*Direct:* Slightly less than Alternative 2 since fewer Proposed Project components would be constructed, thereby reducing potential construction impacts, operational utility demands, and beneficial impacts to stormwater drainage. *Indirect:* Slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed, thereby providing less protection against inland flooding.
Public Services	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts on public services by increasing service disruptions, response times, and/or demand, and from reducing access, supply, capacity, and/or reliability due to future flooding.	*Direct*: Short-term, <u>less-than-significant</u> adverse impacts to response times of public services due to road and/or lane closures during construction. *Indirect:* Short-term, <u>less-than-significant</u> adverse impacts to demand for public services during construction due to an influx of construction workers; Long-term, <u>beneficial</u> impacts to public service demand (fewer flood-related emergencies) and service reliability (fewer service interruptions and road closures) due to increased flood protection against coastal storm surges.	*Direct:* Impacts to response times would be slightly less than Alternative 1 because no road closures or realignments are proposed and lane closures under Alternative 2 are anticipated to be shorter in duration; however, Alternative 2 would have additional short-term, <u>less-than-significant</u> adverse impacts to access to public service facilities due to temporary lane closures and staging areas, and to disruption of public service facilities from increased noise during construction. *Indirect:* Generally the same as Alternative 1, but <u>beneficial</u> effects would be associated with inland flooding instead of coastal flooding.	*Direct:* Slightly less than Alternative 2 since fewer Proposed Project components would be constructed, and therefore fewer impacts on response times, facility access, and disruptions from noise would be expected. *Indirect:* Adverse impacts would be slightly less than Alternative 2 due to fewer anticipated construction workers; <u>beneficial</u> effects would be slightly less since fewer stormwater drainage improvements would be constructed, thereby providing less protection against inland flooding.
Biological Resources	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts from shoreline erosion, habitat alterations, reduction of ecological function, and/or increases in turbidity, sedimentation, or nutrient/contaminant inputs due to future flooding.	*Direct:* Long-term, ***<u>potentially significant adverse</u>*** impacts to aquatic habitats from dredge and fill activities; Short-term and long-term, <u>less-than-significant</u> adverse impacts to terrestrial habitats from vegetation removal; Short-term, <u>less-than-significant</u> impacts to terrestrial and aquatic habitats, wildlife (including threatened and endangered species), and EFH during construction (including increased turbidity, physical disturbance, and noise/vibration); Long-term, <u>less-than-significant</u> adverse impacts to aquatic habitats during operation from minor hydrology alterations, and to aquatic and terrestrial wildlife from limited loss of habitat; Long-term, <u>beneficial</u> impacts to terrestrial and aquatic habitats and wildlife from the removal of invasive species and proposed habitat enhancements. Under Alternative 1, about 6.3 acres of uplands would be impacted (4.0 acres permanently, 2.3 acres temporarily), and 7.4 acres of aquatic habitats would be impacted (5.9 acres permanently, 1.5 acres temporarily). Approximately 1.1 acres of vegetative habitat enhancements, and 1.1 acres of wetlands, would be created or enhanced. *Indirect:* Long-term, <u>less-than-significant</u> adverse impacts to terrestrial and aquatic wildlife (including threatened and endangered species) due to reductions in riparian habitat and increased human activity; Long-term <u>beneficial</u> effects to aquatic habitats and wildlife from the removal of invasive plants and improvements to wetlands, and to habitats from increased protection against coastal flooding and SLR, and decreasing turbidity, sedimentation, and nutrient/contaminant inputs.	*Direct:* Short-term, <u>less-than-significant</u> adverse impacts to terrestrial habitats from vegetation removal and disturbance during construction, and to terrestrial and aquatic habitats, wildlife (including threatened and endangered species), and EFH during construction (including increased turbidity, physical disturbance, and noise/vibration); Long-term, <u>beneficial</u> impacts to terrestrial and aquatic habitats and wildlife from proposed habitat and wetland enhancements. Under Alternative 2, approximately 20.3 acres of uplands would be impacted (0.6 acre permanently, 19.7 acres temporarily), and approximately 5.3 acres of aquatic habitats would be impacted (0.1 acre permanently, 5.2 acres temporarily). Additionally, approximately 11.9 acres of vegetative enhancements, and 7.2 acres of wetlands, would be created or enhanced. *Indirect:* Long-term, <u>less-than-significant</u> adverse impacts to terrestrial and aquatic wildlife, including threatened and endangered species, due to increased human activity; Long-term, <u>beneficial</u> effects to aquatic habitats and wildlife from anticipated reductions in sedimentation, turbidity, and nutrient/contaminant inputs in aquatic habitats.	*Direct:* Under Alternative 3, adverse impacts and <u>beneficial</u> effects would be slightly less than Alternative 2 due to fewer stormwater drainage improvements being constructed. Approximately 12.9 acres of uplands would be impacted (0.6 acre permanently, 12.3 acres temporarily), and approximately 4.0 acres of aquatic habitats would be impacted (0.1 acre permanently, 3.9 acres temporarily). Additionally, approximately 3.5 acres of wetlands would be created or enhanced. *Indirect:* Adverse and beneficial impacts would be slightly less than under Alternative 2 since Fluvial Park, DePeyster Creek Park, and the Losen Slote pump station C and its force main would not be constructed.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Geology and Soils	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts to soil resources through an increase in the potential for land subsidence within the Project Area and an increase in turbidity, sedimentation, nutrient input, and contaminant input due to soil erosion from future flooding.	*Direct:* Short-term, <u>less-than significant</u> adverse impacts to existing geologic and soil conditions in the Project Area during construction (approximately 39 acres of land disturbance and 84,900 CY of soil removed); Long-term, <u>beneficial</u> impacts to soil resources due to a slight decrease in impervious surface area (approximately 0.8-acre decrease). *Indirect:* Short-term, <u>less-than-significant</u> adverse impacts on the exposure of people within the Project Area to radon; Long-term, <u>beneficial</u> effects from reduced hydrocompaction, soil erosion, turbidity, sedimentation, and nutrient/contaminant transport due to reduced coastal flooding.	*Direct:* Same as Alternative 1, except there would be approximately 51 acres of land disturbance and 32,300 CY of soils removed during construction and the long-term decrease in impervious area would be approximately 3.4 acres. *Indirect:* Same as Alternative 1, except there would be no reduction in hydrocompaction since Alternative 2 would not address coastal flooding.	*Direct:* Adverse impacts would be slightly less than Alternative 2 since there would be less ground-disturbing activities and 28,000 CY of potentially contaminated soil would be removed; <u>beneficial</u> effects would be slightly greater than Alternative 2 since the long-term decrease in impervious area would be approximately 3.7 acres. *Indirect:* Adverse impacts and <u>beneficial</u> effects would be slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed.
Water Resources, Water Quality, and Waters of the US	*Direct:* No direct impacts. *Indirect:* ***<u>Potentially significant adverse</u>*** impacts from future flooding to surface water quality and quantity (including scour and transport of sediment, nutrients, and pollutants); groundwater flow, quantity, and quality; and/or the hydrology of WOUS or State-regulated waterbodies or wetlands.	*Direct:* Long-term, ***<u>potentially significant adverse</u>*** impacts to surface water quantity, flow, and quality from construction in surface waters, and to wetlands, open waters, wetland functions and services, and riparian zones from construction in wetlands or open water; Short-term <u>less-than-significant</u> adverse impacts to localized surface water flow and quality, and to wetland areas, functions, and services, and riparian zones from construction activities; Short-term and long-term <u>less-than significant</u> adverse impacts to localized groundwater flow and quality during construction and operation; Long-term, <u>beneficial</u> effects to wetland functions and services where wetlands would be enhanced or created. Under Alternative 1, approximately 2.8 acres of wetlands would be impacted (1.2 acres permanently, 1.6 acres temporarily), 1.5 acres of open waters would be impacted (1.0 acre permanently, 0.5 acre temporarily), and 11.1 acres of riparian zones would be impacted (8.8 acres permanently, 2.3 acres temporarily). Approximately 1.1 acres of wetlands would be created or enhanced. *Indirect*: Short-term, <u>less-than-significant</u> adverse impacts to surface water from construction activities; Long-term, <u>less-than-significant</u> adverse impacts to wetland area, functions, and services upstream of the proposed tide gate on the unnamed tributary to the Hackensack River; Long-term, <u>beneficial</u> effects to surface water quantity, flow, quality, and sediment quality and transport by increasing coastal flood protection, to wetland functions and services by providing protection from SLR effects and increasing coastal flood protection, and to localized surface water quality from proposed parks and habitat enhancements.	*Direct:* Long-term, ***<u>potentially significant adverse</u>*** impacts to surface water quantity, flow, and quality from proposed construction over the Hackensack River, to localized sediment and contaminant transport in East Riser Ditch and Losen Slote, and to wetlands, open waters, wetland functions and services, and riparian zones from construction in wetlands or open waters; Short-term <u>less-than-significant</u> adverse impacts to localized surface water flow and quality, to groundwater flow and quality, and to wetland areas, functions, and services, and riparian zones from construction activities; Long-term <u>less-than-significant</u> adverse impacts to groundwater quality during operation of green infrastructure systems from the localized accumulation of contaminants; Long-term, <u>beneficial</u> effects to wetland functions and services were wetlands would be created or enhanced. Under Alternative 2, approximately 4.5 acres of wetlands would be impacted (0.3 acre permanently, 4.2 acres temporarily), 5.4 acres of open waters would be impacted (0.3 acre permanently, 5.1 acres temporarily), and 8.7 acres of riparian zones would be impacted (1.4 acres permanently, 7.3 acres temporarily). Approximately 7.2 acres of wetlands would be created or enhanced. *Indirect:* Short-term <u>less-than-significant</u> adverse impacts to surface water from vegetation removal and grading activities during construction; Long-term <u>less-than-significant</u> adverse impacts to surface water flow, water quality, and sediment and contaminant transport downstream of proposed Losen Slote force main discharges and in the upper reach of East Riser Ditch; Long-term <u>beneficial</u> effects to surface water quantity, flow, quality, and sediment and contaminant transport, and to off-site wetland functions and services from proposed improvements and enhancements.	*Direct:* Adverse impacts (including the long-term, ***<u>potentially significant adverse</u>*** impacts) and <u>beneficial</u> effects would be slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed. Under Alternative 3, approximately 3.4 acres of wetlands would be impacted (0.3 acre permanently, 3.1 acres temporarily), 3.8 acres of open waters would be impacted (0.3 acre permanently, 3.5 acres temporarily), and 4.9 acres of riparian zones would be impacted (0.8 acre permanently, 4.1 acres temporarily). Approximately 3.5 acres of wetlands would be created or enhanced. *Indirect:* Adverse impacts and <u>beneficial</u> effects would be slightly less than Alternative 2 since fewer stormwater drainage improvements would be constructed.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Hydrology and Flooding	*Direct:* ***Potentially significant adverse*** impacts by permanently altering hydrology, flooding, or flood elevations; substantially and/or permanently disrupting the water table due to changes in surface water runoff; and substantially and/or permanently increasing normal water or flood levels. Over time, depending on SLR, an additional 11 to 26 percent of the Project Area could be at risk of coastal flooding during a 50-year storm surge. *Indirect:* No indirect impacts.	*Direct:* Short-term, less-than-significant adverse impacts to existing flood protection (berms) during construction; Long-term, less-than-significant adverse impacts to the normal water surface elevations of waterways in the Project Area due to disrupted groundwater movement from the LOP; Long-term, beneficial effects to the Project Area due to reduced coastal flooding, reduced impervious surfaces, and improved stormwater management in localized areas. During a 50-year storm surge, Alternative 1 would provide coastal flood protection to between 12 and 21 percent of the Project Area, as compared to the No Action Alternative, depending on SLR. *Indirect:* Long-term, ***potentially significant adverse*** impacts to developed areas outside the Project Area resulting from induced coastal flooding.	*Direct:* Long-term, less-than-significant adverse impacts to the groundwater table in localized areas; Long-term, beneficial effects to the Project Area due to reduced inland flooding from increased stormwater infiltration and conveyance capacity. Under Alternative 2, flood depths in the lower reach of East Riser Ditch would be reduced between 2.5 and 2.9 feet during a 2-year storm and between 1.6 and 2.2 feet during a 100-year storm, with residual flood reduction in the upper reach of East Riser Ditch. During a 100-year storm, approximately 182 buildings would receive inland flood protection against East Riser Ditch, totaling approximately $7.8M in avoided damages. For Losen Slote, flood depths would be reduced by up to 0.9 foot in the Main Reach between approximately Bertolotto Avenue and Niehaus Avenue, and by up to 0.6 foot in the Park Street Reach between its confluence with the Main Reach and approximately the south end of Teresa Court. Approximately 60 buildings would receive inland flood protection against Losen Slote during a 100-year storm, totaling approximately $1.1M in avoided damages. *Indirect:* No indirect impacts.	*Direct:* Generally the same as Alternative 2, except Alternative 3 would not provide flood reduction in the Park Street Reach of Losen Slote due to Losen Slote pump station C and its force main not being constructed. As such, only 44 buildings would receive inland flood protection against Losen Slote, totaling approximately $0.6M in avoided damages. *Indirect:* No indirect impacts (Same as Alternative 2).
Coastal Zone Management	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** impacts from increased long-term risks of coastal zone resources to identifiable hazards, reduced value of the coastal zone, alteration or diminishment of the coastal zones, and/or failure to achieve CZM compliance due to future flooding.	*Direct:* Short-term and long-term, less-than-significant adverse impacts to coastal zone-regulated areas and coastal resources in the Project Area during construction; Long-term, less-than-significant adverse impacts to existing marina access; Long-term, beneficial impacts to public open space, flood hazard areas, and public use due to increased public open spaces and recreational opportunities. *Indirect:* Long-term, beneficial effects to the coastal economy, human health, traffic, and human activities by increasing coastal flood protection.	*Direct:* Same as Alternative 1, except there would be no impacts to marina access, and beneficial effects due to increased public open spaces and recreational opportunities would extend to riparian zones and stormwater management/water quality. *Indirect:* Same as Alternative 1, except beneficial effects would be associated with inland flooding instead of coastal flooding.	*Direct:* Adverse impacts and beneficial effects would be slightly less than Alternative 2 since fewer Proposed Project components would be constructed. *Indirect:* Slightly less than Alternative 2 since Losen Slote pump station C and its force main would not be constructed.
Sustainability / Green Infrastructure	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** impacts from future flooding to drainage patterns that could increase the runoff rate to receiving waters without water quality treatment.	*Direct:* Long-term, beneficial impacts to hydrology due to a decrease in impervious surfaces (a net decrease of 0.8 acre), to communities through increased open space (four new parks and 10.1 acres of public open space, as well as 1.1 acres of created wetlands), to the quality of runoff due to decreased peak runoff rates from drainage enhancements, and to the coastal economy, human health, and human activities from reduced flooding and associated damages. *Indirect:* Long-term, beneficial effects by inducing activities that increase the future potential for green infrastructure construction through demonstrating the performance and community benefits of green infrastructure as part of open space improvements.	*Direct:* Slightly greater than Alternative 1 since there would be a net decrease of 3.4 acres of impervious surfaces, five new parks and 20.0 acres of public open space, 7.2 acres of wetland creation and/or enhancement, and improvements to the quantity, as well as quality, of runoff due to both decreased peak runoff rates and stormwater management through the installation of 41 green infrastructure systems. *Indirect:* Same as Alternative 1.	*Direct:* While there would be a net decrease of 3.7 acres of impervious surfaces under Alternative 3, beneficial impacts would overall be slightly less than Alternative 2 due to the exclusion of two new parks (only 7.6 acres of public open space), only 3.7 acres of wetland creation and/or enhancement, and some decreases in stormwater conveyance capacity since only one pump station and force main would be built for Losen Slote. *Indirect:* Slightly less than Alternative 2 since fewer Proposed Project components would be constructed.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Hazards and Hazardous Materials	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** from future flooding to contaminated sites, the potential introduction or mobilization of contaminants, and/or conflicts with existing or planned remedial investigations.	*Direct:* Short-term, ***potentially significant adverse*** impacts from potentially triggering near-term remediation under the ISRA during construction; Long-term, ***potentially significant adverse*** impacts from the disruption or mobilization of previously known hazardous materials encountered during construction; Short-term, less-than-significant adverse impacts from subsurface disturbance of hazardous materials at known or suspected contaminated sites during construction, and to planned remedial activities that could be delayed temporarily; Short-term and long-term, less-than-significant adverse impacts from potential spills (e.g. gasoline and diesel) during construction and operational activities; Long-term beneficial impacts from the removal of potentially contaminated soils during construction (84,900 CY). Under Alternative 1, up to 13 contaminated sites could be directly impacted. *Indirect:* Long-term, ***potentially significant adverse*** impacts from potential creation of VOC/methane preferential pathways, mobilization of contaminant plumes in soil or groundwater, risk of thermal radiation or blast-overpressure damage from one aboveground storage tank (AST), and interference with future remedial investigations; Long-term, beneficial impacts from the protection of contaminated sites from the erosive effects of coastal flooding. Under Alternative 1, up to 11 contaminated sites could be indirectly impacted.	*Direct:* Same as Alternative 1, including the short- and long-term, ***potentially significant adverse*** impacts, except there are 20 contaminated sites that potentially could be impacted directly by Alternative 2, 32,300 CY of potentially contaminated soil would be exported, and long-term, beneficial impacts could also be realized from the capping of potentially contaminated soil by Alternative 2 components. *Indirect:* Same as Alternative 1, including the long-term, ***potentially significant adverse*** impacts, except there are 20 contaminated sites that potentially could be impacted indirectly by Alternative 2, and beneficial impacts would be realized from reduced erosive effects of inland flooding instead of coastal flooding. Additionally, there would be long-term, less-than-significant adverse impacts from localized increases in water velocity that could cause scour and mobilize contaminated sediments in East Riser Ditch and Losen Slote.	*Direct:* There are 19 contaminated sites that potentially could be impacted directly by Alternative 3, but adverse impacts (including the short- and long-term, ***potentially significant adverse*** impacts) and benefits would be slightly less than Alternative 2 since there would be less ground-disturbing activities, and only 28,000 CY of potentially contaminated soil would be exported. *Indirect:* There are 19 contaminated sites that potentially could be impacted indirectly by Alternative 3, but adverse impacts (including the long-term, ***potentially significant adverse*** impacts) and benefits would be slightly less than Alternative 2 since there would be less ground-disturbing activities (for example, a lower risk of scouring the Losen Slote channel because the Losen Slote C pump station and its force main would not be constructed).
Mineral and Energy Resources	*Direct:* No direct impacts. *Indirect:* ***Potentially significant adverse*** effects from future flooding to energy resources due to the increase of long-term risks to identifiable hazards, increases in consumer prices, a minimal diminishment of these resources in the Project Area, and/or short-term decreases in their supply, availability, or capacity.	*Direct:* Short-term, less-than-significant adverse impacts to the supply, availability, capacity, or costs of mineral and energy resources during construction. *Indirect:* Long-term, beneficial effects from increased coastal flood protection, which would reduce damages to energy resources; benefit their supply, availability, capacity, and cost; and commensurately reduce the need for reconstruction and rebuilding of facilities damaged by flood events, thereby reducing potential future need/use of mineral resources.	*Direct:* Slightly less than Alternative 1 since the amounts of mineral and energy resources required for construction are less for most materials. *Indirect:* Same as Alternative 1, except beneficial effects would stem from increased inland flood protection.	*Direct:* Slightly less than Alternative 2 since fewer Proposed Project components would be constructed, and fewer mineral and energy resources would be required. *Indirect:* Slightly less than Alternative 2 since the Losen Slote pump station C and its force main would not be constructed.

Resource Area	No Action Alternative	Alternative 1: Structural Flood Reduction	Alternative 2: Stormwater Drainage Improvement	Alternative 3: Hybrid
Agricultural Resources and Prime Farmland	*Direct:* No direct impacts. *Indirect:* Less-than-significant adverse impacts from the long-term risk of community and residential gardens to identifiable hazards and/or the prohibition of the use of and access to community and residential gardens for future agricultural use due to future flooding.	*Direct:* No direct impacts. *Indirect:* Long-term, beneficial effects on residential and community gardens due to increased coastal flood protection.	*Direct:* No direct impacts (Same as Alternative 1). *Indirect:* Same as Alternative 1, except beneficial effects would stem from increased inland flood protection and stormwater drainage improvements.	*Direct:* No direct impacts (Same as Alternatives 1 and 2). *Indirect:* Slightly less than Alternative 2 since there would be fewer stormwater drainage improvements.

Table 6.4-2: Mitigation Measures/BMPs Identified to Reduce Potentially Significant Impacts Under Alternatives 1, 2, and 3

<table>
<tr><th rowspan="2">Technical Resource Area</th><th colspan="4">Mitigation Measures and BMPs</th></tr>
<tr><th>Applicable to All Alternatives</th><th>Applicable to Alternative 1</th><th>Applicable to Alternative 2</th><th>Applicable to Alternative 3</th></tr>
<tr><td>Land Use and Land Use Planning</td><td>During Design/Coordination/Pre-Construction:
• The need for both temporary and permanent easements would be minimized to the extent possible.
• Coordination with affected property owners and zoning districts would be conducted to obtain mutually agreeable settlements and to proactively prepare for required zoning changes.
During Construction:
• BMPs would be implemented, as necessary, based on adjacent land uses, to minimize transportation, noise and vibration, and air quality impacts to residences and businesses (see relevant resource areas below for more detail).
During Operations:
• Measures to minimize the potential for wildlife hazards to human health and safety from aircraft collisions would be implemented (e.g., use of approved plant species, coordination with FAA and Teterboro Airport, etc.).</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.
Additionally:
During Design/Coordination/Pre-Construction:
• Consultation with FAA would be conducted to ensure compliance with NEPA, FAA Orders 1050.1F and 5050.4B, FAA AC No. 150/5200-33B, and the Teterboro Airport Wildlife Hazard Management Plan.
• Consultation with Teterboro Airport and other applicable cooperating agencies would be conducted to confirm that there are no plans to purchase the properties for a RPZ program within the 2,500-foot buffer zone; any required notices in compliance with 24 CFR Part 51, Subpart D would be implemented.
During Construction:
• Small construction equipment (i.e., less than 200 feet in height) would be utilized to avoid potential navigational airspace hazards associated with the use of tall equipment near Teterboro Airport in accordance with 14 CFR Part 77.
• Construction near Teterboro Airport runways would occur during daylight hours to eliminate potential impacts from bright construction lighting.</td><td>Same as Alternative 2.</td></tr>
<tr><td>Visual Quality/Aesthetics</td><td>During Design/Coordination/Pre-Construction:
• Consultation with the NJHPO would be conducted to ensure protection and management of cultural and aesthetic components within the viewshed.
• Use of vegetated screening and/or material colors that blend into the existing environment and materials that are non-reflective would be incorporated into the design to promote natural harmony and project coherence and to reduce changes in viewer awareness to the Proposed Project elements, respectively.
• Native vegetation would be used, whenever possible, when creating, enhancing, or restoring vegetated areas.
During Construction:
• Use of screening fences in a similar color to the natural environment to block the view of construction equipment and other materials.
During Operations:
• Sealants on concrete structures would be used and maintained that allow for the effective removal of graffiti.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td></tr>
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<tr><td>Socioeconomics, Community/Populations, and Housing</td><td>During Design/Coordination/Pre-Construction:
• The need for both temporary and permanent easements would be minimized to the extent possible.
• A Public Safety Plan would be developed in coordination with the local authorities to provide for safety of the public, including children, during construction activities.
• Coordination with businesses would occur to address accessibility concerns during construction.
• Coordination with local emergency services (including fire, police, and ambulance services) would occur to ensure that access to critical facilities is maintained. This would also require consideration for accessibility in the event a storm occurs while the Proposed Project is still under construction.
During Construction:
• The Public Safety Plan would be implemented.
• Coordination with local emergency services (including fire, police, and ambulance services) would occur to maintain access to critical facilities.
• Identified accessibility impacts on businesses would be minimized with signage and provision of temporary access ways.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td></tr>
<tr><td>Environmental Justice</td><td>During Design/Coordination/Pre-Construction:
• A Public Safety Plan would be developed; it would establish a protocol for coordinating with representatives of EJ communities to ensure that construction activities occurring close to residences would have the least possible impact on pedestrian and vehicle traffic patterns, and that construction noise and dust would be reduced to the extent practicable.
• The Proposed Project would comply with HUD Section 3 and NJDCA Section 3 requirements, and to the greatest extent possible, provide job training, employment, and contract opportunities for low-income and low-and moderate-income (LMI) residents. A HUD Section 3 Annual Summary Report (Form HUD-60002) would be submitted to the Office of Fair Housing and Equal Opportunity for all covered funding, as well as Quarterly Section 3 reports pursuant to NJDCA Policy 2.10.22 Section VIII.
During Construction:
• BMPs and standard measures would be implemented to maintain access and traffic, and control noise, vibration, and dust.
• The Proposed Project would comply with HUD Section 3 and NJDCA Section 3 requirements.
During Operations:
• The Proposed Project would comply with HUD Section 3 and NJDCA Section 3 requirements.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td></tr>
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Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	**Applicable to Alternative 1**	**Applicable to Alternative 2**	**Applicable to Alternative 3**
Cultural and Historical Resources	**During Design/Coordination/Pre-Construction:** Archaeological Resources • The NJDEP would consult with the NJHPO pursuant to 36 CFR § 800.5 of the National Historic Preservation Act (NHPA) to comply with Section 106 and minimize effects to NRHP-eligible archaeological resources. See **Section 4.6.4.2** for the sequential steps that would be undertaken. Historic Architectural Resources • The NJDEP would consult with the NJHPO pursuant to 36 CFR § 800.5 of the NHPA to comply with Section 106 and minimize effects to NRHP-eligible historic architectural resources. See **Section 4.6.4.2** for the sequential steps that would be undertaken. **During Construction:** Archaeological Resources • Archaeological monitoring may be necessary in locations of high sensitivity where Phase IB testing cannot be completed. Historic Architectural Resources • In consultation with the NJHPO, the NJDEP would mitigate identified adverse effects in accordance with the requirements of Section 106 of the NHPA. Short-term adverse effects to the US Route 46 Bascule Bridge may be mitigated by limiting the degree and magnitude of the construction activities as they encroach on the structure. Potential visual effects to historic architectural resources could be mitigated by selection of materials that are compatible with surroundings in terms of composition, color, texture, and overall appearance, in consultation with the NJHPO.	See "Applicable to All Alternatives" column.	See "Applicable to All Alternatives" column.	Same as "Applicable to All Alternatives," *except no mitigation would be required for the US Route 46 Bascule Bridge.*
Transportation and Circulation	**During Construction:** • Traffic Management Plans (TMPs) would be implemented in conjunction with the local municipalities and service providers to minimize impacts to these entities and provide the public with information on road closures and detours. This would allow pedestrians, bicyclists, freight facilities, transit facilities, and ancillary transportation facilities to plan their travel routes, minimize delays and disruptions, and ensure the safety of these routes. **During Operations:** • Maintenance activities would be performed during non-peak traffic hours to the extent practicable.	See "Applicable to All Alternatives" column. *Additionally:* **During Design/Coordination/Pre-Construction:** • Coordination with local municipalities and service providers (e.g., NJ Transit) would occur on potential monitoring needs, road/lane closures and realignments, and the proposed closure gate on the railroad track. **During Operations:** • Operation of the NJ Transit railroad line closure gate would be coordinated with NJ Transit prior to and during flooding events to minimize delays and disruptions to transit services. Gate closure would be conducted in accordance with NJ Transit procedures.	See "Applicable to All Alternatives" column. *Additionally:* **During Design/Coordination/Pre-Construction:** • Coordination with local municipalities and service providers (e.g., NJ Transit) would occur on potential monitoring needs and road, lane, and sidewalk closures. • Coordination with NJ Transit and local businesses in the Borough of Carlstadt regarding the closure of the railroad bridge over East Riser Ditch would occur prior to its removal and replacement.	Same as Alternative 2.

Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	Applicable to Alternative 1	Applicable to Alternative 2	Applicable to Alternative 3
Noise and Vibration	**During Design/Coordination/Pre-Construction:** • Potential impacts from vibration would be reevaluated, as needed, based on the final pile driving locations to ensure they do not substantially differ from the anticipated impacts identified in this EIS. • If necessary during the permitting process, potential impacts from underwater noise would be reevaluated based on final pile driving locations to ensure they do not substantially differ from the anticipated impacts identified in this EIS. • Contractors and subcontractors would be trained to raise awareness of noise-specific issues and noise-sensitive areas. Noise complaint and response procedures would be established. • A construction schedule that is adjusted to comply with local regulations would be developed. • The construction schedule would be communicated to the public, including days of the week and hours of the day when work would occur. • An approved noise mitigation plan would be developed with the NJSEA. See **Section 4.8.4.2** for additional details on the noise mitigation plan. Additionally, a vibration monitoring plan and compliance monitoring program would be developed. **During Construction:** • Noise reducing and/or the quietest practicable construction methods and equipment, such as the use of noise shrouds around pile driving rigs and equipment equipped with mufflers and noise attenuation devices, would be used. All equipment would be properly maintained. • Contractors would place noise barriers between work areas and noise-sensitive receptors. See **Section 4.8.4.2** for additional details on noise barriers. • Contractors would utilize specific vibration control measures that can be implemented for pile driving activities, including predrilling or augering and maximizing the use of vibratory rather than impact pile driving. Additionally, contractors should consider the use of drilled piles instead of impact or vibratory pile driving. • Construction vehicles would be routed away from residential streets, to the extent possible. • Vehicle idling would be limited in accordance with New Jersey Administrative Code (NJAC) 7:27-14 and NJAC 7:27-15. • Contractors would work with the local municipalities to address any scheduling concerns. Contractors should plan construction activities to occur during daytime hours to eliminate impacts during more sensitive nighttime hours. • Contractors would describe and commit to the developed mitigation and monitoring plans. **During Operations:** • Stationary equipment, such as generators and compressors, would be enclosed and would use acoustical louvers and/or sound attenuators in the exterior walls of these enclosures to reduce noise emissions through the air inlet and outlet louvers of the pump station(s).	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.

Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	**Applicable to Alternative 1**	**Applicable to Alternative 2**	**Applicable to Alternative 3**
Air Quality and Greenhouse Gas Emissions	**During Construction:** • Truck beds would be covered while in transit to limit fugitive emissions. • Water would be sprayed on any unpaved roads or stockpiles to limit fugitive emissions. • Construction staging areas and transport routes would be isolated from sensitive populations. • Control measures on heavy construction equipment and vehicles, such as minimizing operating and idling time, would be implemented to limit criteria pollutant emissions. • Clean diesel would be used in construction equipment and vehicles through the implementation of add-on control technologies such as diesel particulate filters and diesel oxidation catalysts, repowers, and/or newer and cleaner equipment. When feasible, auxiliary power units or electric-powered equipment would be used in lieu of diesel-powered equipment. **During Operations:** • ULSD would be used in permanent, stationary sources to minimize oxides of sulfur emissions.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column. *Additionally:* **During Construction:** • Proposed construction at or near schools would be scheduled to occur when school is not in session. • Windows would be closed and indoor air would be circulated (i.e., air conditioning) in buildings where sensitive receptors are located to limit exposure to outdoor air quality.	See “Applicable to All Alternatives” column.
Global Climate Change and Sea Level Change	As the Proposed Project is itself intended to reduce the impacts of climate change and SLR, no specific mitigation measures or BMPs would be implemented.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.
Recreation	**During Design/Coordination/Pre-Construction:** • Consultation with recreational service providers regarding the proposed footprint would occur in order to minimize impacts to existing recreational areas and facilities. **During Construction:** • A TMP would be implemented to provide recreational services providers and the public with information on road closures and detours. This would allow users and proprietors of recreational facilities to plan their travel routes. Furthermore, road/lane closures would be planned to the extent possible to occur during periods of low recreational services demands.	See “Applicable to All Alternatives” column. *Additionally:* **During Design/Coordination/Pre-Construction:** • Coordination with the Little Ferry Marina and Riverside Boat Works would occur to develop a plan to reduce disruptions to these marinas, and to incorporate long-term access for these marinas into the design. **During Construction:** • Contractors would coordinate with the Little Ferry Marina and Riverside Boat Works to ensure access is maintained to and from the Hackensack River (i.e., through the use of boat cranes, temporary docks, or temporary boat ramps).	See “Applicable to All Alternatives” column. *Additionally:* **During Design/Coordination/Pre-Construction:** • Coordination with Riverside Boat Works would occur to develop a plan to reduce disruptions to this marina, and to incorporate long-term access for this marina into the design. **During Construction:** • Contractors would coordinate with Riverside Boat Works to ensure access is maintained to and from the Hackensack River (i.e., through the use of boat cranes, temporary docks, or temporary boat ramps).	Same as Alternative 2.

Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	**Applicable to Alternative 1**	**Applicable to Alternative 2**	**Applicable to Alternative 3**
Utilities and Service Systems	**During Design/Coordination/Pre-Construction:** • Consultation with utility providers regarding the proposed footprints of the various components would occur in order to minimize impacts to existing utility services. • Utility providers would be consulted with to: (1) have all underground utility lines flagged in the field where they intersect with the temporary easements; and (2) identify proper measures to take while working near utilities (e.g., overhead power lines) to prevent damage to the utilities and ensure the safety of both construction personnel and the public. **During Construction:** • Contractors would coordinate with utility providers and property owners to facilitate the efficient relocation of all necessary utilities. Utility providers would provide advance notice to all affected users of the necessary temporary service disruptions. Furthermore, these disruptions would be planned to the extent possible to occur during periods of low utility demand.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.
Public Services	**During Design/Coordination/Pre-Construction:** • Consultation with public services providers regarding the proposed footprints of the various components would occur in order to minimize impacts to existing public services. • A Public Safety Plan would be developed. **During Construction:** • The Public Safety Plan and a TMP would be implemented to provide emergency service providers and the public with information on road closures and detours. This would allow first responders to plan their travel routes. Furthermore, road/lane closures or realignments would be planned to the extent possible to occur during periods of low public services demands. • Contractors would coordinate with public services providers to provide them with up-to-date information on the total numbers of workers within the Project Area during the work day, to ensure that public services could meet the demand of the increased population size. • Contractors would limit construction activities around noise-sensitive public facilities (i.e., libraries, schools, religious facilities), and implement the appropriate noise and air quality mitigation measures and BMPs.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.

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<tr><th rowspan="2">Technical Resource Area</th><th colspan="4">Mitigation Measures and BMPs</th></tr>
<tr><th>Applicable to All Alternatives</th><th>Applicable to Alternative 1</th><th>Applicable to Alternative 2</th><th>Applicable to Alternative 3</th></tr>
<tr><td>Biological Resources</td><td>During Design/Coordination/Pre-Construction:
Impacts to riparian zones, wetlands, and wetland buffers would be avoided and minimized to the extent practicable. As part of the permitting process, a compensatory mitigation plan would be developed to compensate for long-term unavoidable impacts to regulated wetlands and other WOUS associated with dredging, filling, or other permanent alteration. See Section 4.14.4.2 for additional details on the mitigation plan. Wetland and waterbody impacts from construction dredge and fill activities would be coordinated with the NJDEP, USACE, NMFS, and other applicable regulatory agencies during project permitting.
A bird management plan would be developed to address Proposed Project construction timing and location to avoid or minimize effects to bird species, including special status species. This bird management plan would include pre-construction nest surveys that would identify timing restrictions for construction activities. See Section 4.14.4.2 for additional details on the bird management plan. To reduce the risk of erosion, sedimentation, and associated water quality impacts, a project-specific Stormwater Pollution Prevention Plan (SWPPP) would be prepared in accordance with NJ Stormwater Management Act NJAC 7:8. See Section 4.14.4.2 for examples of the measures and BMPs that could be included in the SWPP.
The Bergen County Soil Conservation District would review and certify the Soil E&S Control Plans as mandated by the Soil Erosion and Sediment Control Act, Chapter 251, Public Law 1975.
The EFH assessment would be revisited in consultation with NMFS to evaluate potential impacts to EFH that could result from construction work below mean high water.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td></tr>
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Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	Applicable to Alternative 1	Applicable to Alternative 2	Applicable to Alternative 3
Biological Resources	**During Construction:** • Impacts to riparian zones, wetlands, and wetland buffers would be avoided and minimized to the extent practicable. Temporarily impacted wetlands and buffers would be restored immediately following construction. The developed compensatory mitigation plan would be implemented. • The bird management plan, SWPPP, and E&S Control Plans would be implemented. • To minimize the potential for introduction or proliferation of invasive species, construction BMPs that address activities such as soil disturbance, vegetation management and inspection, transport of materials, thoroughly cleaning construction equipment, and revegetation and restoration would implemented. • To reduce wildland fire risks and minimize the potential for ignition, construction BMPs that address activities such as equipment maintenance and cleaning and fire would be implemented. • In order to minimize the spatial extent and duration of construction impacts to aquatic habitat, EFH, and aquatic wildlife, BMPs such as silt curtains and turbidity barriers would be implemented, and construction would be conducted in accordance with Federal and State permits and any site-specific conditions specified therein. • To minimize potential for impacts to finfish during key migration periods, seasonal restrictions (i.e., between March 1 and June 30) would be applied to in-water work in accordance with permit conditions. • Noise reducing and/or the quietest practicable construction methods and equipment, such as the use of noise shrouds around pile-driving rigs and equipment with mufflers and noise-attenuation devices, would be used. All equipment would be properly maintained. • Contractors would utilize specific vibration control measures that can be implemented for pile-driving activities, including predrilling or augering and maximizing the use of vibratory rather than impact pile driving. Additionally, contractors should consider the use of drilled piles instead of impact or vibratory pile driving. **During Operations:** • Stationary equipment, such as generators and compressors, would be enclosed and would use acoustical louvers and/or sound attenuators in the exterior walls of these enclosures to reduce noise emissions through the air inlet and outlet louvers of the pump station(s). • To minimize potential for impacts to finfish during key migration periods, seasonal restrictions (i.e., between March 1 and June 30) would be applied to in-water work. • Activities that may introduce sediments into the water would not be conducted without appropriate sediment and erosion control measures in place.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.	See “Applicable to All Alternatives” column.

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<tr><td>Geology and Soils</td><td>During Design/Coordination/Pre-Construction:
• A detailed, site-specific E&S Control Plan would be prepared to address land-disturbance aspects of the Proposed Project and to minimize potential impacts to soil resources during construction.
During Construction:
• The prepared E&S Control Plan would be implemented. See Section 4.15.4.2 for examples of the measures and BMPs that could be included in the E&S Control Plan.
During Operations:
• Activities that may cause soil erosion or compaction would not be conducted without appropriate sediment and erosion control measures in place.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td></tr>
<tr><td>Water Resources, Water Quality, WOUS</td><td>During Design/Coordination/Pre-Construction:
• Impacts to riparian zones, wetlands, and transition areas (i.e., wetland buffers) would be avoided and minimized to the extent practicable, and a compensatory mitigation plan would be developed, as described under Biological Resources.
• Coordination with the NJDEP, USACE, USCG, NMFS, NJSEA, and other applicable regulatory agencies would be conducted, and all necessary permits obtained prior to construction.
• Coordination with the USEPA and BCSA Cooperating PRP Group would be conducted during the final design process to ensure the Proposed Project does not adversely impact the ongoing BCSA PRP Group remediation project.
• A project-specific SWPPP would be prepared, as described under Biological Resources.
• The Bergen County Soil Conservation District would review and certify the Soil Erosion and Sediment Control Plans, as described under Biological Resources.
During Construction:
• Impacts to riparian zones, wetlands, and transition areas (i.e., wetland buffers) would be avoided and minimized to the extent practicable. Temporarily impacted wetlands and buffers would be restored immediately following construction. The developed compensatory mitigation plan would be implemented, as described under Biological Resources.
• The prepared SWPPP would be implemented, as described under Biological Resources.
• In order to minimize the spatial extent and duration of construction impacts to surface water flow, water quality, and sediment transport; wetland area, functions, and values; and groundwater flow and groundwater quality, BMPs (e.g., silt curtains, turbidity barriers, silt fencing, and hay bales) would be implemented, and construction would be conducted in accordance with Federal and State permits, and any conditions specified therein.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column. Additionally:
During Design/Coordination/Pre-Construction:
• In order to minimize the spatial extent and duration of scour and sediment transport as a result of storm events, energy dissipation structures would be installed at the Losen Slote and East Riser Ditch pump station discharge locations.</td><td>Same as Alternative 2.</td></tr>
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<tr><td>Hydrology and Flooding</td><td>During Design/Coordination/Pre-Construction:
• The mitigation measures set forth in Water Resources would be implemented.
During Construction:
• The mitigation measures set forth in Water Resources would be implemented.</td><td>See “Applicable to All Alternatives” column. Additionally:
During Design/Coordination/Pre-Construction:
• The potential for induced flooding would be addressed during the final stages of the design and modeling processes in order to either eliminate them (i.e., through more refined modeling data) or reduce them to less-than-significant levels (i.e., induced flooding only in existing environmental areas in accordance with regulatory requirements).
During Construction:
• Adequate construction planning, including identification of potential emergency measures, would be implemented to avoid potential increased storm surge flooding in the Project Area while construction of the LOP is occurring along existing berms.</td><td>See “Applicable to All Alternatives” column. Additionally:
During Design/Coordination/Pre-Construction:
• The mitigation measures set forth in Water Resources under Alternative 2 would be implemented.</td><td>Same as Alternative 2.</td></tr>
<tr><td>Coastal Zone Management</td><td>During Design/Coordination/Pre-Construction:
• The mitigation measures set forth in Biological Resources, Water Resources, and Cultural and Historical Resources would be implemented.
During Construction:
• Intertidal and subtidal impacts in the Hackensack River (below mean high water), wetland impacts, filling, and riparian and wetland buffers would be minimized to the extent possible, and coordination with the NJDEP, USACE, USCG, NMFS, NJSEA, and other applicable regulatory agencies would be conducted, as appropriate, to ensure proper mitigation and compliance with applicable regulations regarding in-water construction activities (e.g., 33 CFR 110.155).
• The mitigation measures set forth in Biological Resources would be implemented. Any sensitive habitats for endangered or threatened wildlife or plants that would be temporarily disturbed would be identified during the permitting process and appropriate mitigation measures, including timing restrictions and other measures as necessary, would be followed to protect sensitive populations and habitats.
• The mitigation measures set forth in Water Resources and Cultural and Historical Resources would be implemented.
During Operations:
• The mitigation measures set forth in Biological Resources, Water Resources, and Cultural and Historical Resources.</td><td>See “Applicable to All Alternatives” column. Additionally:
During Design/Coordination/Pre-Construction:
• Coordination with the Little Ferry Marina and Riverside Boat Works would occur to develop a plan to reduce disruptions to these marinas, and to incorporate long-term access for these marinas into the design.</td><td>See “Applicable to All Alternatives” column. Additionally:
During Design/Coordination/Pre-Construction:
• Coordination with Riverside Boat Works would occur to develop a plan to reduce disruptions to this marina, and to incorporate long-term access for this marina into the design.</td><td>Same as Alternative 2.</td></tr>
<tr><td>Sustainability/Green Infrastructure</td><td>Implementation of the mitigation measures identified in Recreation, Geology and Soils, Water Resources, Hydrology and Flooding, and Coastal Zone Management would further enhance the sustainability and green infrastructure benefits.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td><td>See “Applicable to All Alternatives” column.</td></tr>
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Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	Applicable to Alternative 1	Applicable to Alternative 2	Applicable to Alternative 3
Hazards and Hazardous Materials	**During Design/Coordination/Pre-Construction:** • HUD would be consulted to design proposed park/recreation features in compliance with HUD ASD requirements. • A Materials Management Plan would be developed to address how any contaminated soil, sediment, surface water, groundwater, or waste materials would be handled for off-site disposal or on-site reuse (in the case of soil). • Coordination with the NJDEP Division of Solid and Hazardous Waste would be required for any actions that involve work within a landfill. A Landfill Disruption Permit would be required. • Parties responsible for completing remediation of properties adjacent to, or within 200 feet of, the Proposed Project footprint would be notified of the design and schedule. • Coordination with the USEPA and BCSA Cooperating PRP Group would be conducted during the final design process to ensure the Proposed Project does not adversely impact the ongoing BCSA PRP Group remediation project. **During Construction:** • Construction contractors would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations. • The Materials Management Plan would be implemented. • A New Jersey LSRP would oversee those portions of the Proposed Project that would be considered a Linear Construction Project as defined by the NJDEP, and the Proposed Project would comply with these and other provisions of Chapter 16 of the NJDEP Administrative Requirements for the Remediation of Contaminated Sites (NJAC 7:26C) as necessary. This could occur with linear landscape features that cross more than one property. **During Operations:** • O&M activities would need to address NJ Site Remediation and Reform Act requirements for contaminated sites.	See "Applicable to All Alternatives" column. *Additionally:* **During Design/Coordination/Pre-Construction:** • The proposed construction near Deluxe International Trucks, Inc. includes a floodwall and excavation along the Hackensack River. These actions could require additional pre-construction review of site-specific records, sampling and analysis of materials to be disturbed, and precautionary planning to ensure mitigation, if not prevention, of the release and spread of contamination during construction, operation, use, and maintenance of features in these areas. • Construction of the Berry's Creek storm surge barrier and closure gate would require work within and in close proximity (i.e., parcels within 200 feet) to UOP and other contaminated sites and waterways, including those within the Berry's Creek Study Area. Design and operation of these features would need to consider disturbance to ongoing and planned remedial investigation and action and potential downstream impacts should the surge barrier result in scour and the spread of known contaminants in soil and sediment. **During Construction:** • The proposed construction near Deluxe International Trucks, Inc. could require the implementation of BMPs to ensure mitigation, if not prevention, of the release and spread of contamination in these areas. • Precautions could be needed near historic fill and the Little Ferry Landfill to ensure that activity does not expose workers, local residents, or ecological receptors to contamination through the release and spread of hazardous materials.	See "Applicable to All Alternatives" column. *Additionally:* **During Design/Coordination/Pre-Construction:** • The proposed construction at Willow Lake Park includes various green infrastructure features. These actions could require additional pre-construction review of site-specific records, sampling and analysis of materials to be disturbed, and precautionary planning to ensure mitigation, if not prevention, of the release and spread of contamination during construction, operation, use, and maintenance of these features. • Dredging and construction at East Riser Ditch and Losen Slote would require work within and in close proximity (i.e., parcels within 200 feet) to contaminated sites and waterways. Design and operation of these features would need to consider downstream impacts and disturbance to ongoing and planned remedial investigation should proposed features, such as pump stations, result in scour and the spread of known contaminants in soil and sediment. **During Construction:** • The proposed construction at Willow Lake Park could require the implementation of BMPs to ensure mitigation, if not prevention, of the release and spread of contamination. • Precautions could be needed near historic fill and the Little Ferry Landfill and Morris Park Avenue Corporation landfill to ensure that activity does not expose workers, local residents, or ecological receptors to contamination through the release and spread of hazardous materials.	Same as Alternative 2.

Technical Resource Area	Mitigation Measures and BMPs			
	Applicable to All Alternatives	Applicable to Alternative 1	Applicable to Alternative 2	Applicable to Alternative 3
Mineral and Energy Resources	**During Design/Coordination/Pre-Construction:** • Construction managers would develop a construction energy conservation plan for energy use. See **Section 4.21.4.2** for examples of the mitigation measures and BMPs that could be included in the energy conservation plan. **During Construction:** • Demolition and debris cleared, as well as excavated soils, would be classified and sorted for beneficial re-use, either for Proposed Project construction or for other suitable uses. • Construction managers would implement the construction energy conservation plan for energy use.	See "Applicable to All Alternatives" column.	See "Applicable to All Alternatives" column.	See "Applicable to All Alternatives" column.
Agricultural Resources and Prime Farmland	No adverse impacts to agricultural resources, prime farmlands, or residential and community gardens have been identified from the proposed construction or operation of the Proposed Project. Therefore, no BMPs or mitigation measures would be required.	See "Applicable to All Alternatives" column.	See "Applicable to All Alternatives" column.	See "Applicable to All Alternatives" column.

7.0 List of Preparers

This section provides the name, education, role, years of experience, and professional disciplines/background of each person involved in the preparation of this EIS.

7.1 NJDEP

Dennis Reinknecht, NJDEP, Manager

Linda Fisher, NJDEP, RBDM Project Team Manager

Alexis Taylor, NJDEP, RBD Outreach Team Leader

Robert Marcolina, NJDEP, RBDM Project Manager

Kim McEvoy, NJDEP, RBD Environmental Team Leader

7.2 Consultants – AECOM and HDR

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Albrecht, Sherri	MA, Environmental Science, Montclair State University, 1996 BS, Biology, Minor Chemistry, Montclair State College, 1986	Water Resources and Water Quality; Coastal Zone Management; Mineral and Energy Resources	25	Water resources analysis; coastal zone management; habitat assessments; ecological evaluations; environmental permitting/wetland delineation
Apte, Vijay, PE	MS, Environmental Engineering, University of Cincinnati, 1983 BE, Civil Engineering, University of Bombay, 1979	Air Quality and Greenhouse Gas Emissions	30	Air quality
Avery, Garrett	BLA, Landscape Architecture – Planning and Sustainable Development, Clemson University, 2006	AECOM RBDM Project Manager; Visual Quality and Aesthetics	10	Landscape architecture and design; visual quality analyses and impact assessment
Barnes, Barbara, RLA	B. Arch, Landscape Architecture and BA History, University of Washington, 2002	Sustainability and Green Infrastructure	14	Certification in restoration ecology; LEED accredited professional; wetland and stream restoration; urban forestry; stormwater and green infrastructure analyses
Boose, Brian W., CEP	BS, Biological Sciences/Ecology, University of California, Davis, 1990	AECOM Project Director II; Cumulative Effects	27	NEPA; experienced in all technical resource areas analyses and in conducting cumulative effect analyses

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Bowins, Jade	MS, Environmental Biology, Hood College, 2016 BS, Biology, Sacred Heart University, 2014	GIS Mapping & Analysis; Visual Quality and Aesthetics	2	GIS analyses and mapping; biological resources; visual quality impact analytical support
Brilhante, Francisco	MS, Environmental Engineering, Manhattan College, 1993 BS, Electrical Engineering, Manhattan College, 1990	GIS Mapping & Analysis	24	GIS analyses and mapping; mathematical modeling; combined sewer overflow, sanitary sewer, and stormwater data analyses, inspections, and permit compliance
Bryant, Cathy, LSRP	BS, Environmental Engineering, Florida Institute of Technology, 1991	Hazards and Hazardous Materials	25	NJDEP LSRP; hazardous material investigation and assessment/impact analyses
Buck, Adam	MS, Architectural Engineering, University of Nebraska at Lincoln, 2013; BS, Architectural Engineering, University of Nebraska at Omaha, 2012	Noise and Vibration	4	Environmental and architectural acoustics; measuring and modeling environmental noise; noise impact analyses
Burrell, Jay, C.	MBA, Business Administration, University of Central Florida, 2017 BS, Forest Resource Management, Clemson University, 1995	Biological Resources; Water Resources, Water Quality, and Waters of the US	20	NEPA documentation; natural resources impact analyses; environmental sampling; permit compliance and monitoring
Busam, Michael, AWB®	BS, Environmental Science and Policy, University of Maryland, College Park, 2014	Utilities and Services; Public Services; Cumulative Effects; Document Control	3	NEPA documentation; biological resources; utilities and public services analytical support
Canova, Amy	MS, Environmental Technology, Imperial College of Science, Technology, and Medicine, London, UK, 1999 BS Environmental Management and Technology, University of Bradford, UK, 1998	Sustainability and Green Infrastructure	16	Sustainable design; green infrastructure design, planning, and impact analyses
Carr, Allison	BA, Geography, George Washington University, 2015	GIS Mapping & Analysis	2	GIS analyses and mapping

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Casey, Tim	BS, Biological/Life Sciences, Saint Xavier University, 1988	Noise and Vibration	30	Noise and vibration analyses for projects involving stationary and mobile sources, including architectural industrial and infrastructure noise analyses
Chapman, Jaclyn	MS, Environmental Science & Management, Sacred Heart University, 2015 BS, Biology, Nebraska Wesleyan University, 2012	Sustainability and Green Infrastructure; Biological Resources	5	Green infrastructure; field biology; biological resources; biological and wetland assessments
Cohen, Michael	MS, Transportation, University of California at Irvine, 1992 BS, Civil Engineering, Massachusetts Institute of Technology, 1988	Transportation and Circulation	25	Traffic engineering and research; traffic operations analyses; corridor/arterial studies, planning, and feasibility studies; traffic signal and MOT design
Cowan, James P.	MS, Acoustics, Pennsylvania State University, 1982 BS, Physics/Mathematics, Muhlenberg College, 1980	Noise and Vibration	35	Acoustics, noise, and vibration impact analyses; Board-certified Noise Control Engineer since 1986
Curran, Jennifer	MS, Marine Environmental Science, SUNY at Stony Brook, 2001 BS, Environmental Science, Johnston State College, 1996	HDR Project Manager; Water Resources	20	Regulatory compliance; ecological restoration; wetlands permitting; dredged material management; water resources impact analyses
Davis, David	MA, Journalism, New York University, 1992 BS, Biology, Sienna College, 1988	Biological Resources; Technical Editor	28	Biological monitoring; estuarine habitat and coastal ecosystem impact analyses
De Rosa, Laurie	MS, Environmental Engineering, Manhattan College, 1987 BS, Applied Statistics, Utah State University, 1983	Surface Water and Sediment Analysis and Modeling	34	Water quality modeling; statistical analyses; data analyses; model development; experience includes BOD-DO eutrophication nutrient and bacteria analyses, wastewater discharge evaluations, and assessment of combined sewer overflows impacts; water quality impact analyses

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Douglass, Ryan	MA, History, University of Glasgow, 2011 BA, History, Widener University, 2009	Cultural and Historic Resources	2	Historic research; contextual history development; museum collection cataloging
Dromsky-Reed, John, PE	MS, Environmental Engineering, New Jersey Institute of Technology, 1999 BS, Marine Science, U.S. Coast Guard Academy, 1986	Hydrology and Flooding	18	Civil engineering; water resources, stormwater, and flood data analyses
Du, Elaine	BS, Civil Engineering, Cooper Union, 2014	Transportation and Circulation (Traffic Operations Analysis/ Reports)	2	Traffic engineering and research
Everett, Emily, AICP	MA, Historic Preservation, University of Delaware, 2001 BA, Art History, University of Rhode Island, 1997	Cultural and Historic Resources	17	NEPA documentation; disaster planning for historic properties; architectural history surveys; National Register Nominations; historic district administration and design review
Farnham, Katherine	MS, Historic Preservation, University of Vermont,1999 BA, Art History and English Literature, Kenyon College, 1994	Cultural and Historic Resources	18	NEPA documentation; National Register evaluations; historic architecture surveys; Historical Commission design review; historic preservation planning
Foster, Celeste	BS, Chemical Engineering, The Cooper Union, 2000	Geology and Soils	16	Chemical engineering; GIS mapping; geology and soils impact analyses
Geiger, Ronald, PE	BS, Civil Engineering, Ohio State University, 1982	Technical Quality Assurance/Quality Control (QA/QC)	34	Professional Engineer (TN, OH, NC, SC, AL); Master Planning; NPDES permit compliance; document QA/QC reviewer
Gillespie, Joshua	BS, Environmental Science and Forest Biology, SUNY Environmental Science and Forestry, 1995	HDR Project Manager	20	NEPA documentation; natural resources impact analyses; permit compliance and monitoring

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Gluck, Jerome	MS, Transportation Planning and Traffic Engineering, Polytechnic University, 1976 BE, Civil Engineering, Cooper Union, 1975	Transportation and Circulation	40	Traffic engineering; transportation planning; traffic impact studies and analyses; highway access management
Greer, Emily	MS, Sustainable Development and Conservation Biology, University of Maryland, College Park, 2016 BS, Conservation Biology, St. Lawrence University, 2012	Socioeconomics; Biological Resources	1	NEPA documentation; natural resources impact analyses; socioeconomic analytical support
Hecht, Jack	MA, Biology, SUNY New Paltz, 2003 BS, Wildlife Biology, University of Massachusetts, 1971	Biological Resources (Threatened and Endangered Species)	45	Certified wildlife biologist; design and execution of field studies; threatened and endangered species impact analyses
Hood, Eileen	BA, Anthropology, Temple University, 2004	Cultural and Historic Resources	13	NEPA documentation; archaeological and historical assessments; National Register evaluations; historical context development; cultural and historic resources analyses
Hughes, Grant	BS, Environmental Science and Technology, university of Maryland, 2011	Land Use, GIS Mapping & Analysis, Technical Reviewer	1	NEPA documentation; environmental analytical support
Jarta, Gina	BA, Acoustics, Columbia College, 2008	Noise and Vibration	8	Architectural acoustics and environmental noise analyses; noise measurement acoustical testing/data analyses
Jenet, Blair	MA, Environmental Science, University of Virginia, 2016 BA, Environmental Science, University of Virginia, 2014	Public Services; Recreation; ASD Analysis; GIS Mapping & Analysis	2	NEPA documentation; GIS mapping; LEED GA; natural resources impact analyses
Kareth, Paul, PG	MS, Geology, University of Cincinnati, 1984; BA, Geology, University of Tennessee, 1981	Geology and Soils	31	Environmental geology; engineering geology; geology and soils impact analyses

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Kriss, Rebecca	MRP, City & Regional Planning, State University of NY Albany, 2012 BA, Urban Studies (Urban Studies and Planning), State University of NY Albany, 2010	Sustainability and Green Infrastructure	8	NEPA documentation, sustainability planning; green infrastructure; stormwater management
Keaveney, Matthew	BS, Geology, Binghamton University, 2012	Hazards and Hazardous Materials	3	Geologist; environmental investigations and restoration; hazardous materials impact analyses
Korpus, Marc	BA, Computer Science, Rutgers University, 2001 JD, Law, Rutgers University, 1981 BA, Political Science and Government, Brooklyn College, 1977	GIS Mapping & Analysis	14	Senior GIS analyst
Kuntz, Samantha	MSHP, Historic Preservation, University of Pennsylvania, 2014 MCP, City and Regional Planning, University of Pennsylvania, 2014 BA, Sociology, Boston University, 2009 BA, Journalism, Boston University, 2009	Cultural and Historic Resources	4	Section 106 of the National Historic Preservation Act; cultural resource management studies; preservation planning; adaptive reuse and redevelopment
LaCaruba, Regina	MA, Environmental Science conc. Environmental Management, Montclair State University, 2010 BS, Biology, Moravian College, 2005	Mineral and Energy Resources; Coastal Zone Management	11	Environmental permitting; natural resource damage assessment and emergency response; regulatory compliance; mineral, energy, and coastal zone analyses
Lehmann, Zachary	BS, Wildlife Management, Unity College, 2006	Biological Resources	12	Field biology; ecological analyses; habitat suitability modeling; geospatial analysis; hydrologic model development

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Liguori, Stephanie, CNRP	BS, Environmental Science, Delaware Valley University, 2010	Air Quality and Greenhouse Gas Emissions; Technical Reviewer	5	NEPA documentation; air quality technical analyses; biological resources analytical support; natural resources impact analyses
Macaulay, Albert D.	MCRP, Environmental Planning, E.J. Bloustein School of Planning and Public Policy, 2013 BA, Architecture, Clemson University, 2011	GIS Mapping & Analysis; Minerals and Energy	4	GIS analyses and mapping; architecture; environmental permitting
Mehta, Pankti	MS, Civil Engineering, Rutgers University, 2014	Transportation and Circulation (Traffic Operations Analysis)	2	Traffic engineering and research; traffic operations analyses
Morin, Edward	MS, Archaeology, Rensselaer Polytechnic Institute, 1980 MA, American Studies, Saint Louis University, 1978 BA, History, Westfield State University, 1975	Cultural and Historic Resources	39	Archaeological and historical assessments; National Register evaluations; archaeological data recovery efforts; cultural and historic resources analyses
Morrell, Kimberly	BA, Anthropology, University of Rhode Island, 1992 BA, Marine Affairs, University of Rhode Island, 1992	Cultural and Historic Resources	25	Archaeological and historical assessments; National Register evaluations; archaeological data recovery efforts; cultural and historic resources analyses; mortuary archaeology
Myers, Jeff	BS, Industrial Engineering, Columbia University, 2001	Transportation and Circulation; Senior Technical Reviewer	16	Transportation/traffic planning, engineering, and impact analyses
Myers, Taralyn	MS, Biology, Environmental Science Concentration, Fairleigh Dickenson University, 2010 BS, Marine Biology, Fairleigh Dickenson University, 2004	Water Resources and Water Quality; Coastal Zone Management	13	Water resources impact analysis; coastal zone management; habitat assessments; ecological evaluations; environmental permitting/wetland delineation
Naumoff, Peter	BA, Geology, City University of New York, Queens College, 1978	Geology and Soils	35	Geological investigations; field mapping; geology and soils impact analyses

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Paquin, Paul	MS, Environmental Engineering, Manhattan College, 1974 BS, Science Engineering, University of Michigan, 1972	Water Resources	45	Water quality modeling and impact analyses; sediment characterization studies; point and non-point source investigations of conventional pollutants, organic chemicals, and metals on freshwater and marine systems; hydrodynamic modeling
Parvis, Patricia, LSRP	MS, Environmental Studies, Long Island University, 1994 BFA, New York University, 1985	Hazards and Hazardous Materials	31	Remedial investigations, environmental permitting; hazardous materials and waste impact analyses
Patel, Jay	MS, Geology, Montclair State University, 2014; BS, Geology, Montclair State University, 2012	Geology and Soils	2	Geology; environmental remediation; geology and soils impact analyses
Patel, Nish	BS, Civil Engineering, Cooper Union, 2016	Transportation and Circulation (Traffic Operations Analysis)	1	Traffic engineering and research; traffic operations analyses
Pelaez, Einah	BS, Civil Engineering, Lehigh University, 1999	Transportation and Circulation (Traffic QA/QC)	17	Traffic engineering accidents/safety studies and land use analyses; QA/QC of transportation analyses
Petree, David	BS, Civil Engineering, University of Missouri – Kansas City, 2012	Transportation and Circulation	6	Traffic engineering and research; traffic operations analyses
Prakash, Jagadish, ACIP	MS, Urban and Regional Planning, Rutgers University, 2000 MS, Development Planning, Pune University, 1998 BS, Microbiology, Bangalore University, 1996	Utilities and Service Systems; Public Services; Land Use and Land Use Planning; Recreation; Socioeconomics, Community/Population, and Housing; Environmental Justice	16	Comprehensive human environment analyses, with specialization in utilities, public services, land use, recreation, socioeconomics, environmental justice, and population dynamics
Reichard, Mikayla	BS, Engineering, Rutgers University, 2016 AA, Science, SUNY Rockland, 2013	Surface Water and Sediment Analysis	1	Water quality modeling support

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Roy, Richard	MA, Historical Archaeology, University of Massachusetts-Boston, 2016 BA, Anthropology, American University, 2012	Cultural and Historic Resources	6	GIS analyses and mapping; historic archaeology; Section 106 of the NHPA; NEPA documentation
Rollino, John, A.	MS, Geoscience, Montclair State University, 2004 MA, Environmental Studies, Montclair State University, 1998 BA, Anthropology; BA History, Upsala College, 1994	Biological Resources; Wetlands/Waters of the US; Agricultural Resources and Prime Farmlands	20	Ecology and habitat restoration; ESA Certified Ecologist; Certified Wetland Delineator (Minnesota #1233); ISA Certified Arborist (Worldwide); biological resources, wetlands, and agricultural resources impact analyses
Rosado, Hayley	MS, Geoscience, Montclair State University, 2016 BA, Mathematics and English, Lafayette College, 2009	Hazards and Hazardous Materials	2	GIS analyses and mapping; Phase I Environmental Assessments
Stein, Julie	MRP, University of North Carolina, Chapel Hill, 2005 BA, Environmental Studies, St. Lawrence University, 1998	Sustainability and Green Infrastructure	18	LEED Accredited Professional–NY; ISI Envision Sustainability Professional-NY; sustainability planning; green infrastructure; stormwater management; climate change vulnerability assessments and mitigation
Torres-Cooban, Ricky, EIT	MS, Stanford University, 2013 BS, University of Massachusetts Amherst, 2012	Global Climate Change and Sea Level Change	3	Coastal processes; climate change vulnerability; civil engineering; water resources
Utku, Murat, PhD, PE	PhD, Civil & Coastal Engineering, Old Dominion University, 1998 MS, Civil, Coastal and Harbor Engineering, Middle East Technical University, 1994 BS, Civil Engineering, Middle East Technical University, 1991	Global Climate Change and Sea Level Change	23	Climate change and sea level change modeling and analyses; hydraulic/coastal engineering; shoreline erosion mitigation

Name	Education	Role	Years of Experience	Professional Disciplines/Background
VerWeire, Kevin	MS, Watershed Hydrology & Management, University of Arizona, 2005 BS, Environmental & Forest Biology, State University of NY College of Environmental Science and Forestry, 2000	Water Resources	12	Watershed hydrologic assessments; stream and wetland restoration design
Violette, Morgan	MS, Environmental Studies/Urban Planning, Rutgers University, 2013 BA, Geosciences and Environmental Studies, Skidmore College, 2010	Groundwater; Hazards and Hazardous Materials	6	Specialist in groundwater impact analyses and hazardous materials and wastes; remedial investigations
Voyce, Lisa	MS, Environmental Engineering (MSEnE in Hazardous Waste/Toxicology), New Jersey Institute of Technology, 1984 BA, Environmental Science/Biology; William Patterson University of New Jersey, 1978	Hazards and Hazardous Materials; Water Resources	28	Specialist in site remediation, human health risk assessments, toxicology, hazardous waste site assessments, remedial investigations, water resource protection, and water resource regulatory compliance
Walker, Jesse, RPA	MA, Anthropology, Temple University, 2003 BA, Anthropology, State University of New York at New Paltz, 1997	Cultural and Historic Resources	16	NEPA documentation; archaeological and historical assessments; National Register evaluations; archaeological data recovery efforts; cultural and historic resources analyses
Warf, Jennifer	MS, Environmental Studies, The University of Charleston, 2003 BA, Zoology, Miami University, 1999	AECOM RBDM Deputy Project Manager; EIS Lead	16	NEPA; natural resources management, biological resources, wetlands, and water resources impact analyses; environmental permitting
Wellins, Maggie	MS, Biology, Montclair State University, 2016 BS, Ecology, Rutgers University, 2006	Biological Resources	10	Certified Wetland Delineator; Professional Wetland Scientist; biological resources impact analyses

Name	Education	Role	Years of Experience	Professional Disciplines/Background
Wu, Charlene	MEM, Ecosystem Science and Conservation, Duke University, 2015 BS, Environmental Science and Policy, University of Maryland, 2011	Cumulative Impact Analysis	5	NEPA documentation; natural resources impact analyses; urban ecology; cumulative effects analysis; environmental permitting compliance
Yang, Yang	MCRP, City and Regional Planning, University of North Carolina at Chapel Hill, 2016 BE, Urban Planning, Southeast University, 2014	Transportation and Circulation	2	Traffic engineering and research; GIS analyses and mapping
Yozzo, David J., PhD	PhD, Environmental Sciences, University of Virginia, 1994 MS, Environmental Sciences, University of Virginia, 1990 BA, Environmental Sciences, SUNY Purchase College, 1987	Biological Resources Water Resources (Wetlands/Benthic Ecology)	22	Estuarine ecologist with expertise in fish and benthic invertebrate communities of salt marshes and tidal freshwater ecosystems, tidal wetlands, and coastal/freshwater habitat restoration
Yuan, Hong, PE	MS, Civil Engineering, Georgia Institute of Technology, 2002 BS, Civil Engineering, Tsinghua University, China, 1998 BS, Economics, Tsinghua University, China, 1998	Transportation and Circulation	16	PE; PTOE; IMSA Traffic Signal II - traffic impact analysis; corridor/arterial studies, planning, and feasibility studies; traffic signal and MOT design; adaptive traffic controls; bicycle and pedestrian facilities design

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9.0 Glossary

100-year Flood – A flood event of a magnitude that occurs, on average, once every 100 years; this equates to a 1 percent chance of occurring in any given year.

A-Weighted Decibel Scale – Non-impulse noise measurement in decibels, weighted to match human hearing frequency response.

Absent – Not in a certain place at a given time.

Accredited – Officially recognized as meeting the essential requirements, as by a government.

Acoustic – Relating to sound or the sense of hearing.

Adjacent – Lying near or close; adjoining; neighboring.

Adopt – To accept or act in accordance with.

Adverse – Acting against or in a contrary direction; opposite; unfavorable.

Aerial – Imagery of the ground from an elevated/direct-down position.

Aesthetics – Pertaining to beauty in both form and appearance.

Agricultural – The science, art, or occupation concerned with cultivating land, raising crops, and feeding, breeding, and raising livestock; farming.

Agricultural resource – Agricultural resources include any land that is used for farmland or for a farming practice, including any buildings or equipment on that land that are used for the farming practice.

Air Pressure – The force exerted by air, whether compressed or unconfined, on any surface in contact with it.

Airborne – Carried by the air.

Amalgamation – A combination or unification of one or more items into one organization or structure.

Ambient Air – Outdoor air surrounding the environment.

Ambient Noise – The total level of noise in an area.

American Community Survey – A nationwide, continuous survey designed to provide communities with demographic, housing, social, and economic data every year.

Amplitude – The loudness of a noise.

Anadromous – Fish species that migrate from the ocean into rivers to breed in freshwater.

Ancillary – Something that serves in an assisting capacity; providing necessary support to the primary activity or operation of an organization, institution, industry, or system.

Anecdotal – Based on or consisting of reports or observations that are based on personal accounts rather than facts or scientific research.

Anthropogenic – Caused or produced by humans.

Aquatic – Of, in, living in, or growing in water.

Aquifer – Any geological formation containing or conducting groundwater, especially one that supplies the water for wells and springs.

Area of Potential Effects (for archeological and historical resources) **–** The geographic area within which a proposed project may directly or indirectly cause changes in the character or use of historic properties.

For the purposes of this document, the APE for archeological resources is limited to the footprint of Proposed Project-related ground disturbance. The APE for historic architectural resources includes properties within the Project Area and their viewshed and soundshed.

Arithmetic – The method or process of computation with figures.

Archaeological – Of, or relating to, historic or prehistoric human activity through artifacts and other physical remains.

Attainment Area – An area or region that meets the NAAQS for a criteria pollutant under the CAA.

Automatic Traffic Recorder – An automated electronic device that records traffic volume and other related information.

Auxillary Power Units – APUs are energy providers typically found on large vehicles and pieces of equipment, such as dump trucks and large construction equipment. They are charged while engines are running, and then can be used to power equipment without idling main engines, which consequently reduces emissions.

Average Annual Daily Traffic – Daily average vehicular traffic measured on a specific roadway segment over a period of 365 days.

Avian – Of, relating to, or derived from birds.

Background – Area behind the main object or figure; the framework of a particular time, location, or event.

Ballast Water – Water carried in ships' ballast tanks to improve stability, balance, and trim. The water is taken up or discharged when cargo is loaded or unloaded. When ships take on ballast water, aquatic plants and animals are also picked up.

Baseline – A basic standard or level; guideline.

Beneficial Impact (Effect) – An effect producing or promoting a favorable result; advantageous.

Benthic – Of, relating to, or occurring at the bottom of a body of water.

Berm – Flat strip of land, raised bank, or terrace bordering a river or stream; artificial ridge or embankment.

Best Management Practices – A practice, or combination of practices, that is determined to be an effective and practicable means of preventing or reducing the amount of pollution generated.

Biological Resources – The living environment and organisms, such as vegetation, wildlife, fisheries, aquatic and terrestrial habitats, special status species, and species of conservation concern.

Biosolid – Organic material resulting from the treatment of domestic sewage in a treatment facility that can be recycled and used in agriculture.

Bioswale – A landscape element designed to remove silt and pollution from surface runoff water.

Blighted – A state of impairment, destruction, ruin, or frustration.

Bounded – The state of being limited, confined, or constrained.

Brackish – Slightly salty water, as in the mixture of river and seawater in estuaries.

Broadband Noise – Noise whose energy is distributed over a wide section of the audible range.

Calibrate – To determine, check, or rectify the graduation of any instrument giving quantitative measurements.

Carbon Dioxide Equivalent – A common measurement for expressing a combination of GHGs that uses CO_2 as the basis for calculating the equivalent amounts of other GHGs.

Census Block – A statistical area bounded by visible features such as streets, roads, streams, and railroad tracks, and by nonvisible boundaries, such as selected property lines and city, township, school district, and county boundaries. A block is the smallest geographic unit for which the US Census Bureau tabulates decennial census data (US Census Bureau 2016).

Census Block Group – A statistical subdivision of a census tract, generally defined to contain between 600 and 3,000 people and 240 and 1,200 housing units, and the smallest geographic unit for which the Census Bureau tabulates sample data (US Census Bureau 2016).

Census Tract – A small, relatively permanent statistical subdivision of a county delineated by a local committee of census data users for the purpose of presenting data (US Census Bureau 2016).

Channel – The deeper part of a river, stream, or ditch; the bed where a natural stream of water runs.

Channelization – A waterway that was made or cut into a channel.

Chemical – A substance produced by, or used in, a chemical process.

Circulation – The continuous movement of a fluid substance.

Cistern – A reservoir, tank, or container for storing or holding water or other liquid.

Classification Exception Area – A site with identified groundwater contamination as defined by NJAC 7:9-1.6 and 1.9(b).

Climate Change – A change in global or regional climate patterns, especially due to an increase in average atmospheric temperature.

Coastal Zone – Areas where coastal waters and adjacent shorelands interface with and influence each other.

Cohesion – The act or state of cohering, uniting, or sticking together.

Colonize – To establish a population of organisms in a new location.

Combustion – The act or process of burning.

Commercial Land Use – The use of land for commercial purposes including office buildings, shops, and restaurants.

Communication Systems – As used in this document, communication systems refer to landline telephones, cable television, and internet.

Communities of Concern – Places that are home to high concentrations of minority, low-income, and other disadvantaged populations.

Confluence – The flowing together, or place of meeting, of two or more streams, rivers, or other waterways.

Conformity Analysis/Determination – A Conformity Analysis considers the total potential direct and indirect air emissions from a proposed project and compares those emissions to *de minimis* levels. If air emissions are found to be potentially in excess of *de minimis* levels, further analysis is performed in a Conformity Determination.

Conservation – The act of conserving; preventing injury, decay, waste, or loss.

Constituent – Part of a whole; component.

Containment Wall – A structure designed and constructed to prevent the slumping of soil when there is a change in ground elevation that exceeds the soil's ability to maintain shape.

Contaminant – A physical, chemical, biological, or radioactive substance that can have an adverse effect on water, air, or soil.

Contamination – The act of contaminating, or of rendering something harmful or impure.

Continuity – The unbroken and consistent existence or operation of something over a period of time.

Continuous Airborne Sound – Sound with duration of 1 second or more.

Controlled Recognized Environmental Condition – A recognized environmental condition resulting from a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority (for example, as evidenced by the issuance of a no further action letter or equivalent, or meeting risk-based criteria established by regulatory authority), with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls).

Cooperating Agency – Any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a Cooperating Agency are described in 40 CFR § 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a Cooperating Agency (40 CFR § 1508.5).

Corridor – A narrow tract of land forming a passageway.

Corrosion – The gradual damage or destruction of something by chemical action.

Council on Environmental Quality – An Executive Office of the President composed of three members appointed by the President and subject to approval by the Senate. The CEQ analyzes and interprets environmental trends, appraises environmental programs and activities of the Federal government, and formulates and recommends national policies to promote the improvement of the quality of the environment.

Cradle-to-grave – The timespan of activities or products from their beginning or creation to end or final disposal.

Criteria Pollutants – The CAA of 1970 required the USEPA to set air quality standards for common and widespread pollutants in order to protect human health and welfare. There are six "criteria pollutants:" O_3, CO, SO_2, Pb, NO_2, and PM.

Critical Facility – Structure, service, or facility that is particularly vulnerable to flooding due to its potential to cause harm, damage, or disruption to community persons, properties, or activities if it is destroyed or impaired.

Cultural Resources – Cultural resources are historic properties as defined by the NHPA, cultural items as defined by the NAGPRA, archaeological resources as defined by the Archaeological Resources Protection Act, sacred sites as defined by Executive Order 13007 to which access is afforded under the American Indian Religious Freedom Act, and collections and associated records as defined by 36 CFR Part 79.

Cultural Order - When viewing the components of the cultural environment, viewers evaluate the scene’s cultural order, determining if the composition is orderly or disorderly.

Cumulative Effect (Impact) – Defined by CEQ regulations as “the impact on the environment which results from the incremental impact of a proposed project when added to other past, present, and reasonably foreseeable future actions in the same space and time, regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR § 1508.7).

Day-night average sound level – An equivalent-average sound level over a 24-hour period with a 10 dB penalty applied during nighttime hours (10:00 PM to 7:00 AM).

De Minimis Levels – Minimum thresholds established by the USEPA for which, if exceeded, a Conformity Determination must be performed for various criteria pollutants in a nonattainment area.

Debris – The remains of anything broken down or destroyed; ruins; rubble.

Decibel – A unit of measurement of sound pressure level.

Degradation – Decline in state to one of less value or quality.

Delineate – To trace the outline of; sketch or trace in outline; represent pictorially.

Demographics – Statistical data on the quantifiable characteristics, such as religion, education, or race, of a particular population or group.

Demolition – The act of destroying or ruining a building or other structure.

Dense – Having the component parts closely compacted together; crowded or compact.

Deposition – The state of being set down or precipitated.

Desirable – Worth having or wanting; pleasing, excellent, or fine.

Direct Impact (Effect) – An impact caused by a proposed project that occurs at the same time and in the same place as the proposed project.

Discharge – To pour forth; emit.

Discharge (of hazardous materials) – Unplanned events where contamination has been released onto the lands or waters of the state (NJAC 7:1E).

Disperse – To spread widely; scatter.

Displacement – The moving of something from its usual or proper place.

Disposal – The action or process of throwing away or getting rid of something.

Diurnal – Of, relating to, or occurring in the daytime.

Diversity – The condition of being composed of differing elements or qualities; variety.

Downstream – With or in the direction of the current of a stream.

Drainage Area – The area drained by a river and all of its tributaries.

Dredge – Remove sand, silt, and mud from the bottom of a waterway or other feature.

Ecology – The branch of biology dealing with the relations and interactions between organisms and their environment, including other organisms.

Effluent – Flowing out or forth; liquid waste or discharge.

Elevated – Raised up, especially above the ground or above the normal level; to advance beyond proper, established, or usual limits.

Elevation – The height to which something is elevated or to which it rises.

Embankment – A raised structure, as of earth or gravel, used especially to hold back water or carry a roadway.

Emergent (plant) **–** Rooted in shallow water and having most of the vegetative growth above the water.

Emission – A release of a pollutant.

Emplacement – A putting in place or position.

Endangered Species – Any species which is in danger of extinction throughout all or a significant portion of its range.

Energy Security – The uninterrupted availability of energy sources at an affordable price; pertains to the cost, reliability, sustainability, and scale of our energy use.

Energy Source – A source that can be used to provide power; may be non-renewable (a finite supply, such as coal or natural gas) or renewable (can be naturally replenished, such as solar or wind).

Environment – The air, water, minerals, and other external factors surrounding and affecting a given organism at any time.

Environmental Assessment – A NEPA disclosure document that provides sufficient evidence and analysis to show whether a proposed project is expected to have a significant impact on the environment or be environmentally controversial.

Environmental Impact Statement – A detailed written statement required by section 102(2)(C) of NEPA, analyzing the environmental impacts of a proposed , adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources..

Environmental Justice – The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EO 12898 requires Federal agencies to identify and address disproportionate adverse effects of their programs, policies, and activities on minority and low-income populations.

Environmental Consequences – Environmental effects of project alternatives, including the proposed action or project, any

Equivalent-Average Sound Level – A single decibel value that accounts for varying sound levels, or the total sound energy, over a specified time period.

Erosion – The wearing away of the land surface by detachment and movement of soil and rock fragments through the action of moving water, wind, and other geological agents.

Estuary – A body of water where a river meets the sea. The Meadowlands is the largest brackish estuary complex in the New York/New Jersey Harbor Estuary and is a highly productive system.

Eutrophication – The process by which a body of water becomes enriched in nutrients that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen and creation of “dead zones.”

Exacerbate – To make a situation or problem worse or more pronounced.

Excavate – To make hollow by removing the inner part; make a hole or cavity in; form into a hollow, as by digging.

Extract – To get, pull, or draw out, usually with special effort, skill, or force.

Farmland – Land being used for agricultural purposes, including cropland, pastures, meadows, and planted woodlands. Important farmlands are subject to the provisions of, and receive special protection under, the FPPA and may include *prime farmland*, *unique farmland*, *farmland of statewide importance*, and *farmland of local importance*. Each of these terms is defined separately.

Farmland of Local Importance – Land that is identified by local agencies as being important for the production of food, feed, fiber, forage, and/or oilseed crops in the corresponding local community.

Farmland of Statewide Importance – Land that is identified by State agencies as being important for the production of food, feed, fiber, forage, and/or oilseed crops in the corresponding State.

Fauna – The animals of a particular region, period, or special environment.

Feature – A prominent or conspicuous part or characteristic.

Finding of No Significant Impact – A NEPA decision document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded (Sec. 1508.4), will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared (40 CFR § 1508.13).

Floodplain – The relatively flat area or lowland adjoining a river, stream, ocean, lake, or other body of water that is susceptible to being inundated by floodwaters.

Floodwall – Vertical artificial barrier designed to temporarily contain the waters of river or other waterway which may rise to unusual levels during seasonal or extreme weather events.

Flora – Vegetation; plant life characteristic of a region, period, or special environment.

Flow – To move along in a stream, river, or other waterway.

Fluctuate – To shift back and forth between values, direction, location, etc.

Fluvial – Of, or relating to, a river or stream; produced by or found in a river or stream.

Flux – The action or process of flowing or flowing out; continuous change, passage, or movement.

Fly Ash – Ash produced in small dark flecks, typically from a furnace, and carried into the air.

Foreground – The ground or parts situated, or represented as situated, in the front.

Form – External appearance of a clearly defined area, as distinguished from color or material.

Formal Organization – A fixed set of rules of intra-organization procedures and structures.

Fragmented – Existing or functioning as though broken into separate parts.

Freight Facilities – Facilities used for the transport of goods or cargo, whether by water, land, or air.

Frequency – The number of times a periodic vibration repeats itself in a specified time, often 1 second; pitch.

Fuel Additives – Substances which increase a fuel's octane rating or act as corrosion inhibitors or lubricants, thus allowing the use of higher compression rations for greater efficiency and power.

Fuel Economy – The fuel efficiency relationship between the distance traveled and the amount of fuel consumed by a vehicle.

Gaseous – Existing in the state of a gas; pertaining to or having the characteristics of gas.

General Conformity Rule – 40 CFR Parts 51 and 93 require Federal actions or federally funded actions planned to occur in a non-attainment or maintenance area to be reviewed prior to their implementation to ensure that the actions would not interfere with applicable state or tribal implementation plans to meet or maintain the NAAQS.

Genotype – The genetic makeup of an organism.

Gentrification – The process of renewal and rebuilding accompanying the influx of middle-class or affluent people into deteriorating areas that often displaces poorer residents.

Geographic – Of, or relating to, the natural features, population, or industries, or a region or regions.

Geographic Information System – A computer-based software system that captures, analyzes, and presents spatial and geographical information.

Geology – Science that deals with the physical history of the Earth, the rocks of which it is composed, and physical changes in the Earth. Geological resources consist of surface and subsurface materials and their properties.

Geometric – The shape or form of a surface or structure.

Geomorphology – The study of the origin and evolution of the physical features (i.e., landforms) of the Earth.

Green Infrastructure – Drainage solutions that minimize runoff from development, restore the natural hydrologic cycle, recharge groundwater, preserve open spaces, and provide long-term benefits for the affected communities (USEPA 2012a).

Green Roof – A roof covered with vegetation, designed for its aesthetic value and energy conservation.

Greenhouse Gas – A gaseous compound in the atmosphere that is capable of absorbing infrared radiation and trapping and holding heat in the atmosphere. Some examples of GHGs include: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Groundwater – The water beneath the surface of the ground, consisting largely of surface water that has seeped down.

Groundwater Recharge – The hydrologic process where water moves downward from the surface to enter groundwater and aquifers.

Habitat – The natural environment of an organism; place that is natural for the life and growth of an organism.

Hackensack River – A river that runs through New York and New Jersey and drains into Newark Bay.

Haphazard – Marked by lack of plan, order, or direction; chosen without reason.

Hazardous Air Pollutants – Air pollutants that may cause or contribute to a serious illness, such as cancer, cause or contribute to death in humans, and/or cause serious adverse environmental effects when they are deposited in soil or water. Examples of HAPs include: benzene, methylene chloride, naphthalene, and asbestos.

Hazardous Material – A substance or material that poses a potential threat to human health or the environment, either by itself or through interaction with other factors, and may be released to the soil, soil vapor, groundwater, surface water, or sediment. This term includes hazardous substances, hazardous wastes, materials designated as hazardous under the provisions of 40 CFR § 172.101, and materials that meet the defining criteria for hazard classes and divisions in 49 CFR Part 173.

Hazardous Substance – Under CERCLA, elements, compounds, mixtures, solutions, and substances which, when released into the environment, may present substantial danger to public health and welfare or the environment. A list of hazardous substances is found in 40 CFR § 302.4.

Hazardous Waste – A waste that poses substantial or potential threats to human health or the environment, and which is regulated under RCRA. Hazardous wastes are identified in 40 CFR § 261.3 and applicable foreign laws, rules, and regulations.

Heavy Metal – Any metal with a specific gravity of 5.0 or greater, especially one that is toxic to organisms, such as lead, mercury, copper, and cadmium.

Herbicide – A substance or preparation for killing plants, especially weeds.

Herpetological – Of, relating to, or derived from reptiles and/or amphibians.

Hertz – A measurement of sound frequency, in cycles per second.

Historic – Dating to the period of human history; within the US, this period is generally accepted to be the period that is post-European contact.

Historic Fill – Non-native material deposited to raise the topographic elevation of a site, and in some instances has contamination present.

Historical Recognized Environmental Condition – A past release of any hazardous substance or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or met Unrestricted Use criteria established by a regulatory authority, without subjecting the property to any required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls).

Human Environment – Includes the natural and physical environment and the relationship of people with that environment.

Hydraulic – Operated by, moved by, or employing water or other liquids in motion.

Hydric Soil – A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic (oxygen-lacking) conditions that favor the growth and regeneration of hydrophytic vegetation; used as one indicator of wetlands.

Hydrology – The study of the occurrence, distribution, circulation, movement, and properties of water.

Impervious Surface – Surfaces covered by impenetrable materials such as asphalt, concrete, brick, stone, rooftops, or compacted soils.

Impulsive Sound – A single peak or burst of peaks with duration of less than 1 second.

Incinerator – A furnace or apparatus for burning trash or garbage into ashes.

Indirect Impact (Effect) – An impact caused by a proposed project that occurs later in time or farther removed in distance from the proposed project, but is still reasonably foreseeable. Indirect impacts may include induced changes in the pattern of land use, population density or growth rate, and related effects on air, water, and other natural and social systems.

Industrial Land Use – Land use of a relatively higher intensity that is generally not compatible with residential development. Examples include light and heavy manufacturing, mining, and chemical refining.

Infiltrate – To filter into or through; to permeate.

Infrastructure – The system of public works of a country, state, or region.

Inorganic – Noting or pertaining to compounds that are not hydrocarbons or their derivatives.

Installation – Any more or less permanent structure.

Instrumentation – The use of, or work done by, instruments.

Intensity – The strength or sharpness of a noise or sound.

Intermittent – Stopping or ceasing for a time; alternately ceasing and beginning again.

Intersection – A place where two or more roads meet.

Inundate – To flood; to cover with water.

Invasive Species – A species that spreads, usually from anthropogenic influence, into an area in which it is not native and causes harm to the natural environment.

Invertebrate – An animal that lacks a spinal column.

ISRA site – A property occupied by facilities with specific NAICS codes listed in the ISRA regulation. ISRA sites have mandatory remediation requirements when certain planned or unplanned business and property transactions occur.

Job-Year - A job-year is equivalent to the full-time employment of one person for one year. For example, 10 job-years would represent the full-time employment of 10 people for 1 year, or of 1 person for 10 years.

Jurisdictional Wetland – Areas that meet wetland hydrology, vegetation, and hydric soil characteristics, and have a direct connection to a water of the US. These areas are regulated by the USACE under Section 404 of the CWA.

Juxtapose – To place and compare side by side.

Known Contaminated Site – Non-homeowner site or property where contamination of soil or groundwater has been confirmed at levels equal to or greater than applicable standards.

L_{10} – The noise level of an area that is exceeded 10percent of the time.

L_{50} – The median sound level or sound level of an area exceeded 50 percent of the time.

L_{90} – The sound level of an area exceeded 90 percent of the time.

Labor Force – All members of a particular organization or population who are able to work, viewed collectively.

Land Use – A description of how land is occupied and utilized; it refers to the activities that occur on land and within the structures occupying it. The two primary categories are natural land use, which includes open or undeveloped areas such as woodlands or wetlands, and human-modified land use, which includes areas developed from a natural land cover condition such as residential areas or agriculture.

Landfill – A low area of land that is built up from deposits of solid refuse in layers covered by soil.

Landscape – A section or expanse of rural scenery, usually extensive, that can be seen from a single viewpoint.

Landscape Unit – Consistent patterns of visual elements within a landscape.

Lane Utilization – A term used in traffic analyses to identify when a lane is being used.

Lead Agency – The agency or agencies preparing or having taken primary responsibility for preparing the EIS.

Levee – An embankment for preventing flooding.

Level of Service – A qualitative measurement that evaluates the quality of a transportation system (i.e., roadway, intersection, etc.) by calculating traffic flow, delay, and overall convenience and serviceability.

Liaison – A person or entity that acts as a link to assist communication or cooperation between groups or people.

LiDAR – An optical remote-sensing technique that uses laser light to densely sample the surface of the Earth, producing highly accurate three dimensional measurements.

Listed Species – Any plant or animal designated as a Federal or State threatened or endangered species, species of special concern, or species that is proposed or a candidate for listing.

Logarithmic – A scale by which the value of a measurement has been adjusted by a power of 10.

Low- and moderate-income Population – As defined by the CDBG Program under HUD, “a person is considered to be of low income only if he or she is a member of a household whose income would qualify as ‘very low income’ under the Section 8 Housing Assistance Payments program. Generally, these Section 8 limits are based on 50% of area median. Similarly, CDBG moderate income relies on Section 8 ‘lower income’ limits, which are generally tied to 80% percent of area median” (HUD 1984).

Low-impact Development – A land planning and engineering design approach to manage stormwater runoff.

Low-income Population – The percentage of persons living below the poverty level as defined by the US Department of Health and Human Services.

Main – A principal pipe carrying water or gas to buildings, or taking sewage from them. Gravity mains are powered by gravity; force mains are powered by pumps.

Maintenance Area – A region that has been designated by the USEPA or the appropriate state air quality agency as having attained compliance with the Federal or state ambient air quality standards, after having been in nonattainment status (i.e., a previous nonattainment area that is now in attainment).

Major Impact – An impact that is particularly large in magnitude, considering both context and intensity, and is likely difficult to mitigate.

Marsh – A tract of low wet land, often treeless and periodically inundated, generally characterized by growth of grasses, sedges, cattails, and rushes.

Maximum Achievable Control Technology –Introduced in the 1990 CAA amendments to reduce the effect of HAPs by requiring the maximum degree of emission reduction achievable for a corresponding HAP source category.

Mean High Water Line – Average of all the high water heights observed over a period of several years.

Meadowlands – The New Jersey Meadowlands are part of the largest wetland ecosystem in northern New Jersey and are a critical component of the New York/New Jersey Harbor Estuary. The Meadowlands are located in a valley between the Palisades to the east and a parallel western ridge. Elevations in the area range from 0 to 10 feet (NAVD 88); the area is prone to chronic flooding.

Meadowlands Interagency Mitigation Advisory Committee (MIMAC) – An interagency review team for mitigation banks and other mitigation projects in the Meadowlands District. The MIMAC consists of representatives from the NMFS, USFWS, USACE, USEPA, NJSEA, and NJDEP Mitigation Unit.

Meteorology – The atmospheric conditions and weather of an area.

Metering Chamber – An underground vault in a wastewater infrastructure system that contains a meter to measure wastewater flow.

Methodology – A particular procedure for completing a task or job.

Metric – A standard for measuring or evaluating.

Metropolitan – Of, or relating to, a large city, its surrounding suburbs, and other neighboring communities.

Microtopograhy – The surface features of an area, material, etc., on a small or microscopic scale; the study of such features.

Middle-ground – An intermediate position or area within a landscape view.

Migration – The process of moving from one area to another.

Mineral Ore – A naturally occurring solid material from which a valuable mineral has been extracted.

Mineral Resources – Concentrations of non-fuel-based materials that can be extracted from the Earth, typically through mining or quarrying operations. Examples include: gold, aluminum, copper, limestone, clay, precious stones/gems, gravel, sand.

Minor Impact – An impact which is of a smaller scale or can be more readily mitigated than impacts categorized as major, considering both context and intensity.

Minority Population – As defined by the US Census Bureau, the minority population includes all non-White and White-Hispanic persons.

Mitigation – Measures taken to reduce, avoid, compensate, and/or rectify adverse impacts on the environment. Per 40 CFR § 1508.20, "mitigation includes: (a) Avoiding the impact altogether by not taking a certain action or parts of an action; (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) Compensating for the impact by replacing or providing substitute resources or environments."

Mobile Sources (emissions) – Vehicles, aircraft, watercraft, construction equipment, and other moving equipment that use internal combustion engines for energy sources and emit air pollutants.

Monitoring – A process of inspecting and recording the progress of mitigation measures that have been implemented.

Muffling – To deaden sound through wrappings or other means.

Municipal – Of, or relating to, a town, city, or its local government.

National Ambient Air Quality Standards – Nationwide standards established by the USEPA for widespread air pollutants, as required by Section 109 of the CAA. Currently, six criteria pollutants are regulated by the NAAQS: CO, Pb, NO_2, O_3, PM, and SO_2.

National Emission Standards for Hazardous Air Pollutants – Standards established by the USEPA that aim to minimize emissions of HAPs from man-made air emission sources.

National Environmental Policy Act – US statute that requires all Federal agencies to consider and document the potential environmental effects of a proposed Federal project on the human and natural environment, prior to undertaking the project.

Natural Harmony - When viewing the components of a scene's natural environment, viewers inherently evaluate the natural harmony of the existing scene, determining if the composition is harmonious or inharmonious.

Negligible – So small or unimportant as to be not worth considering, insignificant

NEPA Process – All measures necessary for compliance with the requirements of Section 2 and Title **I** of NEPA (40 CFR § 1508.21).

New Jersey Department of Environmental Protection – New Jersey agency that manages the State's environment and creates and implements State policies that address pollution and natural resources conservation in the State; the recipient of HUD grant funds and the "Responsible Entity" defined by HUD regulations and Lead Agency for the Proposed Project.

New Source Performance Standards – Standards established by the USEPA that aim to minimize emissions of criteria pollutants from man-made air emission sources.

Nexus – A means of connection; a connected series or group; the core or center.

No Action Alternative – Described in 40 CFR § 1502.14, this alternative represents the *status quo* or baseline conditions without the implementation of any of the activities associated with the Proposed Project.

Noise – Any sound that is undesirable because it interferes with communications or other human activities, is intense enough to affect hearing, or is otherwise annoying; may be intermittent, continuous, steady, or impulsive.

Noise-sensitive – Likely to be negatively impacted by elevated noise levels.

Noise Limits – Values of volume, generally measured in decibels, for which an activity cannot exceed.

Nonattainment Area – An area that has been designated by the USEPA or the appropriate state air quality agency as exceeding one or more of the NAAQS or state ambient air quality standards.

Nor'easter – A strong storm occurring in the northeast Atlantic region of the United States.

Normal Tide – As defined in AECOM's coastal models, 'normal tide' is when the driving forces for water elevations in the model are tidal consitutents only (i.e., no external driving forces like wind or pressure are applied), and represents the water elevation range between -3.63 and 3.63 feet (NAVD 88). This definition was sourced from the ADCIRC model of the FEMA Region II Coastal Storm Surge Study dated September 2014 (FEMA 2014c). Normal tide is not NOAA's mean higher high water or spring high tide, but rather is a tidal range that includes both of those tides.

Notice of Intent – A NEPA-related publication that formally declares the intention to prepare an EIS.

Nuisance – An obnoxious or annoying person, species, thing, condition, or practice.

Octave – A series of eight notes occupying the interval between (and including) two notes, one having twice or half the frequency of vibration of the other.

Odor – A sensation perceived by the sense of smell.

Open Space – Any area of land remaining in its natural state or free from intensive development for residential, commercial, industrial, or institutional use. It includes areas preserved for scenic beauty and visual quality or for the conservation of habitat or ecosystems. When used for recreation, it is known as 'recreational land.'

Operable Unit – A subsection of a larger USEPA Federal Superfund site.

Organic – Of, relating to, or containing carbon compounds.

Ornamental Crop – Crop grown for decorative purposes in gardens and landscape design projects.

Ozone Transport Region – The region from Northern Virginia to New England where the USEPA has set specific ozone emission and control requirements, such as more restrictive ozone precursor *de minimis* levels.

Paleoenvironment – An environment of a past geological age.

Palustrine (wetland) **–** An inland, non-tidal, freshwater wetland that lacks flow.

Palynology – The study of live and fossil spores, pollen grains, and similar plant structures.

Parcel – A distinct, continuous portion or tract of land.

Park-and-ride – A system in which drivers leave their cars in parking lots on the outskirts of a city and travel into the city center on public transportation.

Particle – A minute portion, piece, fragment, or amount.

Patron – A person who is a customer, client, or paying guest.

Pedestrian – A person who goes or travels on foot.

Permanent easement – A full or partial property taking. A full easement involves procuring a defined parcel in its entirety, while a partial property taking involves an easement where the original property would be severed to form two (or more) parcels, only one of which would be acquired. A permanent easement can include a permanent land acquisition that entails a change in land ownership or a permanent agreement with the existing land owner for long-term use.

Permeability – The state or quality of a material or membrane that allows liquids or gases to pass through the material; the capacity of a porous rock or sediment to permit the flow of fluids through its pore spaces.

Pervious Surface – Surfaces which allow the passage of water through them.

Pesticide – A chemical preparation for destroying plant, fungal, or animal pests.

Petroleum – An oily, thick, flammable, usually dark-colored liquid used in a natural or refined state as fuel.

Phenotype – The observable physical properties of an organism driven by the genotype.

Pigment – A coloring matter or substance.

Pile Driving – A construction activity in which a mechanical device is used to drive piles (poles) into soil to provide foundation support for buildings and other structures.

Pitch – The degree of height or depth of a tone or sound, depending upon the relative rapidity of the vibrations by which it is produced.

Planning Horizon – The amount of time extending into the future that is encompassed within a planning process. For the purposes of this document, the planning horizon is 30 years from the completion of the Proposed Project, which would extend through approximately 2052; related to reasonably foreseeable development initiatives.

Plasticity – The water content boundary of a soil between the plastic and semi-solid states, as defined by an Atterbergs Limit laboratory test or field test as defined in the Standard Practice for Classification of Soils for Engineering Purposes (ASTM 2011).

Plasticizer – A group of substances that are used in plastics or other materials to impart viscosity, flexibility, softness, or other properties to the finished product.

Pollinator – An organism that conveys pollen to the stigma of a flower or other plant.

Pollutant – A substance introduced into the environment that adversely affects the usefulness of a resource.

Polychlorinated Biphenyls – A group of organic compounds used in plastics, lubricants, transformers, adhesives, wire coatings, and protective coatings for wood, metal, and concrete.

Polycyclic Aromatic Hydrocarbon – A class of organic compounds produced by incomplete combustion or high-pressure processes.

Poorly Drained Soil – Soil which remains wet at shallow depths for long periods of time because water drains slowly.

Precipitation – The products of condensation in the atmosphere, which fall as rain, snow, or hail.

Preferred Alternative – The alternative which an agency believes would most optimally fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors.

Prehistoric – Within the US, this refers to the period of human history prior to European contact and settlement.

Prime Farmland – A category of highly productive farmland that is recognized and described by the USDA NRCS as land with "the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses."

Procurement – The act of obtaining equipment, materials, or supplies.

Project Area – The area subject to potential impacts from a Proposed Project. For the purposes of this document, the Project Area is the area within the project boundaries, which includes the Boroughs of Carlstadt, Little Ferry, Moonachie, and Teterboro, as well as the Township of South Hackensack, all in Bergen County, New Jersey. Approximate Project Area boundaries are: the Hackensack River to the east; Paterson Plank Road and the southern boundary of Carlstadt to the south; State Route 17 to the west; and I-80 and the northern boundary of the Borough of Little Ferry to the north.

Project Coherence - When viewing the project environment, viewers evaluate the coherence of the project components (i.e. the right-of-way), determining if the project's composition is coherent or incoherent.

Proliferate – To succeed and increase rapidly in number.

Propagate – The natural increase in a population.

Proposed Project – For the purposes of this document, the Proposed Project is the Rebuild by Design Meadowlands Flood Protection Project designed to address: 1) systematic inland flooding from high-intensity rainfall/runoff events; and 2) coastal flooding from storm surges. It analyzes the implementation of structural flood protection and/or stormwater drainage improvements. It must be implemented by September 30, 2022

Public Services – Organizations and community facilities that serve the public, such as police departments, fire departments, hospitals, jails, libraries, and schools.

Pump Station – Facilities including pumps and equipment for pumping fluids from one place to another; used for draining low-lying land and the removal of sewage to processing facilities.

Qualitative – Pertaining to or concerned with quality or qualities.

Quantitative – Of, or relating to, the describing or measuring of quantity.

Qualified Farm – A farm qualifying for a tax assessment reduction under the New Jersey Farmland Assessment Act, which includes being "no less than five acres of farmland actively devoted to an agricultural or horticultural use for the two years immediately preceding the tax year being applied for and meet specific minimum gross income requirements based on the productivity of the land," (New Jersey Department of Agriculture 2016).

Quarry – A place where mineral resources are extracted from the Earth.

Queue – An organized sequence of items.

Rain Barrels – A small, aboveground storage tank often used to collect rainwater from rooftop gutter downspouts and store it for later use.

Rain Garden – A planted depression or hole that allows rainwater runoff from impervious urban areas the opportunity to be absorbed; often implemented in conjunction with roofs, driveways, walkways, parking lots, and compacted lawn areas.

Range of Alternatives – All reasonable alternatives that must be rigorously explored and objectively evaluated within a NEPA disclosure document, as well as those other, non-reasonable alternatives that are eliminated from detailed study with a brief description of the reasons for eliminating them; as described in 40 CFR § 1505.1(e).

Rebuild By Design – A competition launched by HUD in the summer of 2013 to develop ideas to improve physical, ecological, economic, and social resilience in regions affected by Hurricane Sandy. The competition sought to promote innovation by developing flexible solutions that would increase regional resilience.

Recognized Environmental Condition – As defined by the Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM Standard E 1527-13), the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment. De minimis conditions are not recognized environmental conditions.

Record of Decision – A NEPA decision document that follows the completion of an EIS and documents the decision that is made by the Federal agency resulting from the analysis presented in the EIS. The contents of a ROD are as prescribed in 40 CFR § 1505.2.

Redevelopment – The rebuilding of an urban residential or commercial section in decline.

Refuse – Anything thrown away; waste; rubbish.

Remediation – The correction of something bad or defective.

Renewable Energy – A naturally occurring, theoretically inexhaustible source of energy that is not derived from fossil or nuclear fuel.

Reservoir – An artificial lake where water is collected and kept for use.

Residue – Something that remains after a part is removed, disposed of, or used; remainder; rest; remnant.

Resiliency – The ability to recover readily from adversity or difficulties.

Responsible Entity – Assume the responsibility for environmental review, decision-making, and action that would otherwise apply to HUD under NEPA and other provisions of law that further the purposes of NEPA, as specified in 24 CFR § 58.2(a)(7)(i).

Retaining Wall – Structure designed and constructed to resist the lateral pressure of soil when there is a steep angle of change in ground elevation.

Revitalization – Giving of new life, vigor, or vitality to something.

Ridge – A long, narrow elevation of land.

Riparian Area – Plant habitats and communities along the margins of a river, stream, or other waterbody.

Runoff – Something that drains or flows off, as precipitation flows from the land into streams.

Runway protection zone (RPZ) - RPZs or clear zones are a trapezoidal area immediately beyond the end of a runway that serves to enhance the protection of people and property on the ground in the event an aircraft lands or crashes beyond the runway end.

Salinity – The amount of salt present in a particular amount of water.

Sanitary Wastewater – Domestic sewage originating from sinks, toilets, and similar appliances. Sanitary wastewater does not include stormwater.

Saturation Flow Rate – The number of vehicles per hour that could cross a signalized stop line if the signal remained green all of the time.

Scale – To judge an amount according to a fixed proportion.

Scope – A range of actions, alternatives, and impacts to be considered in an environmental impact statement.

Scenic – Of, or relating to, natural scenery.

Seaplane – An airplane provided with floats for taking off from, or landing on, water.

Sediment – Organic, solid particles, often broken down to a small size by weathering and erosion, that settle to the bottom of a liquid.

Sedimentation – The process by which particulates that are in suspension in a liquid settle out and are deposited on the solid surface over which the liquid flows.

Semivolatile Organic Compound – A subgroup of VOCs that tend to have a higher molecular weight and higher boiling point temperature than other VOCs.

Sensitive Receptors – In the context of NEPA, these are entities that are particularly sensitive to noise and/or air quality impacts. These include, but are not limited to, asthmatics, children, and the elderly, as well as specific facilities, such as long-term health care facilities, rehabilitation centers, convalescent centers, retirement homes, residences, schools, playgrounds, and childcare centers.

Setting – The surroundings or environment of something.

Sewage – The waste matter that passes through sewers.

Short-term Impacts – Direct or indirect impacts resulting from an action in the near term. In this context, short-term does not refer to any rigid time period and is determined on a case-by-case basis in terms of the environmental consequences of a proposed project.

Significant Impact – According to 40 CFR § 1508.27, "significance" as used in NEPA requires consideration of both context and intensity:

Context. The significance of an action must be analyzed in several contexts, such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of a proposed project. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action.

Slag – Waste left over after the re-sorting of coal or extraction of a metal from its ore.

Sludge – Mud-like material resulting from industrial or refining processes.

Socioeconomics – The basic attributes and resources associated with the human environment, particularly population and economic activity.

Soil – The mixture of altered mineral and organic material at the Earth's surface that supports plant life.

Solid Waste – As defined by RCRA, any garbage, refuse, sludge, and other discarded material, including solids, semisolids, liquids, and contained gases.

Spawning – To produce and/or deposit eggs, in an aquatic animal.

Special Status Species – Any plant or animal designated as a Federal or State threatened or endangered species, species of special concern, or species that is proposed or a candidate for listing.

Species of Special Concern – A species that warrants special attention because of evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a threatened species.

Spring High Tide – Occurring during full and new moons, spring high tides represent the highest tide in a lunar cycle. They are unrelated to the season of spring.

Stationary – Having a fixed position; not moveable.

Stationary Source – A non-moving, permanent source that emits more than a certain amount of an air pollutant as defined by the USEPA.

Statistical – A numerical fact or datum, especially one computed from a sample.

Storm Surge – An abnormal rise in the level of the sea along a coast caused by the low pressure and high winds of a severe storm.

Stormwater – Water from rain, hail, or snowmelt events. Stormwater runoff occurs when precipitation overflows the land surface. Roads, driveways, parking lots, and other surfaces that do not allow water to soak into the ground increase runoff volumes during storm events.

Stratigraphy – The study of rock layers and layering.

Stratosphere – The second layer of the atmosphere, moving upwards; this layer contains little water vapor and few clouds.

Subsequent – Following in time, order, or place.

Substantial – Of ample or considerable amount, quantity, or size

Substation (electrical) **–** A set of equipment reducing and redirecting the high voltage of electrical power transmission to that suitable for supply to consumers.

Substrate – The base on which an organism lives.

Subsurface – Below the surface, especially a body of water.

Subwatershed – The land that drains into a specific waterbody or larger watershed.

Succession – The process of change in the species structure of an ecological community over time.

Superfund Site – A hazardous waste site that is on the National Priorities List and requires environmental remediation or further investigation for remediation.

Surface Water – Water on the surface of the planet such as in a stream, river, lake, wetland, or ocean.

Sustainability – The creation and maintenance (i.e., endurance) of existing conditions, systems, and processes that can remain productive and relevant over the long-term.

Switching Station (electrical) – Electrical substation that does not have transformers and operates at only one voltage level.

Tailings – The residue of any product, as in mining.

Telecommunication – Communication over a distance by cable, telegraph, telephone, or broadcast.

Temporary – Lasting for only a limited period of time; not permanent.

Temporary easement - A temporary right acquired by one party (from the owner of the property) to use or control the property belonging to another party during construction.

Terrestrial – Of, or relating to, land as distinct from air or water.

Therm – One therm is equal to 100,000 Btu, or the heat required to raise the temperature of 100,000 pounds of water by 1°F.

Threatened Species – Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Tidal – Of, pertaining to, characterized by, or subject to tides.

Tidal Influence – Periodic and consistent inundation of seawater on intertidal lands due to the rising and falling of the tides.

Tidal Range – The vertical difference between a high tide and the succeeding low tide.

Tide – The periodic rise and fall of the waters of the ocean and its inlets, produced by the attraction of the moon and sun, and occurring approximately every 12 hours.

Tide Gate – An opening through which water may flow freely when the **tide** moves in one direction, but which closes automatically and prevents the water from flowing in the other direction; a gate that closes during incoming (flood) tides to prevent tidal waters from moving upland and opens during outgoing (ebb) tides to allow upland waters to flow out.

Topography – The change in elevation over the surface of a land area.

Total Suspended Solids – A water quality parameter measuring the turbidity or cloudiness of water resulting from sediment particles in the water column.

Toxic Substance – A harmful substance that includes elements, compounds, mixtures, and materials of complex composition.

Traffic Volume – The number of vehicles crossing a section of road per unit of time during any selected period.

Transformer – An apparatus for reducing or increasing the voltage of an alternating electrical current.

Transition – The movement, passage, or change from one position, state, stage, subject, or concept to another.

Transportation – The act of moving people or goods.

Tributary – A stream that flows to a larger stream or other body of water.

Troposphere – The lowest layer of the Earth's atmosphere where almost all weather occurs.

Trunk (pipe) – Large pipe (often 48 inches in diameter or larger) that conveys sanitary wastewater collected from multiple mains through multiple municipalities.

Turning Movement Counts – A measure of the type and number of vehicles turning at, or passing through, an intersection.

Underground Storage Tank – A storage tank, not including any underground piping connected to the tank that has at least 10 percent of its volume underground.

Unique Farmland – Land other than "prime farmland" that is used for the production of "specific high-value food and fiber crops."

United States Department of Housing and Urban Development – A Federal agency that creates and implements policies regarding housing and urban living in the US; the grantee of funds for the Proposed Project.

Urban – Of, relating to, or designating a city or town.

Urban Heat Island – A city or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities.

Urban Major Collector – A road with relatively high volume that moves traffic to and from local streets providing access to residential areas.

Urban Minor Arterial – A road with relatively low volume that moves traffic from collector roads to highways and interstates.

Urban Principal Arterial – A road with relatively high volume that moves traffic from collector roads to highways and interstates

Urbanized – To make or cause to become urban.

Utilities and Service Systems – Services that are consumed by the public, such as sanitary wastewater collection and treatment, water supply and distribution, electricity, natural gas, solid waste, stormwater management, and communication systems.

Vapor – A visible exhalation, as fog, mist, steam, smoke, or noxious gas, diffused through or suspended in the air.

Vascular Plant – A plant that is characterized by the presence of tissues that move water and minerals throughout the plant.

Vegetated – To grow in or be covered by plant matter.

Vegetation – All the plants or plant life of a place, taken as a whole.

Vertebrate – An animal that has a spinal column.

Vibration – The oscillating, reciprocating, or other periodic motion of a rigid or elastic body or medium forced from a position or state of equilibrium.

Vibration Decibel Scale – Referred to as vibration velocity, vibrational energy is typically rated using VdB. This scale is not weighted by frequency sensitivity as the dBA scale is for sound.

Vibration Limits – Values of vibration, generally measured in velocity, for which an activity cannot exceed.

Vicinity – The area or region near or about a place; surrounding district.

Viewer Exposure – A qualitative measurement based on the number of viewers exposed to the view, type of viewer activity, duration of their view, speed at which the viewer moves, and position of the viewer.

Viewer Location – The placement within a landscape in which a viewer is exposed to a view.

Viewer Response – A qualitative measurement of a viewer's reaction to a view or change of view within a landscape.

Viewer Sensitivity – A qualitative measurement based on the viewers' concern for scenic quality and the viewers' potential response to change in the visual resources composing the view.

Viewshed – A consistent pattern of visual elements within a landscape; all of the surface area visible from a particular location or sequence of locations (in the instance of a moving object).

Vista – A view or prospect, especially one seen through a long, narrow avenue or passage, as between rows of trees or houses.

Visual Character – A characteristic, especially one that assists in the identification of a visual setting; the description of the visible attributes of a scene or object typically using artistic terms such as form, line, color, and texture.

Visual Quality – A qualitative measurement of the visual and scenic beauty of an area.

Visual Resource – Assets or materials that add benefit to a visual setting.

Volatile Organic Compound – Organic compounds that easily become vapors or gases.

Volatilize – To cause to pass off as vapor through rapid evaporation.

Water Balance – The principle that the sum of water inflows must equal the sum of water outflows, minus any change in water storage that occurs.

Water Column – The area between the surface of the waterbody and the bottom (i.e., benthic sediments) of the waterbody.

Water Quality – The chemical, physical, biological, and radiological characteristics of water; a measure of the condition of water.

Waterbody – A body of water forming a physiographical feature; the part of Earth's surface covered with water (such as a river, lake, or ocean).

Waterfront – The land on the edge of a body of water.

Waterway – A river, canal, or other body of water serving as a route or way of travel or transport.

Waters of the United States – Includes the following: (1) all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; (2) all interstate waters including interstate wetlands; and (3) all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce.

Watershed – The region draining into a particular stream, river, or entire river system.

Water Table – The level below which the ground is saturated with water.

Well-Drained Soil – Soil which drains water readily, but not rapidly.

Wetland – An area that is regularly saturated by surface or groundwater and, thus, is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes, and estuaries.

Zoning Ordinance – Regulations and maps that control the use, density, and bulk of development within a municipality.

10.0 List of Stakeholders

This section includes a list of all agencies, officials, and Native American tribes that have been consulted throughout the preparation of the NEPA process. Stakeholders are organized below as follows: Federal agencies, State agencies; regional, county, municipal, and other local agencies; and Native American tribes. In addition, NJDEP notified all entities registered on the Proposed Project's ListServ of the availability of the DEIS, FEIS, and ROD.

10.1 Federal Agencies

ADVISORY COUNCIL ON HISTORIC PRESERVATION

401 F Street NW, Suite 308
Washington, DC 20001-2637

POC: Jaime Loichinger, Program Analyst

AMTRAK

30th Street Station
2955 Market Street
Philadelphia, PA 19104

POC: Stephen Gardner, Executive Vice President
POC: Petra Messick, Senior Officer of Outreach & Communications

FEDERAL AVIATION ADMINISTRATION

Eastern Region
1 Aviation Plaza
Jamaica, NY 11434-4809

POC: James Robinson, Regional Emergency Transportation Representative

FEDERAL EMERGENCY MANAGEMENT AGENCY

Headquarters
500 C Street, SW
Washington, DC 20472

POC: Diana Matteson, Program Support Specialist

Region 2
26 Federal Plaza, Suite 1337
New York, NY 10278-0002

POC: Michael Audin, Deputy Regional Environmental Officer
POC: Emily Hodecker, Deputy Environmental Planning and Historic Preservation Supervisor

FEDERAL TRANSIT ADMINISTRATION

Region 2 - Lower Manhattan Recovery Office

1 Bowling Green, Room 436
New York, NY 10004

POC: Stephen Goodman, Director, Sandy Recovery Offices
POC: Donald Burns, Acting Director of Planning and Program Development
POC: Dan Moser, Region 2 Community Planner

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Headquarters
1401 Constitution Avenue NW, Room 5128
Washington, DC 20230

POC: Sandy Eslinger, Senior Policy Advisor

National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office
Habitat Conservation Division
James J. Howard Marine Sciences Laboratory
74 Magruder Road
Highlands, NJ 07732

POC: Karen Greene, Mid-Atlantic Field Offices Supervisor
POC: Daniel Marrone, Fishery Biologist

NATIONAL PARKS SERVICE

Northeast Region
US Custom House
200 Chestnut Street, 5th Floor
Philadelphia, PA 19106

POC: Shaun Eyring, Chief of Cultural Resources
POC: Sarah Killinger, Resources Planning and Compliance

US ARMY CORPS OF ENGINEERS

New York District Public Affairs
26 Federal Plaza, Room 2113
New York, NY 10278

POC: Chis Mallery, Deputy Chief, Regulatory Branch
POC: Bryce Wisemiller, Project Manager, Programs and Project Management Division
POC: Jodi M. McDonald, Deputy Chief of Operations Division
POC: Colonel Thomas D. Asbery, New York District Commander

US DEPARTMENT OF HOUSING & URBAN DEVELOPMENT

Headquarters
451 7th Street, SW, Room 7212
Washington, DC 20410

POC: Danielle Schopp, Director of Office of Environment and Energy
POC: Lauren McNamara, Senior Environmental Specialist

US FISH & WILDLIFE SERVICE

New Jersey Field Office
Atlantic Professional Park, Unit 4
4 East Jimmie Leeds Road
Galloway, New Jersey 08205

POC: Eric Shrading, Field Office Supervisor
POC: Carlo Popolizio, Fish and Wildlife Biologist
POC: Ron Popowski, Supervisory Fish and Wildlife Biologist
POC: Steve Mars, Senior Fish and Wildlife Biologist

Region II - New York City Regional Office
26 Federal Plaza
New York, NY 10278

POC: Therese J. Fretwell, Regional Environmental Officer
POC: Alyson Beha, Sandy Senior Regional Planner
POC: Justin Scheid, Deputy Director
POC: Donna Mahon, Disaster Recovery Field Environmental Officer – NJ/CT

US ENVIRONMENTAL PROTECTION AGENCY

Region 2
290 Broadway
Mail Code: 25th FL
New York, NY 10007-1866

POC: Grace Musumeci, Chief of NEPA Section 309/NEPA Compliance Coordinator
POC: Walter Mugdan, Acting Deputy Regional Administrator and Superfund Division Director
POC: Stephanie Lamster, Endangered Species Coordinator

10.2 Native American Tribes

ABSENTEE-SHAWNEE TRIBE OF INDIANS OF OKLAHOMA

2025 South Gordon Cooper Drive
Shawnee, OK 74801

POC: Edwina Butler-Wolf, Governor

DELAWARE NATION, OKLAHOMA

P.O. Box 825
Anadarko, OK 73005

POC: Kerry Holton, President

DELAWARE TRIBE OF INDIANS

5100 Tuxedo Boulevard
Bartlesville, OK 74006

POC: Chester Books, Chief

EASTERN SHAWNEE TRIBE OF OKLAHOMA

P.O. Box 350
Seneca, MO 64865

POC: Glenna Wallace, Chief

SHAWNEE TRIBE

P.O. Box 189
Miami, OK 74354

POC: Ron Sparkman, Chief

10.3 State Agencies

NEW JERSEY STATE HISTORIC PRESERVATION OFFICE

Mail Code 501-04B
P.O. Box 420
Trenton, NJ 08625-0420

POC: Katherine Marcopul, Acting Deputy State Preservation Officer

NEW JERSEY TRANSIT

Headquarters
1 Penn Plaza East
Newark, NJ 07105

POC: Jared Pilosio, Manager, Superstorm Sandy Recovery and Resilience Program
POC: Steve Santoro, Assistant Executive Director, Capital Planning & Programs

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Corporate Offices
4 World Trade Center
150 Greenwich Street
New York, NY 10007

POC: Joe Simenic, Program Director. Storm Mitigation & Resilience

TETERBORO AIRPORT

Port Authority of New York & New Jersey
90 Moonachie Avenue
Teterboro, NJ 07608

POC: Renee Spann, Airport Operations Manager

10.4 Regional, County, Municipal, and Other Local Agencies

BERGEN COUNTY PLANNING AND ENGINEERING

One Bergen County Plaza, 4th Floor
Hackensack, NJ 07601-7076

POC: Joseph Femia, County Engineer

BOROUGH OF CARLSTADT

500 Madison Street
Carlstadt, NJ 07072

POC: Craig Lahullier, Mayor

BOROUGH OF LITTLE FERRY

215-217 Liberty Street
Little Ferry, NJ 07643

POC: Mauro Raguseo, Mayor

BOROUGH OF MOONACHIE

90 Moonachie Avenue
Moonachie, NJ 07074

POC: Dennis Vaccaro, Mayor

BOROUGH OF TETERBORO

510 Route 46 West
Teterboro, NJ 07608

POC: John Peter Watt, Mayor

NEW JERSEY SPORTS AND EXPOSITION AUTHORITY

One Dekorte Park Plaza
P.O. Box 640
Lyndhurst, NJ 07071

POC: Cheryl Rezendes

TOWNSHIP OF SOUTH HACKENSACK

227 Phillips Avenue
South Hackensack, NJ 07606

POC: Gary Brugger, Mayor

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11.0 Comments and Responses to Comments on the DEIS

The public comment period for the DEIS, as required by the NEPA and outlined in 40 CFR § 1506.10, was formally initiated with publication of the NOA for the DEIS in the *Federal Register* on June 1, 2018 in accordance with HUD and CEQ regulations. Following the publication of the NOA, there was a 45-day public review and comment period, during which the DEIS was made available to the general public for comment (including at a formal public hearing on June 26th, 2018), and circulated to stakeholders, other relevant groups, and government agencies that have been identified as having particular interest in, or jurisdiction over, the Proposed Project. The public comment period concluded after 45 days on July 15, 2018. At the conclusion of the 45-day public comment period for the DEIS, NJDEP incorporated substantive public comments into the FEIS. Additional details on the public comment period, including the Public Hearing, can be found in the Public Comment Summary Report (see **Appendix P**).

11.1 Comments and Responses on the DEIS

During the public comment period, the NJDEP received comments via mail, email, and either orally or on a comment card at the public hearing. NJDEP received a total of 88 comments from 27 commenters. Sources of comments included the Public Hearing, as well as written comment letters and comment cards from Federal agencies, private/public entities, and private citizens. A total of 6 comments from 6 commenters were received at the Public Hearing. The remaining 82 comments were from 21 commenters, which included 5 Federal agencies (USEPA, FTA, FAA, US Department of the Interior, and NOAA), 5 private/public entities (Hudsonia, Bergen County, RBD, Elm Group, and NY/NJ Baykeepr/Hackensack Riverkepper), and 11 private citizens.

NEPA requires that the lead agency include and respond to all substantive comments received on the DEIS (40 CFR § 1503.4). Lead agency responses may include the need to:

- Modify the proposed action or alternatives;
- Supplement or include previously absent or updated information;
- Supplement, improve, or modify the substantive environmental analyses;
- Make factual corrections to the text, tables, or figures contained in the DEIS; and/or
- Explain why no further changes to the EIS are necessary.

All comments received on the DEIS and NJDEP's response to substantive comments can be found in the Public Comment Summary Report, along with a copy of the court stenographer's transcript of the Public Hearing (see **Appendix P**).

11.2 Changes to the DEIS

Substantive comments received during the 45-day public comment period were used to prepare the FEIS. Changes made to the DEIS to prepare the FEIS included several minor changes, such as editorial corrections or changes deemed insignificant because they do not change the content, conclusions, or analysis within the EIS; these changes are not outlined in this section. Substantive changes to the EIS are described below. Please refer to **Appendix P** for a full description of changes resulting from each public comment.

- A brief description of factors that influenced the Build Alternative components proposed, and their respective locations, was added to the description of the Proposed Project and alternatives (**Sections 2.5** and **2.5.4.1**).
- The history of contamination in the Meadowlands District, as described in **Section 3.20.3**, was referenced in **Section 3.14.3.1** as a factor contributing to the relative lack of amphibian presence in the Meadowlands District.
- Entities responsible for implementation of the various stormwater rules/regulations, including NJAC 7:8 and NJAC 7:14A, were revised (**Section 3.19.2.2**).
- Additional clean diesel measures recommended by the USEPA were added to the Air Quality Mitigation Measures and BMPs (**Section 4.9.4.2**).
- Additional analysis of the potential impacts of the Proposed Project on EFH was added to the Biological Resources analysis (**Section 4.14**) and the EFH Assessment Report was added as **Appendix Q**.
- Several RFF projects, including the recent closure and planned reconstruction of Washington Elementary School, the Main Street Drainage Improvement Project, Moonachie Road/Washington Avenue and Moonachie Avenue/Empire Boulevard Intersection Improvements projects, and Bergen County's Backflow Preventer Project, were incorporated into the Cumulative Impacts Analysis (**Section 5.0** and **Appendix C**).
- Several incorrect avian and mammal species observations were revised following a review of the original field data collected (**Appendix J**).

The completed FEIS will be circulated in the same manner as the DEIS (including the publication of a NOA in the Federal Register and local media outlets) and has a public review and comment period of 30 days. If additional substantive comments are received during the FEIS public comment period, NJDEP will address these comments in the ROD. The ROD will be available for a 15-day public review period following the publication in the Federal Register of a NOI for the ROD and Request for Release of Funds (RROF).