Peckman River Basin, New Jersey
Flood Risk Management Feasibility Study
Final Integrated Feasibility Report & Environmental Assessment

February 2020

U.S. Army Corps of Engineers
North Atlantic Division, New York District
In partnership with the
New Jersey Department of Environmental Protection

Woody debris and erosion left in the aftermath of Hurricane Floyd (September 1999).

Cover Page Images

Left image: High flows & water levels due to Hurricane Floyd at a bridge abutment along the Peckman River (Little Falls Historical Society, 1999).

Top right image: Pedestrian bridge over Great Notch Brook during the June 30, 2009 storm (USACE, 2009).

Middle right image: Damage from Hurricane Doria to a road adjacent to the Peckman River (Little Falls Historical Society, 1971).

Lower right image: Damaged contents being disposed of due to Peckman River flood damage from Hurricane Floyd (Little Falls Historical Society, 1999).

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This report was prepared by the
New York District, North Atlantic Division of the
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Executive Summary

The U.S. Army Corps of Engineers (USACE), North Atlantic Division, New York District (District) has partnered with the New Jersey Department of Environmental Protection (NJDEP) to undertake the Peckman River Basin, New Jersey flood risk management feasibility study. This final integrated feasibility report and environmental assessment (FIFR/EA) presents the results of the study team's evaluation of various alternatives to manage the risk of damages caused by frequent fluvial flooding. Benefits, costs, and impacts caused by implementation of the Recommended Plan are described in this report. The optimized Recommended Plan, Alternative 10b-40, is fully described in this report.

This report fulfills the requirements of the National Environmental Policy Act of 1969 (NEPA), and was written in accordance with the President's Council on Environmental Quality Rules and Regulations for Implementing NEPA (Title 40, Code of Federal Regulations, Sections 1500-1508), USACE's Procedures for Implementing NEPA (Engineer Regulation 200-2-2), and other applicable Federal and state environmental laws.

Commercial and residential development in the Peckman River watershed has reduced the water holding capacity of the landscape and altered the natural dynamics of the river system. Storm events deposit large amounts of precipitation in the watershed, producing significant runoff. This quickly surpasses the capacity of the river channel, and bridges and culvert openings, resulting in flooding that first begins to occur at the ten percent flood event frequency. The most intense flooding conditions occur in the Borough of Woodland Park and the Township of Little Falls. During Hurricane Floyd (1999), flood waters reportedly reached three to four feet of overbank flow, causing an estimated $12,100,000 (Fiscal Year 2019 [FY19] price level [P.L.]) in flood-related losses to communities in the Peckman River Basin. Residents, businesses, and infrastructure in the Peckman River Basin continue to experience repeated, and significant flood damage due to flash flooding in the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River. Flooding has resulted in millions of dollars in damages, and the deaths of at least two residents in the basin.

The project's purpose is to manage the risk of flooding from the Peckman River. USACE considered a range of nonstructural and structural measures that could potentially manage flood damages in Woodland Park and Little Falls, the basin's most frequently flooded and densely populated areas. Through an iterative plan formulation process, potential fluvial flood risk management measures were identified, evaluated, and compared.

The Recommended Plan includes a combination of a diversion culvert connecting the Peckman and Passaic Rivers; associated weirs; levees and floodwalls; channel modifications; and nonstructural measures within the ten percent floodplain upstream of Route 46. The plan is designed to manage flood risk up to the two percent flood event. The plan would provide $9,440,000 in average annual benefits (FY 20 P.L.). The benefit-to-cost ratio of the plan is 1.5. The Recommended Plan will manage the risk of fluvial flooding in the project area.

The Recommended Plan would not have significant adverse cumulative impacts to land use; topography, geology or soils; state and/or Federal endangered, threatened and special concern species; historic properties; existing demographics, economy, housing and Environmental Justice communities; aesthetic and scenic resources; transportation; and air quality. Flood risk management measures contribute to water quality and aquatic habitat improvements by reducing the amount of manmade debris and pollutants introduced into waterways during flood events. Implementation of the Recommended Plan will result in short-term minor and long-term moderate adverse impacts to upland and wetland vegetation within the project area. The conversion of approximately 0.48 acres of forested wetlands to floodwall/levee and the modification of 1,848 feet of Peckman River will contribute to cumulative losses of riverine or wetland values and functions within the watershed. However, this impact will be minimized

through compensatory riverine and wetland mitigation. The riverine compensatory mitigation consists of restoration of 1,848 linear feet of the Peckman River through the installation of three bendway weir fields along the outer bends of the river where severe bank erosion is occurring and the stabilization of 0.85 acres of streambank with native vegetation. The wetland compensatory mitigation will be achieved through either the purchase of credits at a state approved mitigation bank or through off-site restoration of 0.96 acres of forested wetlands. It will also result in short term park closures and other construction-related disruptions to recreation, but these impacts will have negligible cumulative impacts. The Recommended Plan will introduce short-term increases in the noise environment from construction. These changes will have a negligible cumulative effect. There will be no adverse long term cumulative impacts on the existing environment once construction is completed.

The estimated project first cost is $146,188,000 (FY 20 P.L.). In accordance with the cost share provisions of Section 103 of the Water Resources Development Act of 1986, as amended (33 U.S. Code 2213), the Federal share of the project first cost is estimated to be $95,022,000 and the non-Federal share is estimated to be $51,166,000, which equates to 65 percent Federal and 35 percent non-Federal (FY 20 P.L.). The non-Federal costs include the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas estimated to be $5,273,000 (FY 20 P.L.). The non-Federal study sponsor, NJDEP, has indicated its support for the Recommended Plan and is willing to enter into a Project Partnership Agreement with the Federal government for the implementation of the plan. The design of the project will be refined during pre-construction engineering and design based on site-specific information.

Pertinent Data

Description & Location

The Recommended Plan includes a combination of a diversion culvert connecting the Peckman and Passaic Rivers; associated weirs; levees and floodwalls; channel modifications; and nonstructural measures within the ten percent floodplain upstream of Route 46. The plan is designed to manage flood risk up to the two percent flood event. The project will reduce the risk of flooding for those flood events that have up to a two percent chance of occurring in a given year. The project area includes the Township Little Falls and Borough of Woodland Park, which are located in Passaic County, New Jersey in the northern part of the state.

Plan Features

A 1,500-foot long, 40-foot diameter double box diversion culvert would be constructed between the Peckman and Passaic Rivers to divert floodwater from the Peckman into the Passaic River. The inlet at the Peckman River includes two weirs to manage flow and create a pool near the inlet. Channel modifications would be constructed along the Peckman River near the inlet. Approximately 2,170 linear feet of levees and/or floodwalls at a height up to +145 feet North American Vertical Datum of 1988 (NAVD88), would be built upstream and downstream of the ponding weir. In addition, 1,207 linear feet of levees and/or floodwalls would be constructed in the vicinity of Little Falls High School, between the track and baseball fields. These levees and/or floodwalls would be constructed at a height up to +145 feet NAVD88. Up to sixteen structures would be elevated so that their main floor elevations would be to a final height of one foot above the base flood elevation. The plan also includes up to 38 structures to be wet floodproofed and four structures to be dry floodproofed. All nonstructural plan elements are situated within the ten percent floodplain, and will be implemented based on the voluntary willingness of owners. Compensatory mitigation due to unavoidable temporary or permanent environmental impacts to forested wetland, riparian habitat, and stream restoration will be completed.

Economics

Costs (FY 20 P.L.)

Total Project Cost	$176,598,000[1]
Initial Project Cost	$146,188,000[2]
Annual Investment Cost	$5,609,000
Annual OMRR&R	$575,000
Total Annual Cost	$6,184,000

Benefits (FY 20 P.L.)

Average Annual Benefits	$9,440,000
Average Annual Net Benefits	$3,292,000
Benefit-to-Cost Ratio	1.5

Costs and benefits are annualized at 2.75 percent over a 50-year period of analysis (2027 through 2076).

Real Estate Requirements

The project would impact up to 29 parcels (17 privately-owned and 12 publicly-owned). The project would necessitate the acquisition of 5.84 acres of property. Permanent easements totaling 11.35 acres, and 6.20 acres of temporary easements would also be required. In some instances, more than one estate may be required to be obtained over the lands of the same owner. Required Lands, Easements, and Rights-of-Way total 23.39 acres.

Cost Apportionment[3] (FY 20 P.L.)

Cost Category	Federal Share	Non-Federal Share	Total
Total Project Cost	$114,789,000[1]	$61,809,000	$176,598,000
Initial Project Costs	$95,022,000[2]	$51,166,000	$146,188,000
Real Estate Costs[4]	$0	$5,273,000	$5,273,000
Cash Contribution	$0	$4,907,000	$4,907,000

[1] The Total Project Cost is the basis for the Project Partnership Agreement, and is based upon the midpoint of construction (January 2026). [2] Does not include interest during construction. [3] Construction is cost shared 65 percent Federal/35 percent non-Federal. [4] LERRDs are a non-Federal sponsor responsibility creditable towards the 35 percent non-Federal cost share.

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** Sections marked with an asterisk are applicable to the satisfaction of National Environmental Policy Act requirements*

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Appendices

Acronyms

AAB	Average Annual Benefits
AAC	Average Annual Costs
AAD	Average Annual Damages
ACM	Asbestos-Containing Material
APE	Area of Potential Affect
AQXRs	Air Quality Control Regions
BFE	Base Flood Elevation
BMP	Best Management Practices
CAA	Clean Air Act of 1963
CAP	Continuing Authorities Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System
CDBG-DR	USHUD Community Development Block Grant Disaster Recovery Program
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
DBA	Weighted Decibel
District	United States Army Corps of Engineers, New York District
DIFR/EA	Draft Integrated Feasibility Report and Environmental Assessment
DPW	Department of Public Works
EAD	Equivalent Annual Damages
ECB	Engineering and Construction Bulletin
EMS	Emergency Medical Service
EO	Executive Order
ER	Engineering Regulation
EPA RBP	U.S. Environmental Protection Agency Rapid Bioassessment Protocol
EPW	Evaluation of Planned Wetlands
ESA	Endangered Species Act of 1973
ETL	Engineering Technical Letter
EQ	Environmental Quality
FCSA	Feasibility Cost-Sharing Agreement
FEMA	Federal Emergency Management Agency
FHACAR	New Jersey Flood Hazard Area Control Act Rules
FIA	Flood Insurance Administration
FIFR/EA	Final Integrated Feasibility Report and Environmental Assessment
FIS	Flood Insurance Study
FWCAR	Fish and Wildlife Coordination Act Report
FY	Fiscal Year
GDM	General Design Memorandum
GHG	Greenhouse Gases
GIS	Geographic Information System
HEC-FDA	Hydrologic Engineering Center-Flood Damage Analysis model
HEC-RAS	USACE Hydrologic Engineering Center River Analysis System model
HMP	Hazard Mitigation Plan
HSI	Habitat Suitability Index
HTRW	Hazardous, Toxic and Radioactive Waste
IBA	Important Bird Area
ICA	Incremental Cost Analysis
KCS	Known Contaminated Sites
LBP	Lead-Based Paint

LDN	Day-Night Noise Level
LER	Land, Easements, and Rights-of-Way
LERRDS	Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas
LOI	Letters of Interpretation
LPP	Locally Preferred Plan
NAAQS	National Ambient Air Quality Standards
NNBFs	Natural and Nature-Based Features
NAVD88	North American Vertical Datum of 1988
NED	National Economic Development
NEPA	National Environmental Policy Act of 1969
NFIP	National Flood Insurance Program
N.J.A.C	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJDEP BFBM	New Jersey Department of Environmental Protection, Bureau of Freshwater and Biological Monitoring
NJFHACA	NJ Flood Hazard Area Control Act
NJHPO	New Jersey Historic Preservation Office
NNBF	Natural and Nature-Based Feature
NPL	National Priority List
NRCS	Natural Resources Conservation Service
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standard
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OMRR&R	Operation, Maintenance, Repair, Replacement, and Rehabilitation
OSE	Other Social Effects
P&G	1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies
PCB	Polychlorinated Biphenyl
PED	Pre-Construction Engineering and Design
PL	Price Level
PL	Public Law
PM	Particulate Matter
PMP	Project Management Plan
PPA	Project Partnership Agreement
RCRA	Resources Conservation and Recovery Act of 1976
RCRIS	Resource Conservation and Recovery Information System
RED	Regional Economic Development
SEM	Superfund Enterprise Management System
SIP	State Implementation Plan
SVOA	Semi-Volatile Organics
TRIS	Toxic Release Inventory System
TSP	Tentatively Selected Plan
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	US Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USHUD	U.S. Department of Housing and Urban Development
VOA	Volatile Organics

Chapter 1: Introduction

1.1 Introduction to This Report

The U.S. Army Corps of Engineers (USACE), New York District (District) prepared this final integrated feasibility report and environmental assessment (FIFR/EA) for the Peckman River Basin, New Jersey, flood risk management feasibility study. It includes a description of the costs and benefits of an optimized Recommended Plan for managing flood risk within the Peckman River Basin, New Jersey. The Peckman River Basin is located in portions of Essex and Passaic Counties, New Jersey.

The Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with managing and reducing risk to the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements (Principles and Guidelines [P&G], 1983). Water and related land resources projects are formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective. Pursuant to this, the FIFR/EA: (1) summarizes the problems, needs, and opportunities for flood risk management in the Peckman River Basin; (2) presents and discuss the results of the plan formulation for flood risk management; (3) identifies specific details of the Recommended Plan, including inherent risks; and (4) will be used to assist in determining the extent of the Federal interest and local support for the plan.

USACE has evaluated an array of structural and nonstructural alternatives, and natural and nature-based features including levees, floodwalls, channel modifications, structure elevation, floodproofing, and buyouts. The design of the project will be refined during the pre-construction engineering and design (PED) phase based on site-specific information.

1.2 National Environmental Policy Act Requirements

This FIFR/EA was prepared pursuant to the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality's (CEQ) Guidance Regarding NEPA Regulations, and the USACE's Procedures for Implementing NEPA (Engineering Regulation [ER] 200-2-2). NEPA requires USACE to integrate environmental values into its decision making processes by considering the environmental impacts of its proposed actions, and reasonable alternatives to those actions. Federal regulations to implement NEPA are found in Title 40 Code of Federal Regulations (CFR) Parts 1500-1508. The intent of NEPA is to ensure that information is made available to public officials and citizens about major actions taken by Federal agencies, and to identify and consider public concerns and issues. "Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork" (40 CFR §1506.4). The purpose of an EA is to demonstrate a Federal agency's compliance with NEPA. This FIFR/EA must discuss:

- the need for the proposed action
- the proposed action and alternatives
- the probable environmental impacts of the proposed action
- the agencies and persons consulted during preparation of the FIFR/EA

This integrated report is consistent with NEPA statutory requirements. The report reflects an integrated planning process, which avoids, minimizes, and mitigates adverse project effects associated with flood risk management actions. Sections of text marked with an asterisk are applicable to the satisfaction of NEPA requirements.

1.3 Study Authority & Non-Federal Sponsor

In response to frequent significant flooding in the Peckman River Basin, the study was authorized by a resolution of the U.S. House of Representatives, Committee on Transportation and Infrastructure Resolution Docket 2644 adopted on June 21, 2000. This authority states:

> "*Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Chief of Engineers on the Passaic River Mainstem project, New Jersey and New York, published as House Document 163, 101st Congress, 1st Session, and other pertinent reports to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of water resources development, including flood control, environmental restoration and protection, stream bank restoration, and other allied purposes for the Peckman River and tributaries, New Jersey*."

A Feasibility Cost Sharing Agreement (FCSA) for the study was executed in October 2002 with the NJDEP as the study non-Federal sponsor.

1.4 Study Purpose, Scope & History

The purpose of the study is to determine if there is a technically feasible, economically justified, and environmentally acceptable recommendation for Federal participation in flood risk management for the Peckman River Basin. The study team evaluated potential solutions to the frequent fluvial flooding problems within the Peckman River Basin and assessed the Federal interest in participating in flood risk management plans. The study team identified and recommended a plan in coordination with NJDEP, as described in Chapters 4 and 10. This report documents the study and constitutes an interim response to the study authority.

Following authorization of the study in June 2000, a Reconnaissance Study was initiated to examine flooding in the Peckman River Basin. The Peckman River Basin, New Jersey, Reconnaissance Report (USACE, 2002) recommended a comprehensive basin-wide study to further examine the feasibility of Federal participation in a project that could provide flood risk management and ecosystem restoration in the basin. Based on the recommendation and approval of the Reconnaissance Report, the FCSA for the current study was executed in October 2002 between USACE and NJDEP. Although ecosystem restoration is an authorized study purpose and the approved Reconnaissance Report indicates Federal interest in both flood risk management and ecosystem restoration, NJDEP has indicated its preference to currently focus only on the flood risk management component of the authorization.

As described in Section 3.1, the Peckman River Basin experiences economic damages due to flash flooding in the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River (Figure 1). USACE and NJDEP are currently completing an analysis of backwater flooding from the Passaic River, under the authorization for the Passaic River Basin flood risk management study. Because of this, the scope of this study is limited to addressing flooding caused by the Peckman River and its tributaries.

The feasibility phase has progressed from its initiation following execution of the FCSA as funding has been made available. By 2014, a suite of measures to address flood risk within the primary damage centers of the Township of Little Falls and the Borough of Woodland Park were developed. At this point NJDEP requested that a Locally Preferred Plan (LPP) be considered. Due to this request, the study was paused between November 2014 to August 2017 to allow time for a revision to the scope and cost necessary for study completion. Following study resumption more alternatives were developed and evaluated. Based on the alternatives update, the National Economic Development (NED) plan became the selected plan. No LPP is being pursued at this time.

Figure 1. Flooded shopping mall parking lot in Woodland Park, New Jersey.

1.5 Study Area: The Peckman River Basin

The Peckman River Basin is located in Passaic and Essex Counties, New Jersey within New Jersey's 8th Congressional District (Figure 2). It is located in northern New Jersey approximately 15 miles west of Manhattan, New York City. Its drainage area is approximately 9.8 square miles. The basin is typified by suburban development.

The Peckman River Basin is one of the sub-watersheds of the Passaic River (Figure 3). The confluence of the Peckman River with the Passaic River is located within the central section of the Passaic River Basin.

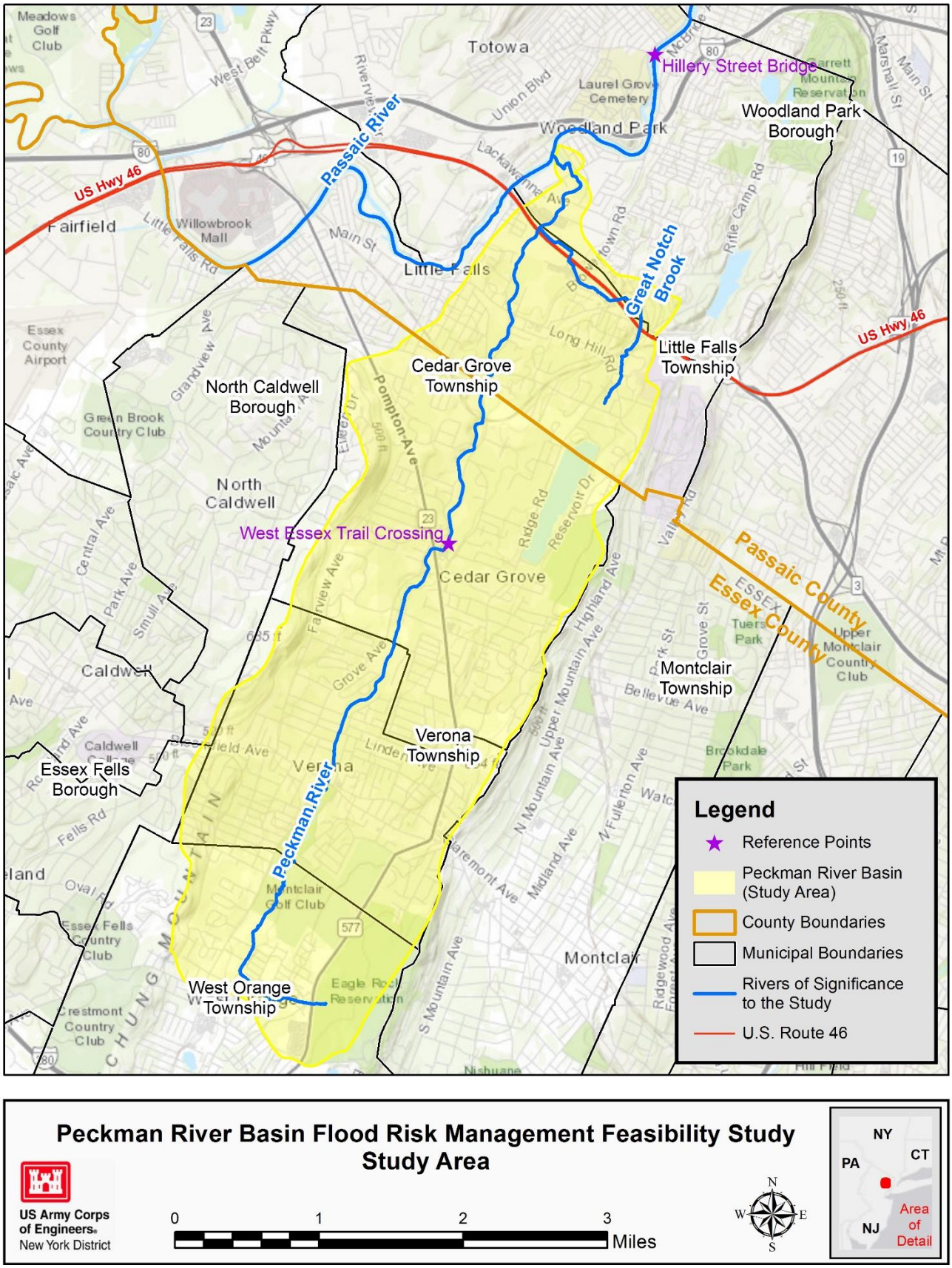

Figure 2. The Peckman River Basin (study area).

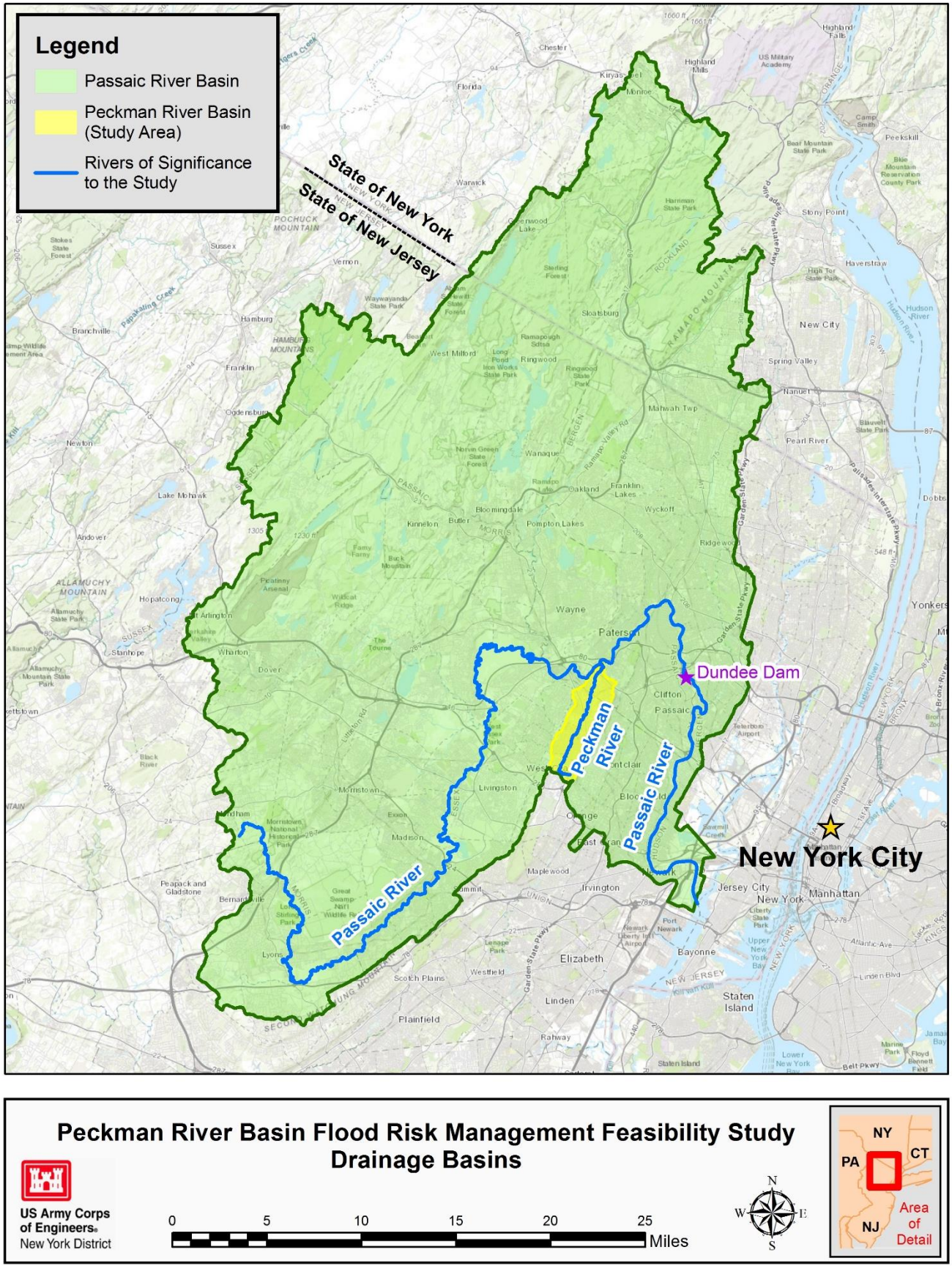

Figure 3. Relationship of the Peckman and Passaic Basins.

1.5.1 Municipalities within the Peckman River Basin

There are five municipalities in the Peckman River Basin (Figure 2). The Township of West Orange is situated in the central portion of Essex County and contains approximately 12.2 square miles with easy access to the Garden State Parkway and the New Jersey Parkway. It lies in northern New Jersey within the New York Metropolitan Area, and is easily accessible to the highway and rail network which serves the northern New York-New Jersey metropolitan complex. As the region grew, West Orange was able to capitalize on its proximity to emerge as a manufacturing economy in the early 1800s which continued into the early 20th century. Today, manufacturing in West Orange has been replaced by service, financial, and retail enterprises. The Township borders on nine developed suburban municipalities. These include: Montclair, Verona, Essex Falls, Roseland, Livingston, Millburn, Maplewood, South Orange, and Orange.

Moving to the northeast, the Township of Verona, also in Essex County, lies between two mountains, the First and Second Watchung Mountains, with the Peckman River flowing at the bottom of the valley. According to the United States Census Bureau, the township has a total area of 2.8 square miles, of which almost 99.3 percent is land and the remainder is water. Verona is bordered by Cedar Grove, Montclair, West Orange, Essex Fells and North Caldwell. The Township of Verona also provides easy access to the Garden State Parkway and the New Jersey Parkway

The Township of Cedar Grove is located further to the northeast in Essex County. Access to Cedar Grove is provided by a number of county and regional highways, including the Garden State Parkway to the east.

Towards the northeast, the Township of Little Falls covers 2.75 square miles within the southern border of Passaic County, adjacent to Essex County (Figure 4). The township is bordered by six municipalities, including the Borough of Woodland Park, the City of Clifton, the Town of Montclair, the Township of Cedar Grove, the Township of North Caldwell, and the Township of Wayne.

Figure 4. Little Falls, New Jersey (2018).

Little Falls is characterized by relatively hilly terrain in its eastern portion, containing suburban residential developments and institutional uses (Montclair State University). The western portion of the township contains a less topographically diverse terrain; most of the land area in closer proximity to the Passaic River is flat. State Highway Route 46 (Route 46) comprises the eastern border of the Township, while the Passaic River comprises the north/northwest border of the Township (Figure 2). Great Notch Brook, a tributary to the Peckman River, is located in eastern Little Falls, and enters the river just downstream of Route 46. Areas of Little Falls in the vicinity of the Passaic River are flood hazard areas that have been prone to flooding in the past.

The Borough of Woodland Park (formerly West Patterson) is one of 16 municipalities in Passaic County (Figure 5). The borough is located in the northeastern section of New Jersey and the lower end of the county, about 20 miles west of New York City. Highway access is provided by U.S. Interstate 80 in the northern edge of the city and Route 46 along its southern border. Natural features such as Garret Mountain on the east and the Passaic River on the west, form the Borough's other two borders. Woodland Park is situated to the north of the Township of Little Falls and is approximately three square miles in size. Though a highly urbanized and developed municipality, with a mixture of residential, retail, office, and industrial properties, a significant portion of the borough remains open space due to municipal parkland, two County parks, and two reservoirs: the Great Notch Reservoir and the New Street Reservoir. Both of these reservoirs are managed by the Passaic Valley Water Commission. These reservoirs are for storage of drinking water, not for stormwater management purposes.

Figure 5. Woodland Park, New Jersey (2016).

1.5.2 Waterways within the Peckman River Basin

Tributaries of the Peckman River include Great Notch Brook, which enters the Peckman River just downstream of Route 46, and two un-named tributaries that discharge into the Peckman River in Cedar Grove. Great Notch Brook is the largest of the three Peckman River tributaries. The Peckman River is a tributary of the Passaic River.

Peckman River

The Peckman River originates in the southernmost, upstream municipality in the Passaic River Basin, the Township of West Orange, New Jersey, and flows northeasterly through the Township of Verona, the Township of Cedar Grove, the Township of Little Falls, and the Borough of Woodland Park to its confluence with the Passaic River. Figure 6 represents roughly the midpoint of the stream (see location of this point in Figure 2). The length of the Peckman River is approximately 8.5 miles. The elevation change along the river is approximately 260 feet, with the sharpest elevation change occurring within Cedar Grove.

The downstream portion of the Peckman River in Woodland Park is within close proximity to Dowling Brook, which is also a tributary to the Passaic River. During extraordinary flooding events, natural diversion of flow from the Peckman River across Woodland Park to Dowling Brook has been reported.

Figure 6. The Peckman River at the West Essex Trail crossing (2018).

Great Notch Brook

Great Notch Brook is a tributary to the Peckman River. Originating in a residential neighborhood in the eastern portion of Little Falls, Great Notch Brook flows north and then west for approximately 1.5 miles before discharging into the Peckman River just south of Route 46 in Woodland Park. The drainage basin for Great Notch Brook is approximately 0.6 square miles, with its confluence on the Peckman River immediately downstream of the Route 46 Bridge. Flash flooding from the brook occurs often, as the tributary carries essentially all local stormwater runoff.

Passaic River

The Passaic River (Figure 7) originates in southern Morris County, New Jersey. It flows for 90 miles before discharging into Newark Bay (Figure 3). The Passaic River runs parallel to the Peckman River upstream of Route 46. The Passaic River Basin drains an area of 935 square miles, of which 787 square miles are in New Jersey and 148 square miles are in New York. There are three distinctly different regions that comprise the Passaic River Basin. The mountainous and heavily wooded Highland Area is 500 square miles in extent, 13 miles wide and 38 miles long. The Central Basin is 262 square miles in extent, nine miles wide and 30 miles long. The Passaic River passes out of the Central Basin through the narrow

rock gorge restriction at Little Falls. The study area is within the Central Basin. The Lower Valley is 173 square miles in extent, about seven miles wide and 24 miles long. Heavily urbanized and densely populated, the valley has rolling sides and a comparatively wide rolling bottom land that narrows down to about three-quarters of a mile below Dundee Dam.

Areas downstream of Dundee Dam (Figure 3) are subject to high water levels from tidal events, as well as from flow in the Passaic River. The Dundee Dam is built upon a natural falls; originally seven feet high, it was raised to support historic commercial uses in 1861 to a level of 20 feet high, plus a one-foot high cap of locally-mined sandstone. The dam is the upstream boundary of tidal influence in the Passaic River Basin. It is also the upriver boundary of the U.S. Environmental Protection Agency (USEPA) Lower Passaic River Study Area for the Diamond Alkali Superfund Site, and the upstream limit of the study area for the USACE Passaic River Tidal coastal storm risk management feasibility study. In addition, approximately 7.5 miles upstream of the Dundee Dam is the Great Falls at Paterson. The Great Falls is 77 feet high and is the second largest waterfall by volume east of the Mississippi, with Niagara Falls being the largest. The Peckman River confluence with the Passaic River is located approximately 10.5 miles upstream of the Dundee Dam.

The USACE Passaic River Tidal, New Jersey coastal storm risk management feasibility study, the USEPA Superfund study, and the USACE Passaic River Mainstem, New Jersey flood risk management study are all being conducted under separate authorizations different than that for the Peckman River Basin, New Jersey flood risk management study. The Passaic River Tidal study was completed with the approval of the Chief of Engineer's Report in 2019. The Superfund study is currently underway. The Passaic River Mainstem study is currently suspended.

Figure 7. The Passaic River and the Hillery Street Bridge near Woodland Park, New Jersey (2009). The location of this bridge is marked in Figure 2.

1.6 Project Area: Communities at Greatest Flood Risk

The narrow floodplain in the municipalities of West Orange, Verona and Cedar Grove heavily limits the number of structures affected by damages. The Peckman River floodplain generally remains narrow as it flows through upstream municipalities (Figure 8). The ten percent, one percent, and 0.2 percent floodplains tend to overlap in these municipalities and appear to be constrained by steep slopes in some areas. In other areas that are less steep, the floodplain widens slightly, and these wider areas appear to be open space, parkland or wetland/riparian corridors without any structures to be damaged. The result of this is that a limited number of structures in West Orange, Verona and Cedar Grove lie within the floodplain. The number of structures in the 0.2 percent floodplain is 12 in West Orange, 120 in Verona, and 60 in Cedar Grove. The number of structures in the one percent floodplain is less than 12 in West Orange, 90 in Verona, and 36 in Cedar Grove. The number of structures in the ten percent floodplain is six in West Orange, 12 in Verona and six in Cedar Grove. There are too few structures within the Peckman River floodplain in Cedar Grove, Verona, or West Orange to justify looking into nonstructural measures in these municipalities.

The communities of Little Falls and Woodland Park are at greatest risk of flooding due to their geography, topography, and relatively dense development. The floodplain is wide and flat, with a significant number of structures within the 10 percent, one percent (Figure 8) and 0.2 percent floodplains. These communities are hydrologically connected since there are no physical barriers that constrain floodwaters. These relatively low-lying lands are subject to frequent flooding from the Peckman and Passaic Rivers, as detailed in Sections 3.1 and 3.2. These two communities have a combined 273 structures in the 10 percent floodplain, 471 structures in the one percent floodplain, and 549 structures in the 0.2 percent floodplain that are impacted from Peckman River flooding.

The ten percent floodplain includes 200 residential structures with an aggregate depreciated replacement value of approximately $46,272,000 (Fiscal Year 2019 [FY19] price level [P.L.], and 73 non-residential structures (commercial/municipal/institution) with an aggregate depreciated replacement value of approximately $142,133,000 (FY19 P.L.).

The one percent floodplain includes 346 residential structures with an aggregate depreciated replacement value of approximately $90,978,000 (FY19 P.L.), and 125 non-residential structures (commercial/ municipal/ institutional) with an aggregate depreciated replacement value of approximately $226,179,000 (FY19 P.L.).

The 0.2 percent floodplain includes 407 residential structures with an aggregate depreciated replacement value of approximately $104,525,000 (FY19 P.L.), and 142 non-residential structures (commercial/ municipal/ institutional) with an aggregate depreciated replacement value of approximately $254,613,000 (FY19 P.L.).

The project area is defined as the area that is considered when formulating plans. The study team has focused its plan formulation and technical analysis within the boundaries of Little Falls and Woodland Park, because they are at significantly greater risk of flooding than other communities in the Peckman River Basin (Figures 8, 9, and 10). The discussion of environmental and economic impacts and benefits of alternative plans presented in Chapter 2, Chapter 5, and Chapter 6 are limited to the boundaries of the project area (Figure 11).

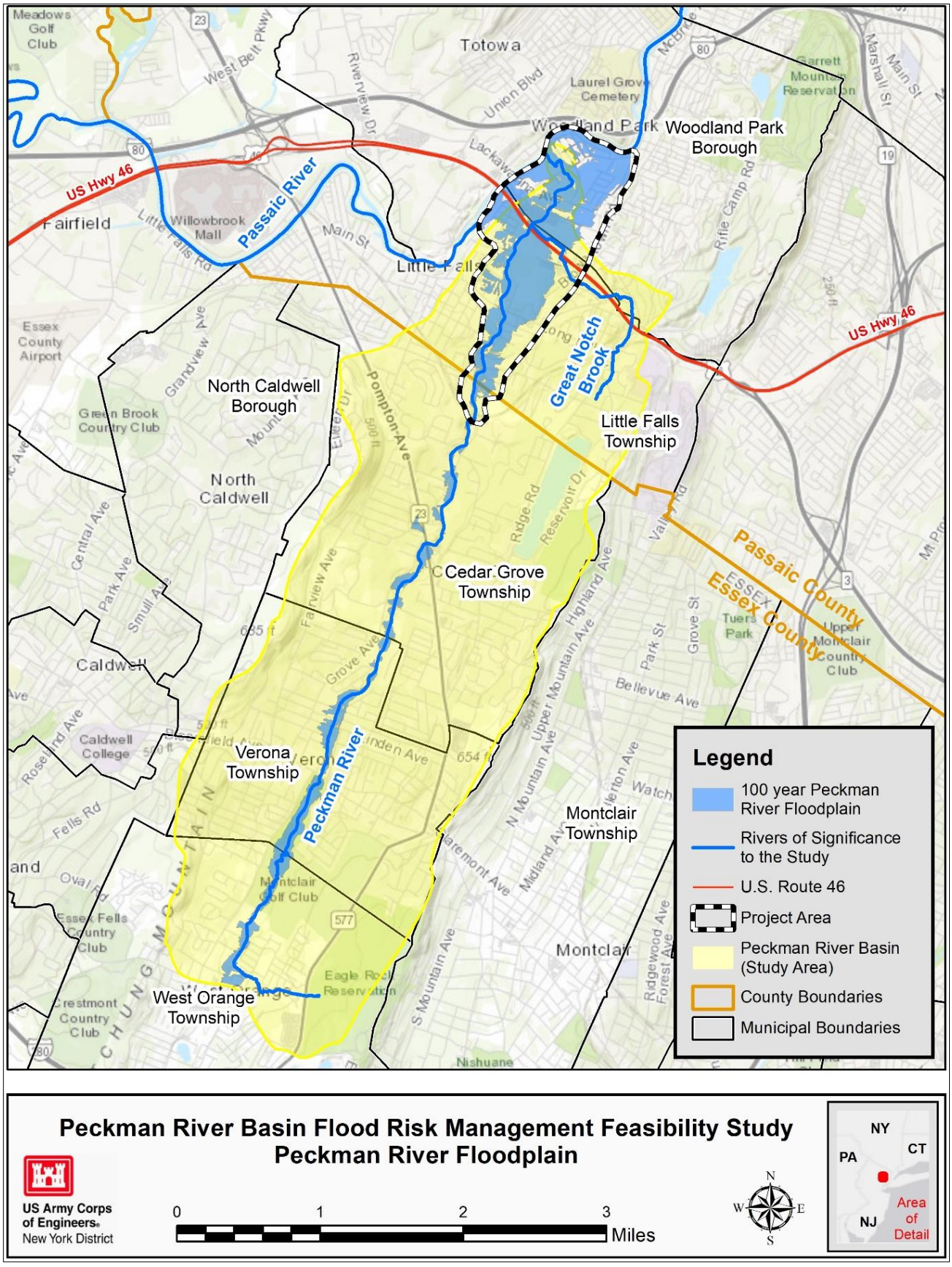

Figure 8. The one percent Peckman River floodplain.

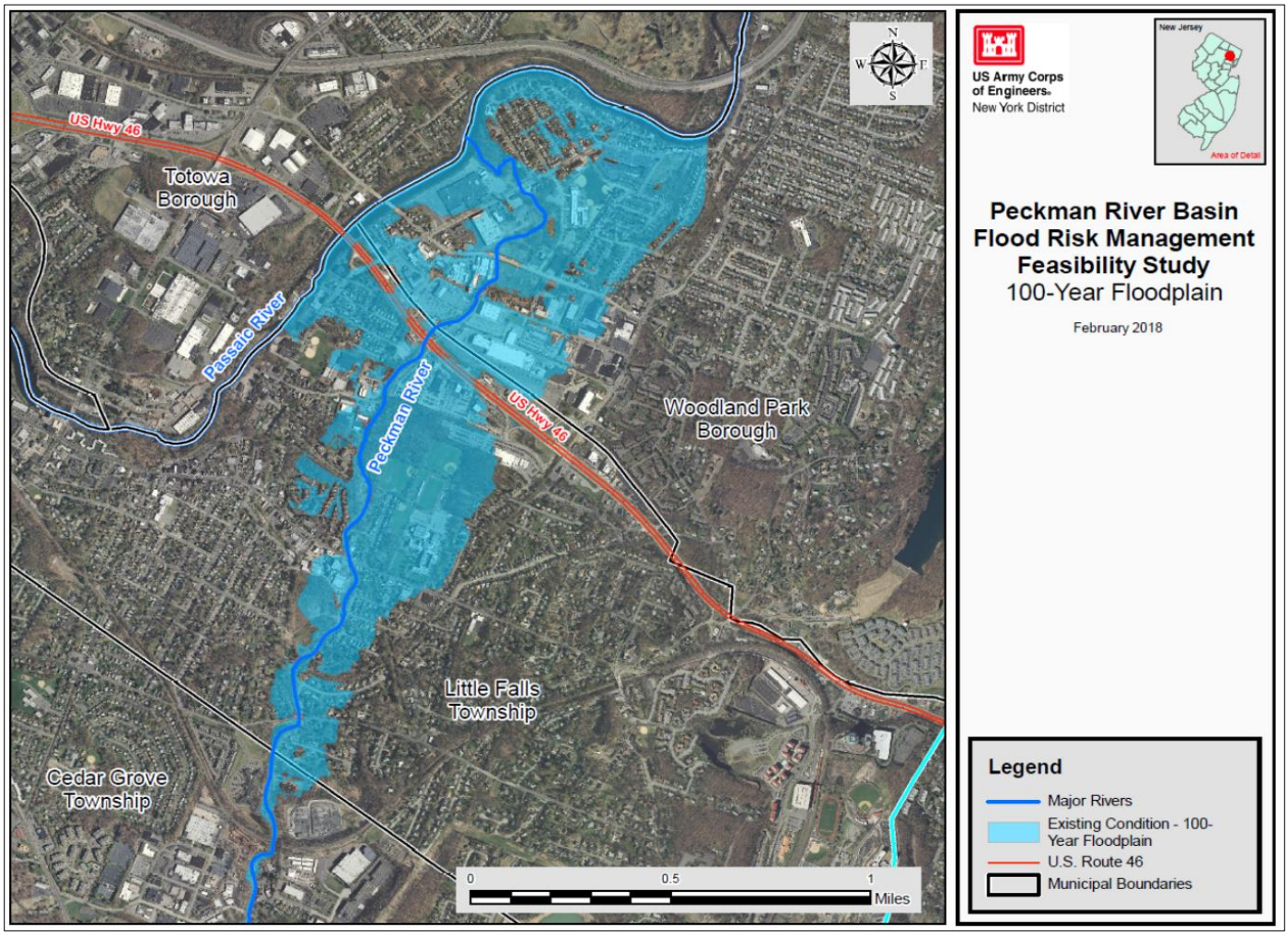

Figure 9. The one percent floodplain of the Peckman River in the Township of Little Falls and the Borough of Woodland Park. Note the Passaic River floodplain is not shown.

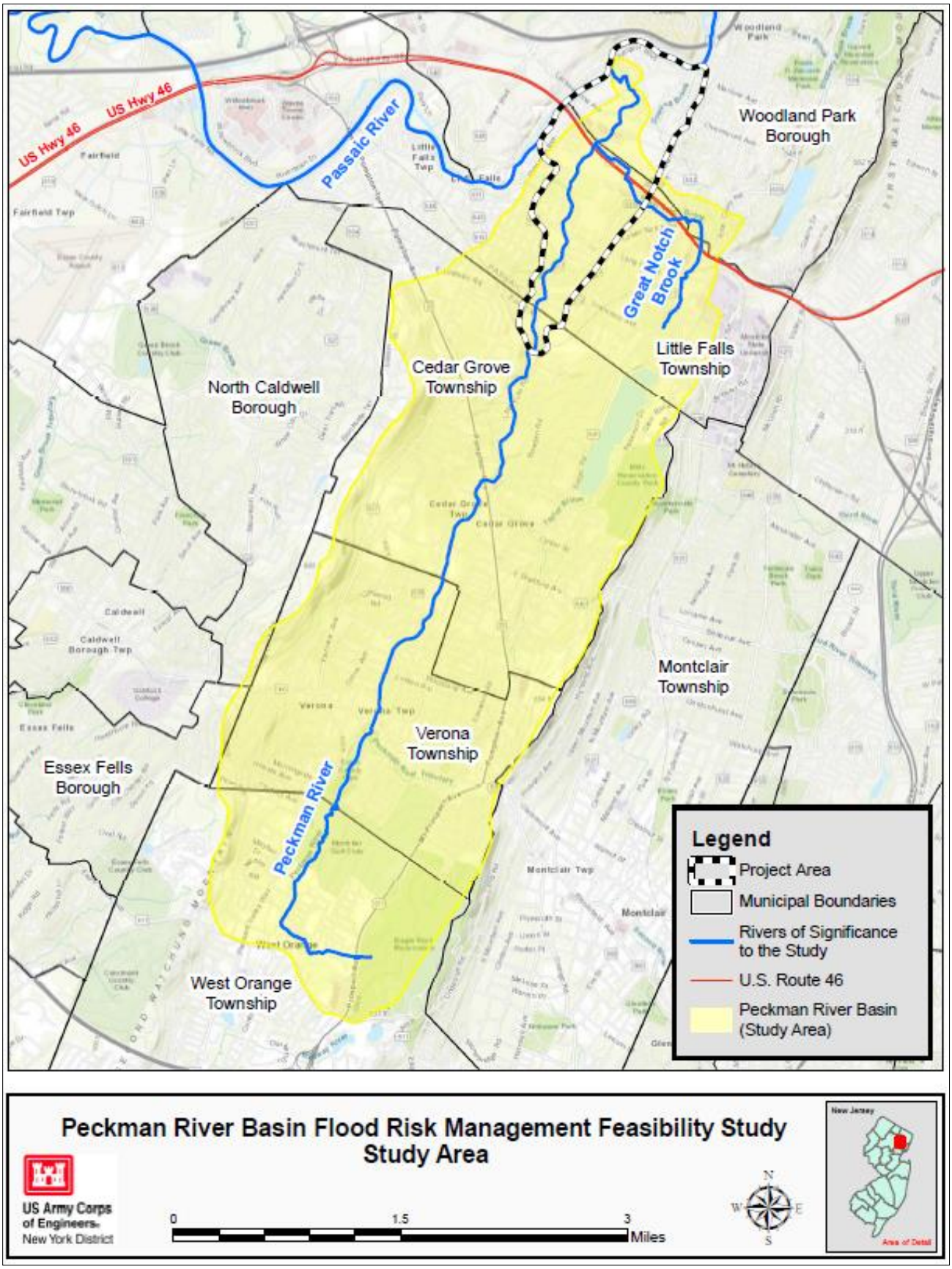

Figure 10. Location of the project area within the Passaic River Basin (study area).

Figure 11. Project area.

1.7 Need for Action*

Residents, businesses, and infrastructure in the Peckman River Basin experience repeated, significant flood damage due to flash flooding in the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River. Extensive development of the basin has led to the interrelated problems of flooding and ecosystem degradation. The majority of the watershed is heavily developed. Half of the basin is dominated by residential housing. Undeveloped areas of remaining forest reservoirs, and wetlands along the river corridor comprise only 29 percent of the basin. Commercial and residential development in the watershed has reduced the water holding capacity of the landscape and altered the natural dynamics of the river system. Storms deposit large amounts of rain in the watershed, producing significant runoff. This quickly surpasses the capacity of the rivers, streams, and bridges and culvert openings, resulting in flooding that first begins to occur at the ten percent flood event. Marked degradation of the river basin ecology has occurred, with areas impacted by stream bank erosion, loss of riparian habitat, and the occurrence of invasive species.

Some of the most severe flood damages in the Peckman River Basin have been caused by hurricanes and tropical storms. Hurricane Floyd (1999) caused an estimated $12,100,000 (FY19 P.L.) in flood-related losses to communities in the Peckman River Basin, and resulted in the death of one resident (Figures 12 and 13). Hundreds of homes and businesses in Little Falls and Woodland Park were affected by flooding. The Woodland Park business district was one of the hardest hit areas, with over three feet of flood water inundating structures and roads. In Little Falls, businesses were inundated with over four feet of water, and the Jackson Park residential area suffered extensive flooding. Almost all of Hurricane Floyd flood damages to areas within the Peckman River Basin were a result of Peckman River flooding, as flooding from the Passaic River in this area was of a much lesser magnitude. Hurricane Doria in August 1971 caused an estimated $12,000,000 (FY19 P.L.) in flood-related damages (Figure 14). A storm event in May 1968 caused an estimated $18,600,000 (FY19 P.L.) in flood related losses. A storm event in July 1945 resulted in one death within the project area.

Figure 12. Repairs being performed on a property due to Peckman River flood damage from Hurricane Floyd (1999).

Figure 13. Damaged contents being disposed of due to Peckman River flood damage from Hurricane Floyd (1999).

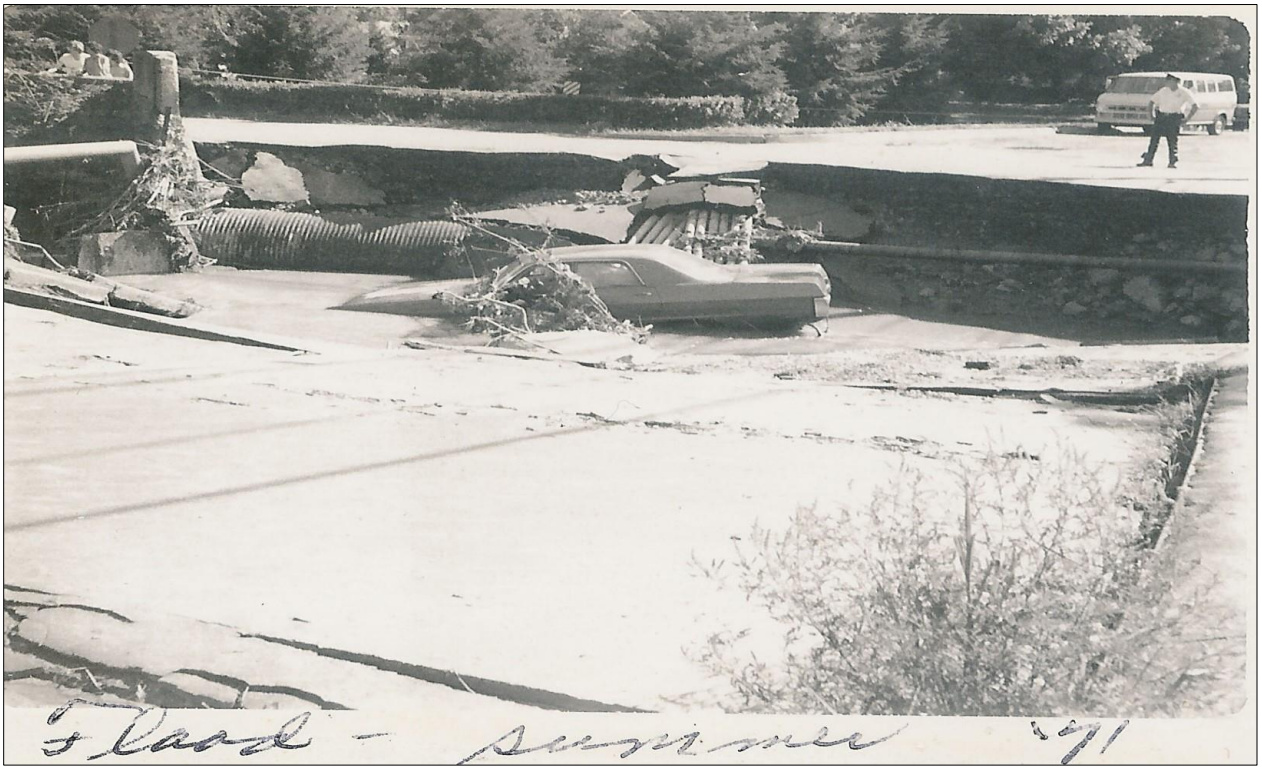

Figure 14. Damage from Hurricane Doria to a road adjacent to the Peckman River (1971).

1.8 Prior Studies & Reports

Many USACE reports have been produced in support of the study. The reports listed below are the most pertinent to the evolution of the study.

Detailed Project Report for the Peckman River, Township of Little Falls, Section 205 of the 1948 Flood Control Act (September 1981). An evaluation of flood risk along the Peckman River in Woodland Park, Little Falls, Cedar Grove, and Verona was conducted in 1981. Part of the evaluation included a determination as to whether a study of flood risk management for Little Falls alone would be more favorable than pursuing a basin-wide solution. Nine flood risk management alternatives (six structural and three nonstructural) were considered for the basin, primarily in Little Falls. Woodland Park was determined to be subject to backwater flooding from the Passaic River, and was therefore not considered for flood risk management under this study because the problem of backwater flooding is the focus of the Passaic River Basin flood risk management study. Cedar Grove and Verona were deemed not to warrant economically-justified flood risk management due to limited flood damages. It was concluded at the time that structural and nonstructural alternatives for flood risk management on the Peckman River in Little Falls were not in the Federal interest based on benefit-cost ratios that ranged from a low of 0.10 to a high of 0.27. However, the basis of the hydrologic and hydraulic analysis used in the report is unclear. Changes to the reliability of available hydrologic and hydraulic data has been enhanced by the installation of a USGS gage in Verona, which has recorded stream flow data from 1979 to the present. This updated stream flow data has informed the basin-wide USACE Passaic River Mainstem, New Jersey flood risk management study; the study is currently suspended.

Passaic River Basin, New Jersey and New York, Phase 1 General Design Memorandum, Flood Protection Feasibility Study, Main Stem Passaic River (December 1987). The report detailed a recommendation for flood risk management in the Passaic River Basin. The Recommended Plan detailed in this 1987 report consists of a 39-foot diameter, 13.5-mile long main tunnel; a 22-foot diameter, 1.2-mile long spur tunnel; 5.9 miles of channel modifications; 37.3 miles of levees and floodwalls, and preservation of 5,350 acres of flood storage, 5,200 of which are wetlands. This plan would protect flood-prone areas along the Passaic, Pompton, Pequannock, Wanaque, Ramapo, Rockaway and Whippany Rivers, and Deepavaal and Pinch Brooks.

Three measures identified as possible basin-wide interim projects were also studied under the Passaic River Basin Phase I Advanced Engineering and Design authorization.

- **Emergency Preparedness.** A study on flood emergency preparedness, including a flood warning system was conducted under the authority of the Continuing Authorities Program (CAP), Section 205 of the Flood Control Act of 1948. The plan was to improve the timeliness, accuracy, and reliability of flood warnings throughout the basin. It included the establishment of local self-help programs; increased rain and stream gage density and automation; improved flood warning systems and flood hazard mapping; improved computer software and flood warning hardware facilities; and enhanced local response programs. The report was approved by the Chief of Engineers in September 1984. The installation was completed in 1988 and the project is now operational. The project will be the primary data source governing the operation of the USACE Passaic River Mainstem, New Jersey flood risk management project if constructed; the Passaic River Mainstem study is currently suspended.
- **Preservation of Natural Flood Storage.** The study resulted in a recommendation for no interim action, but for further consideration as an early action measure in conjunction with the USACE Passaic River Mainstem, New Jersey flood risk management study, which is currently suspended. The authorized flood risk management project contains preservation of key Central Basin natural flood storage areas as a nonstructural project element. To date, the Preservation of Natural Storage Areas project has authorized for the purchase of up to 5,350 acres; 3,400 have been bought to date, and the project is ongoing.

The authorized Passaic River Mainstem, New Jersey project evolved from more than 150 plans presented in public meeting in the early 1980s consisting of combinations of channel modifications, levees and floodwalls, upstream reservoirs, floodplain evacuation (buyout), floodproofing of structures, raising structures, diversion tunnels, and other measures. In June 1984, NJDEP Commissioner developed criteria for plan selection and determined that a dual inlet tunnel plan best met those criteria. NJDEP asked USACE to proceed into feasibility design of this plan in 1988, and then-New Jersey Governor Kean committed the State to working with USACE on the project to ensure project authorization and resolve fine-tuning decisions during the design of the plan. The project was authorized by the Resources Development Act (WRDA) of 1990 and WRDA 1992.

General Design Memorandum (GDM), Passaic River Flood Risk Management Project (September 1995). The purpose of the GDM study was to refine the analysis and design of the aforementioned 1987 Recommended Plan, which included the construction of a flood tunnel for diversion of Passaic River flood waters. Implementation of the Recommended Plan was expected to significantly reduce Passaic River flooding in areas of Woodland Park that are subject to inundation from both the Passaic and Peckman Rivers. In the GDM as well as a 1981 Detailed Project Report, the Passaic River was assumed to be the primary source of flooding for Woodland Park; therefore, preliminary indications were that a reduction in flooding from the Passaic River would significantly reduce flood damage in Woodland Park. No detailed analysis was performed on how the project would have affected Peckman River flooding within Woodland Park due to the reduction of backwater influence. Although the specific dependence or independence of Passaic River and Peckman River flooding events was not analyzed as part of the GDM study, the hydrology and hydraulics data developed for the report indicates the Peckman River is a more significant source of flooding in Woodland Park and Little Falls than previously detailed in the GDM, Flood Insurance Studies (FIS), or the 1981 Detailed Project Report.

Peckman River Basin, New Jersey Section 205 Initial Appraisal Report (July 2001). The purpose of the CAP Section 205 study was to conduct an appraisal for flood risk management opportunities, and to evaluate the potential for Federal interest in flood risk management within the Peckman River Basin. Structural alternatives providing flood risk management up to approximately the two percent flood design level were evaluated. Alternative plans considered include diversion of flood waters from the Peckman River to the Passaic River, earthen levees and concrete floodwalls, and channel modifications to increase channel capacity. The estimated costs (FY 01 P.L.) of the structural alternatives considered in this analysis ranged from approximately $16,000,000 for the diversion culvert, to $30,000,000 for channel modifications, and $40,000,000 for levees and floodwalls. It was expected that the annual benefits of one or more of these alternatives would exceed the estimated annual costs. The diversion culvert alternative appears to be the most economically viable of the alternatives evaluated. The conclusion in the Initial Appraisal Report was that benefits of flood risk management measures would exceed the project costs resulting in net economic contributions.

Peckman River Basin, New Jersey, Reconnaissance Report 905(b) (January 2002). The purpose of the Section 905(b) preliminary analysis was to study flood risk management and ecosystem restoration opportunities along the Peckman River, and to evaluate the Federal interest for a potential flood risk management within the Peckman River Basin. Specific objectives of the reconnaissance study were to: (1) determine if the water resources problem(s) warrant Federal participation in feasibility studies; (2) define the Federal interest; (3) complete a Section 905(b) preliminary analysis; (4) prepare a Project Management Plan (PMP); (5) assess the level of interest and support from non-Federal entities; and (6) negotiate and execute a FCSA.

The 905(b) report detailed that Federal interest existed for flood risk management in the Peckman River Basin. It was also concluded that significant local support for flood risk management existed, and that it was expected that a non-Federal sponsor would be willing and able to cost-share feasibility studies and

project implementation. Furthermore, a preliminary ecosystem evaluation of the basin resulted in the identification of numerous opportunities for ecosystem restoration and/or enhancement. It was recommended that the 905(b) report be approved as the basis for completing a PMP for a cost-shared feasibility phase.

Other Reports. USACE produced the following studies and reports related to flood risk management:

- Report on the Flood of August 1973 (circa 1974)
- Passaic River Basin Historical Flood Damage Report: Rockaway and Passaic Rivers, New Jersey (circa 1980)
- Report for Flood Protection Feasibility, Main Stem Passaic River, New Jersey (December 1987)
- Passaic River, New Jersey Buyout Study (September 1995)
- Passaic River, New Jersey Buyout Study Update (August 2005)
- Passaic River, New Jersey Buyout Study Update (February 2017)
- Tropical Storm (Hurricane) Floyd, September 16, 1999, Post-Flood Report (July 2000)
- Peckman River Basin, New Jersey Flood Risk Management Feasibility Study Integrated Feasibility Report and Environmental Assessment (May 2018)

Numerous studies and reports were produced by other agencies. These include:

- Federal Emergency Management Agency (FEMA), Flood Insurance Administration (FIA), Repetitive Loss Data for Woodland Park and Little Falls (2013)
- New Jersey Department of Environmental Protection (NJDEP), Flood Hazard Area Maps (circa 1975)
- FEMA, FIA, FIS for Verona (August 1979), Cedar Grove (August 1979), Little Falls (February 1981), and West Paterson (June 1981), and subsequent updates
- Natural Resources Conservation Service (NRCS), Peckman River Streambank Restoration, Emergency Watershed Protection, Borough of West Paterson, Passaic County, Engineering Report (March 1999)
- Passaic County, Bridge Reconstruction Plans: Lackawanna Avenue (1994) and McBride Avenue (2000), West Paterson
- NJDEP, Bureau of Water Monitoring, Ambient Biomonitoring Network (2018)
- Township of Little Falls, New Jersey Master Plan (2008)
- Borough of Woodland Park, New Jersey Master Plan (2010)

Figure 15 shows the locations of projects completed and ongoing studies in the Passaic River basin by USACE within the Passaic River Basin.

- Molly Ann's Brook – construction completed 2007
- Lower Saddle River – ongoing study
- Long Hill Township – deferred study
- Jackson Brook – ongoing study
- Malapardis Brook – ongoing project design
- Ramapo River at Mahwah/Suffern – deferred study
- Joseph Minish Waterfront Park – ongoing construction
- Floodway Buyout – awaiting approval for construction
- Ramapo River at Oakland – construction completed 2007
- McKeel Brook – construction complete 2004
- South First Street Floodwall at Harrison – study deferred
- Lower Passaic River Restoration Project – ongoing study, conducted jointly between USACE and USEPA
- Newark Bay Superfund Study – ongoing study by USEPA
- USACE Passaic River Tidal, New Jersey coastal storm risk management feasibility study – draft feasibility report released in 2017

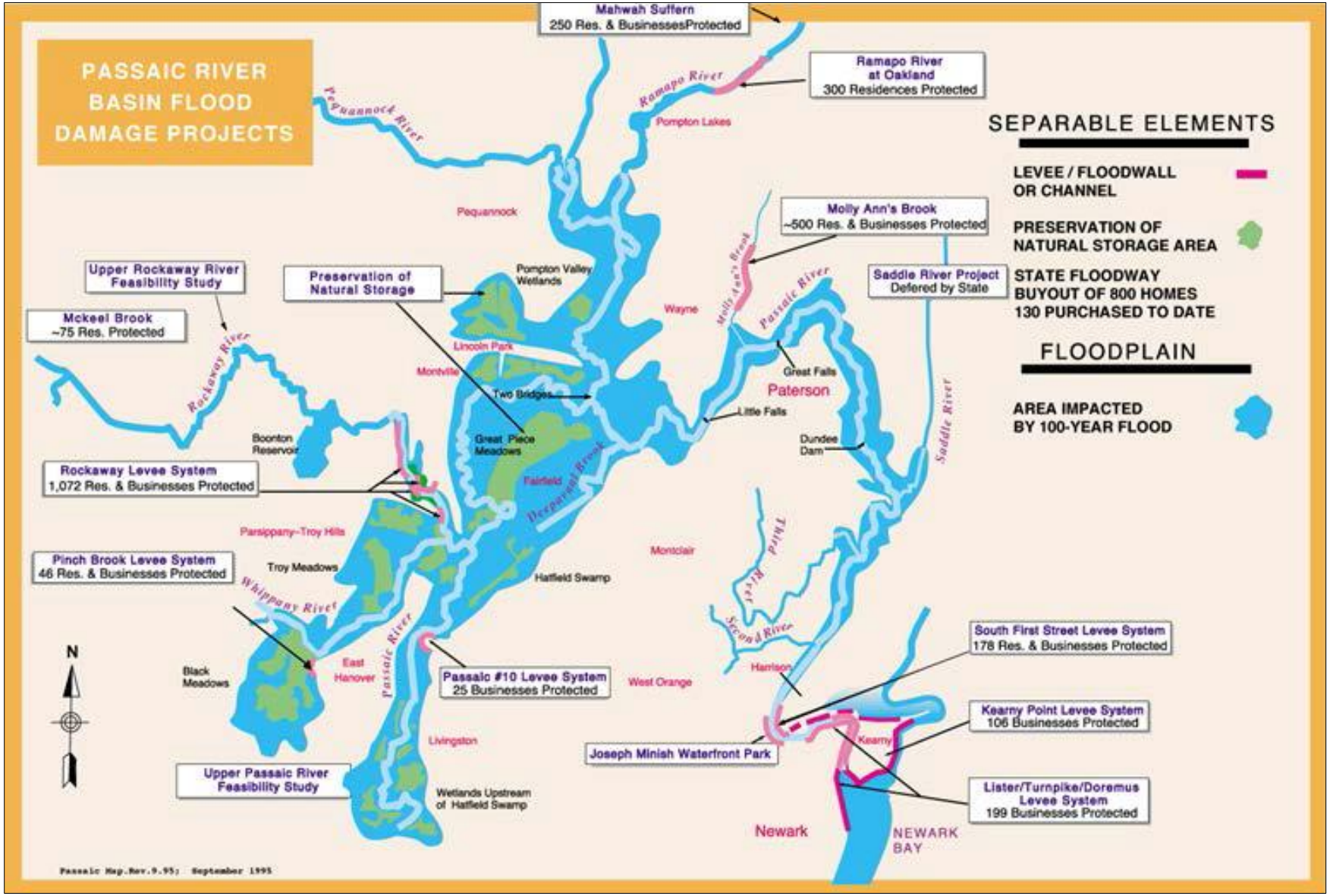

Figure 15. USACE projects and studies within the Passaic River Basin.

Chapter 2: Existing Conditions/Affected Environment*

This description of the environment that may be affected is in accordance with the requirements of National Environmental Policy Act (NEPA) and serves as the baseline for Chapters 5 and 6, which contain the Integrated Environmental Assessment. Photographs of the project area are included in Appendix G. Additional details regarding environmental setting can be found in in Appendix A-1. For the purposes of consistent orientation during discussions related to streambanks, the banks will be referred to as left or right based on a downstream viewpoint.

The discussion of environmental and economic impacts and benefits of alternative plans presented in Chapters 2, 5, and 6 are limited to the boundaries of the project area (Figure 11).

2.1 Topography, Geology & Soils

2.1.1 Geology & Topography

The project area is located within the Piedmont Physiographic Province. Generally, the Piedmont Province is characterized by interbedded sandstone, shale, conglomerate, basalt, and diabase (Lewis, Jason, and Wieben, undated). The bedrock geology of the Peckman River from its origination at Eagle Rock Reservation to the Essex/Passaic County Line is comprised of Orange Mountain Basalt which is a dark-greenish-gray to black, fine-grained dense hard basalt. From the Essex/Passaic County line north, the bedrock geology is composed of the Feltville Formation, which consists of reddish, fine to coarse grained sandstone, shales, and mudstone (Volkert, 2006). Elevations range from approximately + 360 feet NAVD88 in Verona to + 180 feet NAVD88 in Little Falls (Volkert, 2006).

The surface geology of the Passaic and Peckman Rivers within the project area is comprised of post-glacial alluvium consisting of moderately to well-sorted sand, silt, and pebble to cobble gravel that contains variable amounts of organic matter, demolition debris, and trash (Stanford, 2003). Through the majority of the project area, the surface geology of the Peckman River corridor includes artificial fill, defined as “artificially emplaced sand, gravel, silt, clay, and rock fragments, and man-made materials including cinders, ash, brick, concrete wood, slag, asphalt, metal, glass, and trash” that is variable in color but generally dark brown, gray, or black. The thickness of the fill is generally less than 20 feet but can be as much as 60 feet (Stanford, 2003). Appendix C-3 includes information about project area-specific soils, which will be used during project design to ensure appropriate site-specific design.

The project area topography is defined by a sharp 100-foot slope traveling approximately a mile from south to north (Figure 16). The Peckman River travels down this gradient to the relatively shallow areas close to the Passaic River. The project area is bounded to the east by steep cliffs. The area’s topography speaks to its flood risk. In the south, flash floods are common because of the sharp change in elevation along the Peckman River. The relatively low elevation northern parts of the project area are most affected by overbank and backwater flooding from the Passaic River.

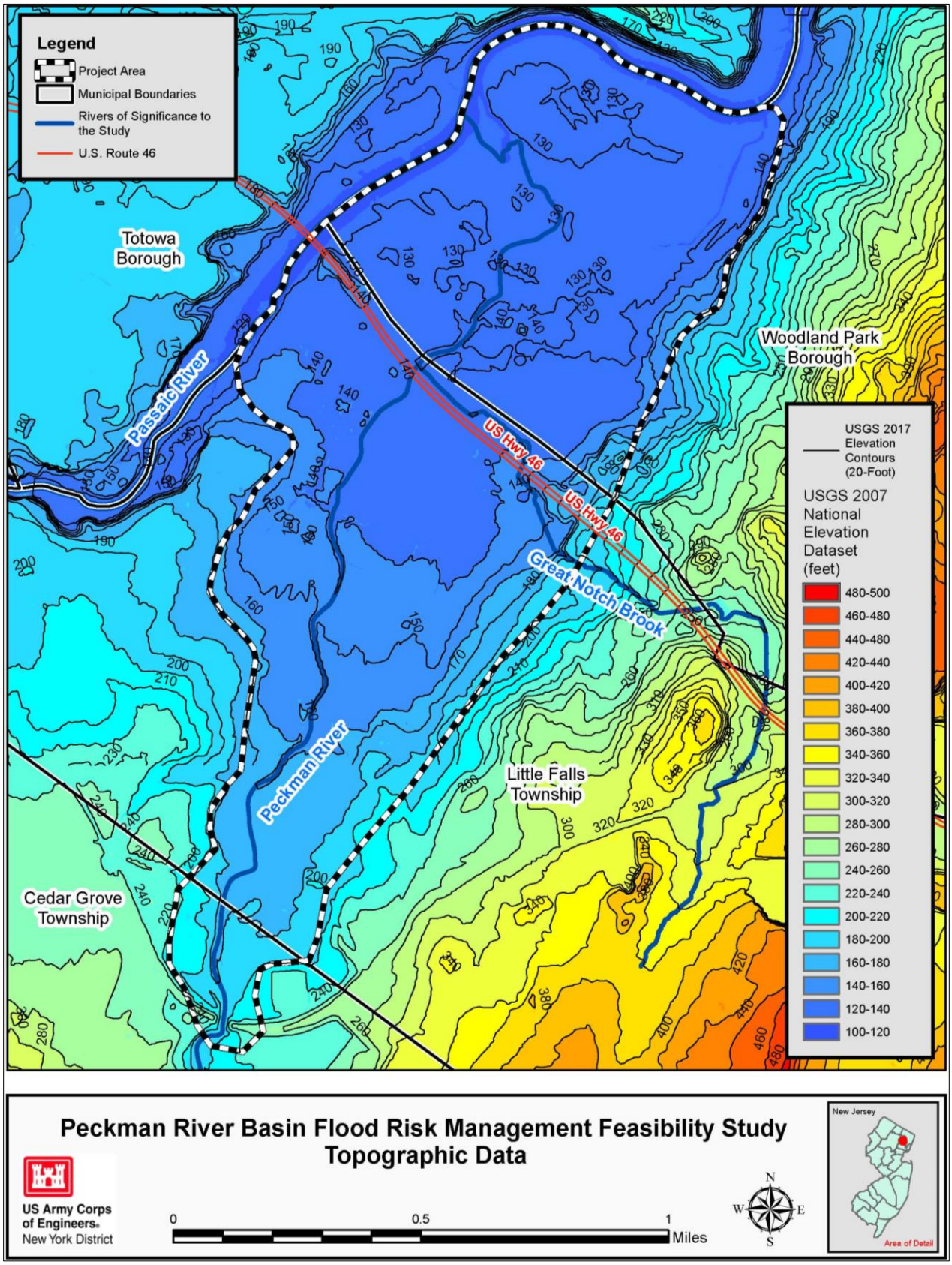

Figure 16. Topography of project area.

2.1.2 Soils

Dominant soil types within the project area consist of the Urban Land-Knickerbocker complex, Boonton loam, Boonton-Urban land complex, the Parsippany, Preakness and Pompton series, fluvaquents, and Udorthents.

Urban land is classified as land mostly covered by streets, parking lots, buildings and other structures of urban areas with slopes ranging from zero to eight percent. The Knickerbocker series consists of very deep, well and somewhat excessively drained soils formed in sandy outwash. The Knickerbocker series is typically found on nearly level to steep soils on lake plains and terraces. The potential for surface runoff is low to high. This soil type does not typically flood or pond (NRCS, 2002a).

The Boonton series is formed in glacial till consisting primarily of red to brown shale, sandstone, basalt and some granitic gneiss. This series is typically found on gently sloping to very steep uplands. The Boonton series is moderately well to well drained (NRCS, 2018).

The Parsippany series consists of fine glaciolacustrine deposits derived from basalt, shale and granitic gneiss material. This soil type is typically found on floodplains on outwash plains on slopes ranging from zero to three percent. Parsippany soils are poorly drained, and frequently flood and pond. A seasonal zone of water saturation is at six inches during January, February, March, April, May, October, November, and December (NRCS, 2002b).

The Pompton series consists of coarse-loamy outwash derived from gneiss, sandstone and basalt typically located on outwash plains and terraces in waterways. Slopes range from zero to three percent. Pompton soils are moderately well drained and somewhat poorly drained and have a low to very low surface runoff. This series does not typically flood or pond and the groundwater table is within 12 inches of the surface in the late winter and early spring (NRCS 2009).

The Preakness series consist of sandy loam on outwash plains and terraces. Slopes range from zero to three percent. Preakness soils are poorly to very poorly drained, and frequently flood in the spring and pond in winter (NRCS, 2002c).

Both Fluvaquents and Udifluvents have zero to three percent slopes. Fluvaquents have parent material consisting of recent alluvium and are commonly found on floodplains and in river valleys. The natural drainage class is somewhat poorly drained and is frequently flooded. Parent material of Udifluvents soil consists of alluvium and is typically consistent in outwash plains and floodplains. The drainage class is moderately well drained and is frequently flooded (NRCS, 2007).

The Udorthents soil type is typically identified in areas where the original in-situ soils have been altered through human activity. Substratums included within this series includes refuse substratum, where areas have been used for refuse disposal (e.g. landfill), and loamy substratum, where the in-situ soil has either been removed and/or covered with a loamy fill material. These soils typically consist of moderately deep to deep well drained to somewhat poorly drained soils. Within the project area, Udorthents are found on slopes ranging from zero to eight percent (NRCS, 2018).

A preliminary geotechnical investigation was performed for in January 2012. The work included a total of 23 geotechnical borings drilled along the Peckman River Basin. Twenty one borings were completed in Little Falls and two borings were drilled in Cedar Grove. The borings indicate that surficial soils are comprised of fill and recent river alluvium overlying glacial deposits that are underlain by bedrock. See Appendix C-3 for the results of the preliminary subsurface investigation results within the project area.

Hydric Soils

Fluvaquents-Udifluvents, Parsippany, Pompton, and Preakness series are included on the list of hydric soils for New Jersey developed by the NRCS. Soils with this classification are those saturated through natural or artificial means sufficiently enough to support the growth and regeneration of hydrophytic vegetation (NRCS, 2018a).

Prime Farmland Soils

Prime farmland soils are defined by the United States Department of Agriculture (USDA) as land that has the best combination of characteristics for producing food. It can have any land use ranging from cultivated land, pastureland, forest, or other; however it is usually not urban or water areas. The USDA states that, “the soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management and acceptable farming methods, are applied.” The Boonton and Pompton soils are defined as prime farmland soils and/or soils of statewide importance (NRCS, 2018b).

2.2 Climate

The climate of the Peckman River Basin is characteristic of the entire Middle Atlantic seaboard. Marked changes of weather are frequent, particularly during the spring and fall. The winters are moderate in temperature and snowfall. The summers are moderate with hot and humid weather and the potential for frequent thunderstorms. Rainfall is moderate and well distributed throughout the year. The relative humidity is high. The average annual temperature is 52 degrees Fahrenheit at Little Falls, with extremes from 11 degrees Fahrenheit below zero to 105 degrees Fahrenheit above zero. The growing season averages 167 days. The mean annual relative humidity is 65 percent. Prevailing winds are from the northwest, with an annual average velocity of ten miles per hour at nearby Newark, New Jersey. The number of days with precipitation average about 122 inches per year.

The Peckman River basin is best represented by a precipitation station at Little Falls. The location of the station is at Latitude 40 degrees 53 minutes north and Longitude 74 degrees 14 minutes west. The elevation of the station is 150 feet. This station is used for historic precipitation records for this study.

The mean annual snowfall is 21.4 inches at Little Falls. The mean annual precipitation in the Peckman River watershed is approximately 51.5 inches, as derived from the records of the Little Falls station. The observed highest daily value at this station was 12.79 inches (September 17, 1999 during Hurricane Floyd). The monthly extremes were 17.85 inches in September 1999 and 0.36 inches in November 1976. The distribution of precipitation throughout the year is fairly uniform, with higher amounts occurring during the summer months.

2.3 A History of Flooding

The storms that occur over the northeastern states have their origins in or near the Pacific and the South Atlantic oceans and may be classified as: extratropical storms, which include thunderstorms; cyclonic (transcontinental) storms; and tropical storms, which include the West Indies hurricanes. The extratropical storms, which, due to rapid convective circulation when a tropical marine air mass is lifted suddenly on contact with hills and mountainous terrain, cause heavy rains, usually in the summer and fall seasons. The thunderstorms, due to rapid convective circulation, usually in July, are limited in extent and cause local flooding on flashy streams. The cyclonic storms, containing transcontinental air mass movements with attendant "highs" and “lows," usually occur in the winter or early spring and are potential flood producers over large areas because of their widespread extent. The West Indies hurricanes, of tropical origin, proceed northward along the coastal areas accompanied by extremely violent winds and torrential rains of several days duration.

These storms sometimes cause large scale rain events that result in flooding of the Peckman River Basin. As described in Section 3.1, flash flooding in the Peckman River, and backwater and overbank flooding

from the Passaic River frequently and significantly impact the basin. The study area is impacted by both types of flooding, though typically not concurrently. Two lives have been reported to have been lost within the basin due to flooding, one in a July 1945 storm event and one due to Hurricane Floyd in 1999. The flood damage and life loss experienced in the study area underscore the need for a project to reduce flood damages, including communicating residual risk that remains with flood risk management projects and programs in place.

2.3.1 Past Storms & Historical Floods

The following is a description of major floods that have impacted the Peckman River Basin. Detailed information about storm stage elevations, frequencies, and gage data can be found in Appendix C-1 and Appendix C-2.

July 1945 Event

In July 1945 there were several consecutive days of heavy rainfall in the study area. This rainfall was unrelated to any tropical storms or hurricanes. Sometime before July 22, 1945, the dam in the Essex county Park at Verona Lake gave way, sending floodwaters down the Peckman in to Little Falls. This flood caused massive erosion that washed out roads (Figure 17), removed the earth supporting the Erie Railroad tracks over the Peckman (Figure 18), and removing houses from their foundations (Figure 19). One death occurred during this event when a house was washed off its foundation with a woman who lived there inside.

Figure 17. A road that was washed out in Little Falls during the 1945 flood. Photo courtesy of the Little Falls Historical Society. Photographed July 22, 1945.

Figure 18. Erie Railroad tracks suspended in the air after the Peckman River flood of July 1945 washed away the earth supporting the bridge for the tracks. Courtesy of the Little Falls Historical Society. Photographed July 22, 1945.

Figure 19. The Riker family house on Cedar Grove Road in Little Falls, NJ after it had been destroyed by the Peckman River flood of 1945. The house was split down the middle and collapsed. The house was washed from its foundation and collapsed, killing a woman who lived there. Courtesy of the Little Falls Historical Society. Photographed July 22, 1945.

Tropical Storm Doria (August 25-28, 1971)

Tropical Storm Doria was the costliest tropical cyclone in the 1971 Atlantic hurricane season (Figure 20). The storm developed from a tropical wave on August 20 to the east of the Lesser Antilles. It made landfall near Morehead City, North Carolina. It turned to the northeast, and moved through the mid-Atlantic and New England into Maine. The storm dropped heavy precipitation in New Jersey, peaking at 10.29 inches in Little Falls (Roth, 2017). This rainfall lead to record-breaking river levels and flooding in many houses. Hurricane Doria was estimated to have a four percent annual chance of occurrence, and caused an estimated $2,000,000 (FY18 P.L) in flood-related damages.

Hurricane Floyd (September 18-19, 1999)

Hurricane Floyd began as a Cape Verde type hurricane east of the Lesser Antilles. The storm made landfall on September 16 near Cape Fear, North Carolina with Category 2 winds of 105 miles per hour. After crossing eastern North Carolina and Virginia, it weakened to a tropical storm. Its center moved offshore along the coasts of the Delmarva Peninsula and New Jersey. On September 17, 1999 the storm moved over Long Island, New York, making landfall again roughly at the Queens County-Nassau County border, and headed towards New England where it became extra-tropical.

Figure 20. Damage from Hurricane Doria to a bridge abutment & road along the Peckman River (1971).

One of the most damaging floods of record in the basin resulted from Hurricane Floyd, causing an estimated $11,600,000 (FY19 P.L.) in flood-related losses. Hurricane Floyd resulted in new flood peaks of record at as many as sixty stream gages within the portions of New Jersey and New York within the District's civil works boundaries.

Hundreds of homes and businesses were affected by flooding in Little Falls and Woodland Park (Figure 21). The Woodland Park business district situated north of Route 46 was one of the hardest hit areas, with over three feet of flood water. In Little Falls, businesses south of Route 46 were inundated with over four feet of water, and the Jackson Park residential area suffered extensive flooding from flood waters diverting from the Peckman River to the west and into the Passaic River. Almost all of Hurricane Floyd flood damages to areas within the Peckman River Basin were a result of Peckman River flooding. Flooding from the Passaic River and subsequent backwater flooding of the Peckman River, was of a much lesser magnitude during the storm. This was due to the Passaic River water levels not rising to a height that would cause backwater or overbank flooding in Little Falls or Woodland Park.

Figure 21. High flows and water levels due to Hurricane Floyd at a bridge abutment along the Peckman River (1999).

April 2007 Nor'easter

The April 2007 nor'easter was not a significant event for the Peckman River Basin, however, communities within the floodplain of the mainstem of the Passaic River were inundated with flood waters. Areas within the Peckman River Basin subject to backwater flooding from the Passaic River had impassable streets and some minor structure flooding. The storm underscored that there is no firm or reliable relationship between high water on the Passaic and Peckman Rivers.

Hurricane Irene (August 27-28, 2011)

Hurricane Irene was the first major hurricane of the 2011 Atlantic Hurricane season. The storm began east of the Lesser Antilles and was designated as Tropical Storm Irene on August 20, 2011. The storm passed through St. Croix and Puerto Rico, and then made landfall in the continental United States on August 27, 2011 on the Outer Banks of North Carolina. Irene moved from land to Atlantic Ocean several times, affecting Florida, South Carolina, North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, Rhode Island, Vermont, and Maine, as well as Canada. Hurricane Irene caused widespread destruction and at least 49 deaths. Due to record rainfall, severe river flooding occurred in the Raritan, Millstone, Rockaway, Rahway, Delaware and Passaic Rivers (Figure 22). Hurricane Irene caused flooding on both the Peckman and Passaic Rivers, and breaking records for peak discharges. The Peckman River peaked on August 28, 2011 at a gage height of 9.16 feet and a discharge of 2,010 feet^3/s (USGS, 2018a). The Passaic River peaked on August 30, 2011at Little Falls at a gage height of 14.19 feet. and a discharge of 20,800 feet^3/s (USGS, 2018b). Both of these peaks were substantially above flood stage. Flooding was caused by both rivers, first the Peckman, and then roughly two days later, the Passaic. In Woodland Park, approximately 500 structures

were flooded during this event. First floor flooding was common, with chest-deep waters inundating many structures. The Borough estimates that its residents incurred approximately $5,000,000 (FY19 P.L.) in damage from the storm.

Figure 22. Flood damage in Little Falls, New Jersey after Hurricane Irene (2011).

August 2018 Flood Event

On August 11, 2018, the Peckman River Basin received five inches of rain in a matter of hours. Overbank flooding substantially damages neighborhoods and commercial areas in Little Falls and Woodland Park (Figure 23 and Figure 24). Many homes and businesses were impacted by flash flooding. Bank erosion caused debris to cause hydraulic bottlenecks at road overpasses, exacerbating flooding in many areas. The communities continue to recover from the flood event.

The study team considered the flood dynamics observed during the August 2018 flood event during planning. The storm's effects prompted the study team to update engineering models that informed decision making. Chapter 3 describes this effort and resulting planning decisions.

Figure 23. Peckman River erosion in Little Falls, New Jersey (August 2018).

Figure 24. Clean Up in Little Falls, New Jersey (August 2018).

2.4 Land Use & Zoning

From the data obtained from NJDEP (Table 1 and Table 2), land use in Woodland Park is predominantly residential, followed by open space and commercial area. Similarly, land use in Little Falls is predominantly residential, followed by public and commercial uses. Current land uses in the project area are shown in Figure 25.

Table 1. Land use in Woodland Park (NJDEP, 2017).

Land Use	Parcels	Acres (rounded)	Percentage (rounded)
Residential	3,968	763	45%
Commercial	424	211	12%
Industrial	65	44	3%
Public	56	45	3%
Open Space	70	521	31%
Others	93	112	7%
Total	**4,676**	**1,696**	**100%**

Table 2. Land use in Little Falls (NJDEP, 2017).

Land Use	Parcels	Acres (rounded)	Percentage (rounded)
Residential	3,538	821	46%
Commercial	181	191	11%
Industrial	46	19	1%
Public	11	453	26%
Open Space	370	100	6%
Others	0	176	10%
Total	**4,146**	**1760**	**100%**

The project area is most densely developed along the Passaic River, with the oldest neighborhoods located along the river. Most residential development is made up of detached single-family homes.

The project area's two main commercial districts are located between Browertown Road and the Passaic River in Woodland Park, and along Main Street/East Main Street in Little Falls. Passaic Valley High School, with its track and baseball fields, is located at the eastern edge of the Main Street commercial corridor. The commercial districts are largely surrounded by residential development.

Relatively small parks including Peckman Preserve provide recreational opportunities and open space for residents. There are parks abutting the Passaic River that provide access to the water for residents and wildlife alike.

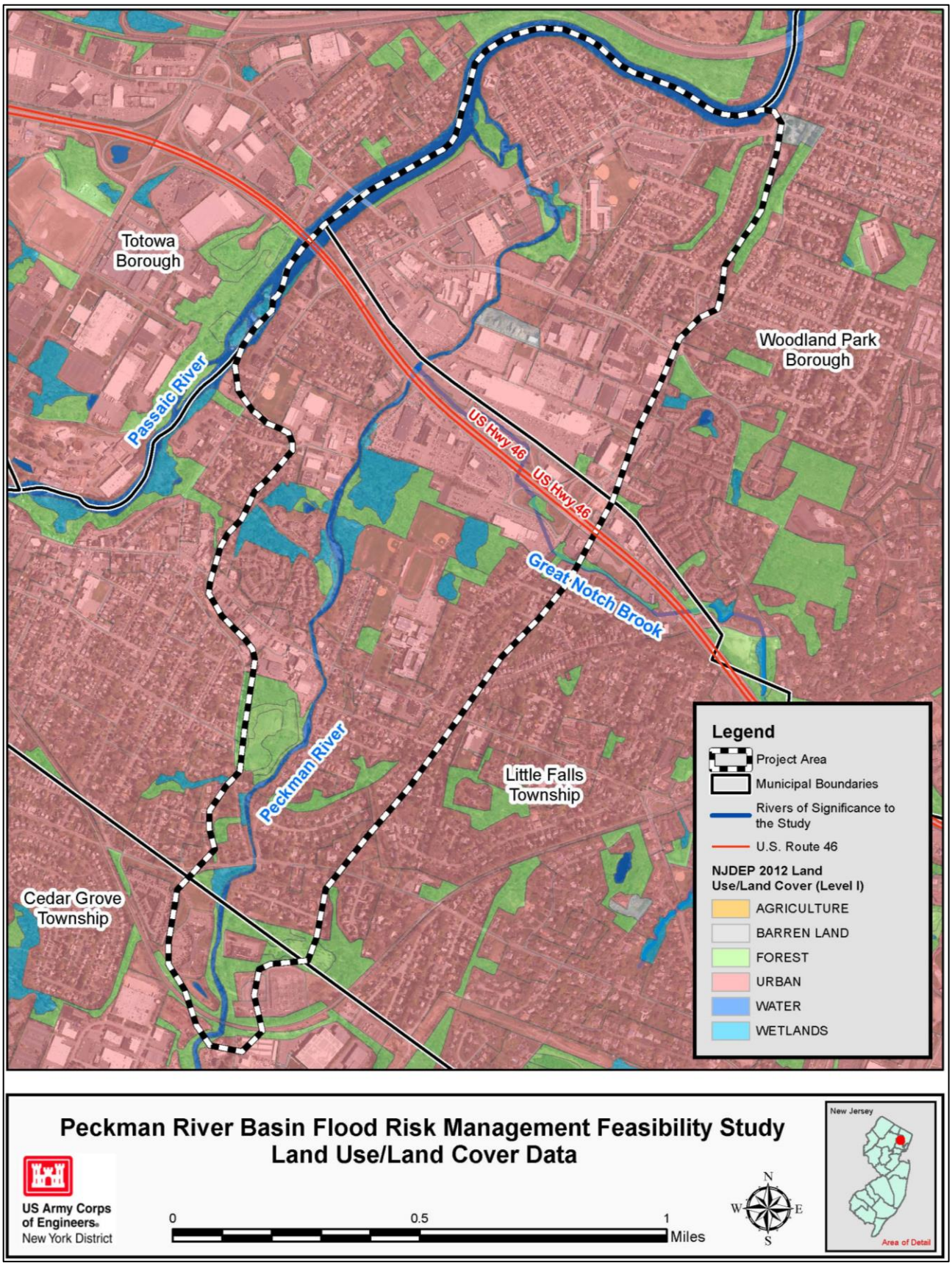

Figure 25. Land use within the project area.

2.5 Socioeconomics

Socioeconomics is the study of how economic activity affects and is shaped by social processes. In general, it analyzes how societies may change because of their local or regional economy, or the global economy.

2.5.1 Demographics

According to the 2010 U.S. Census, the population of the municipalities in the project area has increased since 2000. Table 3 presents a summary of the population data for the project area.

Table 3. Population of New Jersey, Little Falls, and Woodland Park (U.S. Census, 2010).

Location	2000 Census	2010 Census	% Change (rounded)
New Jersey	8,414,350	8,791,894	5%
Little Falls	10,855	14,432	33%
Woodland Park	10,987	11,819	8%

Income: Both of the municipalities of Woodland Park and Little Falls have a higher than average median household income for Passaic County, but are fairly representative of the average median household income of New Jersey. The median household income for Woodland Park is $70,000, which is 13 percent higher than the average for Passaic County ($62,000), but 5% lower than the average for the state of New Jersey ($74,000). For Little Falls, the median household income is higher, at $79,000. This is 27 percent higher than the average for Passaic County and 7 percent higher than the average for the state of New Jersey.

Labor Force: The unemployment rates for Woodland Park (4.1 percent) and Little Falls (5.9 percent) are lower than that for Passaic County. Management, professional, and related occupations form the largest segment of the working population for both Woodland Park (39.5 percent) and Little Falls (43.7 percent). Sales and office occupations ranked second for Woodland Park (28.6 percent) and Little Falls (32.4 percent). These employment sectors are also ranked first and second for Passaic County and the State of New Jersey, respectively.

2.5.2 Environmental Justice

USEPA defines environmental justice as 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. Fair treatment means no group of peoples should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies". "Environmental justice is achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work" (USEPA, 2019).

EO 12898 "Federal Actions to address Environmental Justice in Minority and Low Income Populations" mandates that each Federal agency identify and address potential disproportionately high and adverse effects of its activities, programs, and policies on minority populations and low income populations. Specifically, adverse effects that pertain to human health and the environment must be identified and addressed. According to EO 12898, minority populations exist where the percentage of minorities exceeds 50 percent or where the minority population percentage in the affected area is meaningfully greater than in the general population. EO 12898 does not provide criteria to determine if an affected area consists of a low-income population.

A cursory analysis was conducted to determine the potential applicability of environmental justice issues. The analysis took into account a comparison of the percentage of low income and minority populations occurring in each municipality within the counties in which they are located. Those municipalities where the combined minority populations and/or the low income populations are higher than the county would be subject to environmental justice considerations.

The combined minority population of Passaic County is 57.6 percent (US Census, 2019a). The percentage of individuals living below the poverty line is 17 percent, and the percentage of families living below the poverty line is 15.3 percent (US Census, 2019b). Little Falls has a combined minority population of 21.3 percent (US Census 2019c), which is lower than Passaic County overall. In addition, the percentage of individuals and families living below the poverty level is lower than Passaic County overall at 6.5 percent and 4.5 percent respectively (US Census 2019d).

Woodland Park has a combined minority population of 40.6 percent, which is lower than Passaic County (US Census 2019e) and below 50 percent. The percentage of individuals and families living below the poverty level is less than Passaic County at 6.2 percent and 5.0 percent, respectively (US Census, 2019f). Based on this analysis, there are no communities within the project area that warrant environmental justice considerations.

2.6 Existing Water Resource Projects

Local stakeholders have implemented efforts on their own to reduce flood risk in the project area. The Township of Little Falls has bought out approximately 59 residential structures, with more buyouts planned. However, these structures are impacted by Passaic River flooding, not Peckman River flooding. This flooding is caused by Passaic River overbank flooding within Little Falls, not Passaic backwater flooding up the Peckman River.

The Borough of Woodland Park has bought out several properties within its municipality due to flooding from the Peckman River. One residential property on Radcliffe Avenue was bought out using funding from the Blue Acres Program, an NJDEP buyout program for properties that have suffered flooding in their history. Buyouts of three residential properties on Bergen Boulevard were implemented using U.S. Housing of Urban Development (USHUD) Community Development Block Grant-Disaster Recovery (CDBG-DR) funding. One residential structure on Bergen Boulevard was demolished utilizing CDBG-DR funding.

There have been a few clearing and snagging efforts within the portion of Peckman River that traverses Little Falls and Woodland Park. Little Falls and Woodland Park have received a $150,000 grant to buy an excavator to allow The Township of Little Falls and the Borough of Woodland Park to conduct their own snagging and clearing of the Peckman River, subject to engineering approval and the necessary permitting. The next snagging and clearing effort is currently being planned.

The U.S. Geological Survey (USGS) is currently installing water level gages within the Peckman River as part of a flood warning system. Two gages were installed in Little Falls in May 2017, with a third planned for installation. The flood warning system will provide information about water levels that can inform local leaders and residents about potential flooding in the project area.

Chapter 10 includes a table summarizing existing and planned water resource projects.

2.7 Critical Infrastructure

Elements of critical infrastructure lie within the project area (Figure 26). The elements inside the one percent floodplain are those that are most at risk in the event of a flood. Flooding may cut off access to these entities, and subsequently increase the risk of loss of life and property damages to residents.

The critical infrastructure elements within the project area are: Route 46, an emergency medical service, two fire stations, three schools, and at least three gas stations. Route 46 is one of the most significant critical infrastructure elements because it is the major transportation corridor in and out of Woodland Park and Little Falls. In the event of an emergency, residents will evacuate via Route 46. In the event that this route is inaccessible due to flooding, residents will need to use a detour, usually smaller surface streets are able to be traveled. Flooded roadways pose significant life safety risks by impeding access for emergency vehicles and travel to safety. The Pulse Medical Transportation Emergency Medical Service (EMS) is a first responder service for injured residents. If flooded, this EMS facility may not be able to respond, or may have delayed response times to injured persons. The Passaic Valley Hose Company Two fire station is a critical public service for the area. If Passaic Valley Hose Company Two was unable to respond to a fire or other emergency situation, there would be only one other fire station within the project area that could respond.

Three school facilities are located in the project area - Woodland Park Public Schools district office, Memorial Middle School (serving 482 students [Great Schools 2017]), and the Passaic Valley High School (serving 1,301 students [National Center for Education Statistics 2018]). These are some of the major schools in the area, and would affect many families if inoperable. Additionally, children cannot evacuate on their own, and are considered a vulnerable population. Evacuation of schools, daycare centers, hospitals, and senior care centers pose the greatest risk to already vulnerable populations.

At least three gas stations lie within the project area. There are several additional gas stations in the surrounding area, but the loss of the three gas stations would increase demand at the surrounding stations and could also precipitate an environmental incident.

Outside of the project area, but nearby, there is more critical infrastructure, including a potable water treatment plant, an electrical substation, eight EMS facilities, five gas stations, four fire stations, an oil and natural gas pipeline, two police stations, and four schools. When the project area is flooded, extra stress is put upon these critical infrastructure elements, and access to and from these elements could be compromised. The Verona Waste Water Treatment Plant, is upstream of the river, and would require an extraordinary event to be impacted. Two nursing homes - Alaris Health at Cedar Grove, and St. Vincent's Healthcare and Rehabilitation Center) - could face some real challenges during a flood. Should the elderly residents need to be evacuated, it may be difficult for the residents to receive their normal care and cause medical hardship for the residents, the staff, and emergency responders.

2.8 Transportation

Vehicle: The project area is connected to major population centers, including New York City, through a network of highways, railways, and bridges. Route 46 functions as the dividing line between Woodland Park and Little Falls. Other major roads of note are Paterson Avenue and Browerton Road, which both run north-south on the east side of the Peckman River starting from Main Street/East Main Street and converging at the northeastern tip of the project area near the Passaic River (Paterson Avenue becomes McBride Avenue). There are four bridges along Route 46 and five bridges on the Peckman River (Figure 27). The bridge at McBride Avenue is a 69-foot wide vehicular bridge. It is located immediately before the Peckman River's discharge into Passaic River. South of the McBride Avenue bridge is another 64-foot wide vehicular bridge. It is located along Lackawanna Avenue. Another bridge in the project area is the one the runs along Route 46. It is 142 feet wide and provides both pedestrian and vehicular access. South of the Route 46 is a 57-foot wide bridge running along the East Main Street. It provides both pedestrian and vehicular access. Additionally, a bridge is located at Francisco Avenue right next to its intersection with Cedar Grove Road. It is a 57-foot wide vehicular bridge. There are seven additional bridges just outside the project area. Also nearby are U.S. Interstate 80 and the Garden State Parkway.

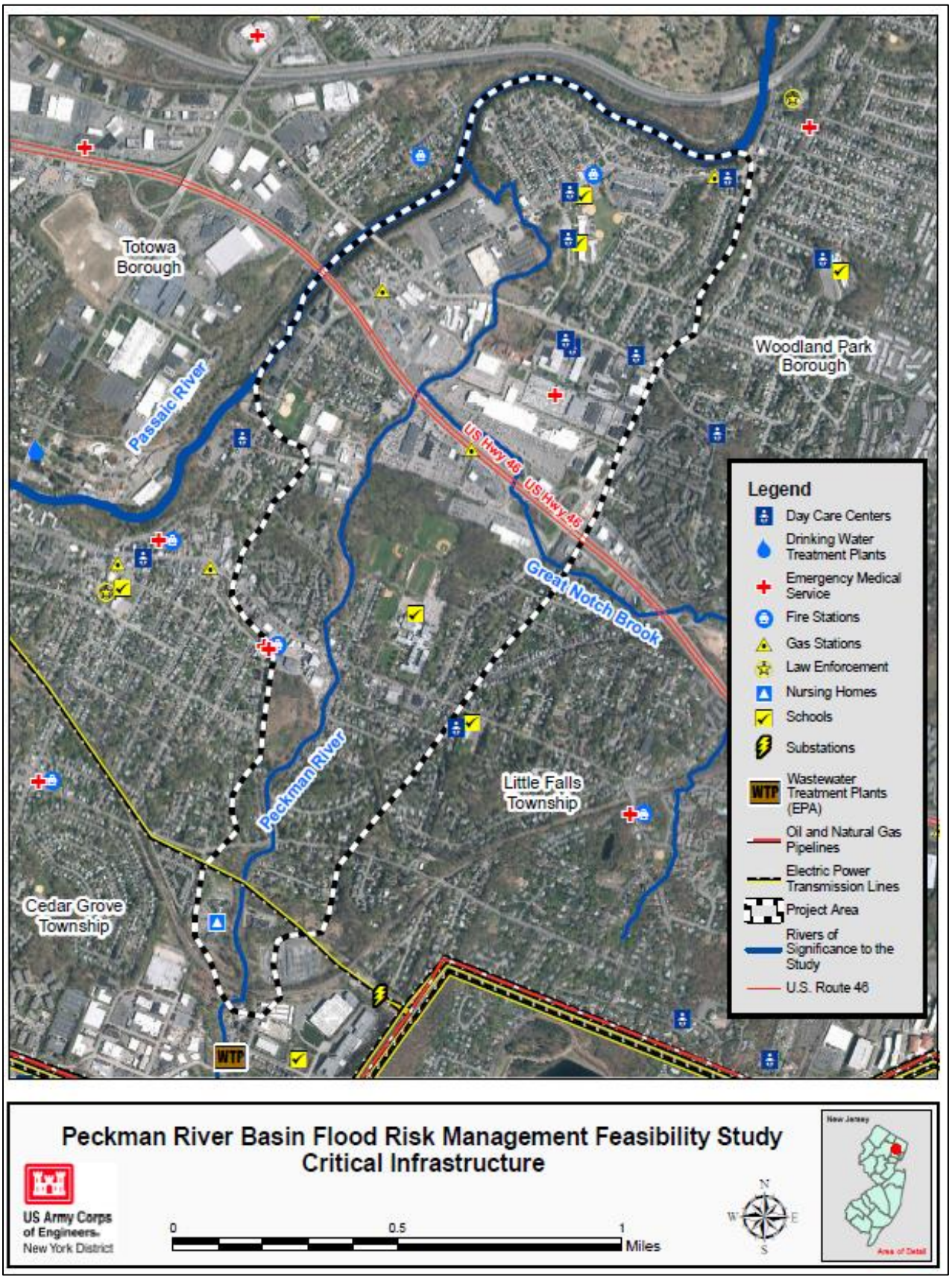

Figure 26. Critical infrastructure in and around the Project Area. See Figure 21 for transportation infrastructure.

Rail: Both the Little Falls station and Montclair State University station of NJ Transit serve Little Falls, offering service on the Montclair-Boonton Line to Hoboken Terminal in Hoboken, or from Montclair State University Station on Midtown Direct trains to New York City's Pennsylvania Station in Midtown Manhattan via the Secaucus Junction. Outside the project area but nearby are five NJ Transit train stations.

2.9 Water Resources

2.9.1 Surface Water

Three water bodies are located within the project area; the Peckman River, Great Notch Brook and the Passaic River. See Section 1.5.2 for a detailed description of their geography and topography.

Peckman River

Along with receiving point and non-point discharges related to stormwater runoff and treated sewage water, the Peckman River has experienced modifications associated with recreation, development of infrastructure and erosion control. The Peckman River was dammed in Verona in 1814 to create Verona Lake, initially to provide water power for a grist mill. In later years, the lake was converted to recreational use. As part of the conversion to a lake, the river was channelized via a stone wall for approximately 480 feet below the dam. Sewage treatment plants in Cedar Grove and Verona discharge treated waste water into the Peckman River. Numerous bridge crossings have been constructed across the Peckman River, and a review of historic maps indicate that the river has been realigned to accommodate road construction.

Within the project area, development, particularly north of Route 46 in the Borough of Woodland Park, has occurred within feet of the streambanks. In several locations, the streambanks have been replaced with concrete retaining walls. In other locations, one or both river banks have been stabilized with rip-rap. Remnants of an abandoned dam spillway located in the river in Little Falls were removed in 2011 to help reduce flooding. A portion of the dam spillway is still embedded within the left bank of the river. In addition, the Passaic Valley Sewer Authority performs semi-routine gravel and debris removal in the Peckman River to assist in flood mitigation. The most recent effort occurred in January 2017 (Kelleher, 2017).

The average channel width of the Peckman River within the project area ranges from 20-40 feet with an average depth of one foot to one and one-half feet. Based on field investigations, the substrate consists predominantly of cobble and gravel with a lower presence of sand, silt and clay (USACE, 2010b).

Great Notch Brook

Great Notch Brook originates within a residential development immediately north of Francisco Street between Ridge and Long Hill Roads in Little Falls (Figure 2 in Appendix A-1). From there, it meanders through mostly residential areas until just before its confluence with the Peckman River, where the land use transitions to commercial use. Within the project area, Great Notch Brook resembles a large drainage ditch, having undergone significant modifications to accommodate construction of Route 46 and commercial development. In two locations, the brook flows subsurface for several hundred feet. The first location is at Browertown Road, where the brook flows under it and Rose Street for approximately 300 feet before daylighting into an area that serves as a stormwater retention pond adjacent to the eastbound side of Route 46. Great Notch Brook then flows from there under Route 46 for approximately 250 feet before daylighting into a large shopping center parking lot located on the westbound side of Route 46. Within the shopping center, the stream banks are predominantly maintained lawn with a few trees and small shrubs. Flow within the brook is relatively uniform and does not exhibit any significant aquatic habitat features such as pool and riffle complexes. Based on general observations during site visits, the substrate of Great Notch Brook is predominantly fine sediment with lesser amounts of cobble and gravel.

Figure 27. Important transportation routes.

Passaic River

Within the project area, the Passaic River flows in a northerly direction. The width of the river ranges between 150 to 250 feet with the exception of where a large vegetated gravel bar has established and has reduced the channel width to approximately 55-60 feet. Channel substrate is comprised of cobbles, gravel, and sand (NJDEP, 2012). The portion of the right bank of the Passaic River within the project area includes a modest riparian corridor vegetated with mature deciduous trees. Similar to the Peckman River, development has occurred within feet of the top of the river banks. The river within and near the vicinity of the project area has been subject to modifications related to industry. For example, the historic Beattie's Mill Dam is located approximately 1.4 miles upstream from the Passaic River's confluence of the Peckman River (Refer to Figure 2 in Appendix A). In addition, the Passaic River is used as a water supply for the water treatment plant and intake system located within the vicinity of project area in Totowa, New Jersey, just below Beattie's Dam.

2.9.2 Water Quality & Habitat

Peckman River

The Peckman River and its tributaries, including Great Notch Brook, are designated as FW2-NT by NJDEP. By definition, designated uses for FW2 waters include: 1) maintenance, migration and propagation of the natural and established biota; 2) primary contact recreation; 3) industrial and agricultural water supply; 4) public potable water supply after conventional filtration treatment and disinfection; and 5) any other reasonable uses. Non-trout (NT) waters are those "not generally suitable for trout because of their physical, chemical, or biological characteristics but are suitable for a wide variety of other fishes" (NJDEP, 2016).

The NJDEP Bureau of Freshwater and Biological Monitoring (BFBM) conducts monitoring of surface water quality through a combination of chemical analyses and surveys of macroinvertebrates and/or fish surveys. Two NJDEP BFBM macroinvertebrate monitoring stations have been established in within the Peckman River; one in Cedar Grove (Station AN0275A) and one at McBride Avenue in Woodland Park near the confluence of the Peckman and Passaic Rivers (Station AN0275). In addition, two fish sampling stations are established within the Peckman River in Cedar Grove (NJS11-10) approximately 0.35 miles from the northern border of the project area, and in Woodland Park (NJS11-156-R3) within the project area.

Based on the composition of species found in NJDEP fish and macroinvertebrate surveys, the water quality of the Peckman River is indicative of a system that has experienced moderate to major changes in structure of the biological community, and moderate changes in ecosystem function. It is not attaining the designated aquatic life uses. Therefore, it falls below the acceptable regulatory range and is considered impaired based on Federal Clean Water Act standards (NJDEP BFBM, 2013; NJDEP BFBM, 2011; Miller, 2012) .

Evaluations of the habitat within the macroinvertebrate and fish monitoring stations conducted by NJDEP BFBM during fish and benthic surveys noted characteristics consistent with a stressed aquatic communities. These characteristics included sediment deposition, channel modifications, severe bank erosion, and a limited riparian zone. In addition, water testing indicated high conductivity, which can be an indicator of a high level of dissolved solids often times attributed to stormwater runoff in urban areas (NJDEP BFBM, 2011).

The District conducted macroinvertebrate and fish surveys following the NJDEP survey methods within the Peckman River in September 2010. Based on species collected, the conclusion regarding the water quality reached by the District was the same as the NJDEP BFBM: the Peckman River is impaired. As part of these surveys, the District also conducted a stream habitat assessment of approximately 3,700 feet of the Peckman River using the USEPA's Rapid Bioassessment Protocols (EPA RBP) for wadeable

streams. The EPA RBP stream assessment method was selected by the District for use because the NJDEP BFBM utilizes it as part of their fish and macroinvertebrate sampling procedures. This stream assessment method employs a habitat rating scale of optimal, sub-optimal, marginal, or poor as it relates to a river system having the habitat structure required to support and maintain a diverse aquatic resource community.

The portions of river evaluated included two reference reaches approximately 1.7 and 2.4 miles, respectively, upstream of the project area in Cedar Grove, and two reaches within the project area in the vicinity of the Peckman Preserve and the Passaic Valley High School (Refer to Appendix A-2 for survey locations). The reference reaches had more extensive pool and riffle complexes than the two project area reaches. The 2010 stream assessment determined that all four reaches surveyed exhibited "suboptimal" habitat. Factors contributing to the suboptimal rating include alterations to the river channel, a high level of embeddedness, and moderate sediment deposition, and a lack of riparian zone (District, 2010b).

Great Notch Brook

Biological surveys and habitat assessments were not conducted within Great Notch Brook. However, based on general field investigations conducted by the District, aquatic habitat in Great Notch Brook within the project area is considered minimal for fish and macroinvertebrates due to the lack of riffle pool complexes and vegetative cover, and the high level of embeddedness of finer sediments within the cobble and gravel substrate.

Passaic River

Similar to the Peckman River, the Passaic River is designated as FW2-NT. The District did not conduct surveys and habitat assessments within the Passaic River. NJDEP BFBM has a macroinvertebrate monitoring station (ANO274) located within the project area. Based on the composition of species found during a 2008 macroinvertebrate survey conducted by NJDEP BFBM, the Passaic River is considered impaired based on Federal Clean Water Act standards (Miller, 2012).

2.9.3 Wetlands

Federal (33 CFR 328.3(b); EO 11990) and State (N.J.A.C. 7:7A1.4) definitions of wetlands are similar, identifying wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." As defined above, wetlands generally include swamps, marshes, bogs, and similar areas.

A review of New Jersey's geographic information system (GIS) environmental mapping database (NJ Geoweb) and the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps was conducted to assess potential wetlands within the project area (Figure 1 in Appendix A-1). Both the NJ Geoweb and the USFWS NWI maps indicate the presence of several forested wetland complexes along the Peckman River ranging from approximately half an acre to nine acres in size. The Township of Little Falls hired a consultant in 2013, to perform a wetland delineation on Township-owned property north of the Passaic Valley High School. The wetland delineation confirmed the presence of a forested wetland complex approximately two acres in size with several smaller wetlands less than 0.25 acres in size near the larger complex. The wetland delineation is included as Figure 3 in Appendix A-1.

NJ Geoweb and the USFWS NWI mapping databases also indicate the presence of a three acre forested wetland complex on the right bank of the Passaic River. No wetland complexes were indicated along Great Notch Brook by either mapping databases.

2.10 Vegetation

2.10.1 Uplands & Riparian Corridor

Uplands

Vegetation within the project area is predominantly limited to landscaped lawns with a few forested sections along the Peckman River and Passaic River. The largest tract of undeveloped forested land is located immediately north of the Passaic Valley High School in Little Falls.

The majority of uplands within the project area have been developed with two exceptions: a tract of land located on the left side of the Peckman River approximately 12 acres in size known as the Peckman Preserve and a forested tract approximately 18 acres in size on the eastern side of the Peckman River located on the northern boundary of the Passaic Valley High School. Shrub and tree species native to New Jersey that have been observed within the upland and riparian areas are indicated in Table 4.

Table 4. Tree and Shrub Species Observed within Upland and Riparian Zones within the Project Area.

Common Name	Scientific Name	Growth Form
Spice bush	*Lindera benzoin*	Shrub
Black haw	*Viburnum prunifolium*	Shrub
Box elder	*Acer negundo*	Understory Tree
American hornbeam	*Carpinus caroliniana*	Understory tree
Red maple	*Acer rubrum*	Tree
Silver maple	*Acer saccharinum*	Tree
Sugar maple	*Acer saccharum*	Tree
Bitternut hickory	*Carya cordiformis*	Tree
American beech	*Fagus grandifolia*	Tree
Green ash	*Fraxinus pennsylvanica*	Tree
White ash	*Fraxinus Americana*	Tree
Black walnut	*Juglans nigra*	Tree
Tulip tree	*Liriodendron tulipifera*	Tree
Eastern white pine	*Pinus strobus*	Tree
Sycamore	*Platanus occidentalis*	Tree
Black cherry	*Prunus serotina*	Tree
Northern red oak	*Quercus rubra*	Tree
Pin oak	*Quercus palustris*	Tree
Black Locust	*Robinia pseudoacacia*	Tree
Black Willow	*Salix nigra*	Tree
American basswood	*Tilia Americana*	Tree
American elm	*Ulmus Americana*	Tree
Slippery elm	*Ulmus rubra*	Tree

Riparian Zone

The New Jersey Flood Hazard Area Control Act Rules, N.J.A.C. 13 (FHACAR) establishes and requires the preservation of riparian zones. The width of the established riparian zone is based on the environmental resources being protected and can range from 50, 150 or 300 feet as measured from the side of surface waters. Given that the Peckman and Passaic Rivers, and Great Notch Brook are designated FW2-NT and do not support habitat critical to the survival of any threatened or endangered species, the riparian zones for each waterbody is 50 feet, as described in N.J.A.C. 7:13-4.1(c) 3.

In general, the average width of the riparian zone along the Peckman River within the project area south of Route 46 ranges between 20 feet to greater than the 50 feet. However, the riparian zone along the Peckman River north of Route 46 has been particularly subject to disturbance related to development and has been reduced to an average width of five to ten feet.

Japanese knotweed (*Fallopia japonica*) essentially occurs as a monoculture along the Peckman River riparian zone within the project area. Upstream of the Peckman Preserve, Japanese knotweed was observed to be commonly present and locally dominant, but not as monotypic as the downstream area.

The riparian corridor along Great Notch Brook has been significantly disturbed and is predominantly maintained lawn with the exception of a small cluster of deciduous trees on the side of Route 46 near Browertown Road. The riparian zone width along the Passaic River ranges between five to 50 feet, and is characterized by steep slopes and mature deciduous trees.

2.10.2 Wetlands

Herbaceous and fern species noted within wetlands include skunk cabbage (*Symplorcarpus foetidus*), clearweed (*Pilea pumila*), touch-me-knot (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda spectabilis*). Tree and shrub species observed include green ash, sycamore, silver maple, American elm and spice bush (Table 4).

2.11 Aquatic Resources & Wildlife

2.11.1 Fisheries

Fish collected by NJDEP BFBM at the monitoring station during their most recent survey include (in order of abundance), longnose dace (*Rhinichthys cataractae*), tessellated darter (*Etheostoma olmstedi*), eastern silvery minnow (*Hybognathus regius*), pumpkinseed (*Lepomis gibbosus*), white sucker (*Catostomus commersoni*), redbreast sunfish (*Lepomis auritus*), blacknose dace (*Rhinichthys atratulus*), common carp (*Cyprinus carpio*), American eel (*Anguilla rostrata*), smallmouth bass (*Micropterus dolomieu*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macochirus*), yellow bullhead (*Ameirus nebulosus*), goldfish (*Carassius auratus*), banded killifish (*Fundulus diaphanous*), western mosquitofish (*Gambusia affinis*), and largemouth bass (*Micropterus salmoides*). Dominant species included longnose dace, tessellated darter, and eastern silvery minnow (*Hybognathus regius*) (NJDEP BFBM, 2013).

Species collected during a 2011 survey at the monitoring station in Cedar Grove include (in order of abundance) creek chub, white sucker, blacknose dace, largemouth bass, golden shiner, American eel, green sunfish, banded killifish, eastern silvery minnow, redbreast sunfish and tessellated darter. Dominant species included creek chub, white sucker, and blacknose dace (NJDEP BFBM, 2011).

The District conducted a fish survey within the project area in July 2010 (Refer to Figure 2 in Appendix A-2) to characterize fish species inhabiting the project area. Species caught included white sucker, blacknose dace, creek chub, American eel, bluegill, common carp, green sunfish, smallmouth bass, and white sucker, banded killifish, green sunfish and largemouth bass. Fish survey results indicated that the Peckman River is inhabited predominantly of species considered as generalists that can tolerate degraded conditions (USACE, 2010c).

Fish surveys were not conducted by the District within the Passaic River or Great Notch Brook. However, it is expected that they would contain similar species as the Peckman River given their interconnection. The New Jersey Division of Fish and Wildlife stocks the Passaic River with northern pike within the project area (Refer to Figure 4 in Appendix A-1).

2.11.2 Benthic Resources

The dominant family of invertebrates collected during the District's 2010 macroinvertebrate survey belonged to the family midges (*Chironomidae*). The second most dominant family was net-spinning caddisflys (*Hydropsychidae*). Other groups caught included danceflies (*Empididae*), snail (*Planorbidae*), amphipods (*Crangonyctidae*), and oligochaete worms (*Tubificidae*) (USACE, 2011).

Dominant benthic species collected at the biological monitoring station in Cedar Grove during the NJDEP BFBM 2008 water quality survey included caddisfly in the family Hydropscychidae, and microcaddisfly in the family Hydroptilidae. Other groups of species captured include amphipods (*Gammaridae*), flatworm (*Dugesiidae*), cranefly (*Limoniidae*), midges, freshwater clam (*Sphaeriidae*), and beetle (*Elmidae*).

Dominant benthic species collected at the biological monitoring station in Woodland Park during the NJDEP BFBM 2008 water quality survey included amphipods, and midges. Other groups of species captured included black fly (*Simuliidae*), freshwater isopods (*Asellidae*), a type of crustacean, flatworm (*Dugesiidae*), damselfly (*Coenagrionidae*), leech (*Glossiphoniidae*), and mayfly (*Baetidae*) (Miller, 2012).

A biomonitoring station (ANO274) is established in the Passaic River within the project area. Dominant benthic species collected at the Passaic River biological monitoring station during the NJDEP BFBM 2008 water quality survey included amphipods, net-spinning caddisfly and midges. Other groups of species captured include blackfly, mayfly (*Heptigeniidae*), snail, fingernail clam (*Sphaeriidae*), and freshwater clam (*Corbiculidae*) (Miller, 2012).

2.11.3 Birds

Commonly occurring bird species include mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), crow (*Corvus brachyrhynchos*), goldfinch (*Carduelis tristis*), robin (*Turdus migratorius*), black capped chickadee (*Parus atricapillus*), hairy woodpecker (*Leuconotopicus villosus*), downy woodpecker (*Picoides pubescens*), blue jay (*Cyanocitta cristata*), and chipping sparrow (*Spizella passerine*).

The Garret Mountain Reservation and Rifle Camp Preserves are located approximately two miles and 1.5 miles east, respectively, from the project area (refer to Figure 2 in Appendix A-1). The areas are designated as an Important Bird Areas (IBA) by the National Audubon Society. IBAs are sites that support habitat necessary for breeding, overwintering, or migration. The goal of the IBA Program is "to stop habitat loss by setting science-based priorities for habitat conservation and promoting positive action to safeguard vital bird habitats." The National Audubon Society considers these two areas as a significant migratory stopover for various bird species. Over 200 species have been recorded in the Garret Mountain Reservation, and over 100 species have been recorded in Rifle Camp Park (E-bird, 2018). It would therefore be expected that species utilizing the parks could also occur within the project area.

2.11.4 Mammals

Site specific surveys to document mammal species have not been conducted, although white tailed deer (*Odocoileus virginianus*) were observed in the project area during a field visit in 2017. Given the level of urbanization within the majority of the project area, species expected to occur within the area are those that are adapted to urban environments. Such species include red fox (*Vulpes vulpes*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), skunk (*Conepauts mesoleucus*), eastern chipmunk (*Tamias striatus*), and woodchuck (*Marmota monax*).

2.12 Reptiles and Amphibians

Site specific surveys were not conducted to identify reptile and amphibian species. Due to the fact that the project area is more urbanized, reptile and amphibian species that are more adapted to this type of

environmental setting include American toad (*Bufo americanus*), bullfrog (*Rana catesbeiana*), garter snake (*Thamnophis sirtalis*), and eastern box turtle (*Terrapene Carolina*).

2.13 Threatened & Endangered Species

Section 7 of the Endangered Species Act (ESA) of 1973 requires a Federal agency to ensure that any action authorized, funded or carried out by the agency does not jeopardize Federally-listed endangered and threatened species or result in the destruction or adverse modification of designated critical habitat of a Federally-listed species.

State-listed endangered, threatened and special concern species are protected under the New Jersey Endangered Species Conservation Act of 1973.

2.13.1 Federal Endangered, Threatened & Special Concern Species

The District received a Draft Fish and Wildlife Coordination Act Report regarding the study in 2014 that noted the Federally-endangered Indiana bat (*Myotis sodalist*) as potentially occurring within the project area.

Due to the time that has passed between the submission of the draft Fish and Wildlife Coordination Act Report (FWCAR) and publication of the October 2019 Revised DIFR/EA, the District obtained an official list of endangered and threatened species that may occur within the project area on November 16, 2017 (USFWS, 2017a). Included in the list is the Indiana bat, and the Federally threatened northern long-eared bat (*Myotis septentrionalis*), which was listed in 2015. As the official lists are only valid for three months, an additional list was obtained October 8, 2019 where there were no changes to the species listed. No other Federally endangered or threatened species were identified in the list. The list is located in Appendix A-4 of the report.

Information provided in the list was further supplemented by a review of the "New Jersey Municipalities with Hibernation or Maternity Occurrence of Indiana bat or Northern Long-eared bat" list (USFWS, 2017b). Based on this list, Woodland Park has a known northern long-eared bat maternity colony. In addition, municipalities within a five mile radius of the project area with known northern long-eared bat maternity colonies include the City of Paterson, the Township of Wayne, and the Boroughs of Haledon and Totowa.

Brief descriptions of the species habitat preferences are below:

Indiana Bat

Indiana bats spend the winter hibernating in caves and mines, with hibernation beginning in late October and emergence occurring typically in April. The Hibernia Mine located in Hibernia, New Jersey is a known Indiana bat hibernaculum and is located approximately 21 miles from the project area.

During the summer months, numerous female bats roost together in maternity colonies under the loose bark of dead or dying trees within riparian, floodplain, and upland forests. Maternity colonies use multiple roosts in both living and dead trees. Adult males usually roost in trees near maternity roosts, but some males remain near the hibernaculum.

Tree species commonly used as roost sites include American elm, slippery elm, shagbark hickory, silver maple, and green ash. Adult males usually roost in trees near maternity roosts, but some remain near the hibernaculum. Preferred foraging areas include streams, associated floodplain forests, and impounded bodies of water such as ponds and reservoirs. However, Indiana bats have been observed in upland forests, pastures, and clearings with early successional vegetation, cropland borders, and wooded fencerows (USFWS, 2007).

Northern Long-Eared Bat

Similar to the Indiana bat, the northern long eared bat hibernates in caves and abandoned mines with hibernation generally beginning in October/November and emergence typically occurring in April. Northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live and dead trees. Unlike Indiana bats, northern long-eared bats have also been observed in manmade structures such as buildings, barns, sheds, cabins, under eaves of buildings, and bat houses. Preferred foraging areas are in forested habitats (USFWS, 2015).

Other Species

The USFWS listed the rusty patched bumble bee (*Bombus affinis*) as endangered under the Endangered Species Act in January 2017. However, based on a Fish and Wildlife Coordination Act Report prepared for another USACE study in the region, the USFWS presumed that this species is extirpated in New Jersey although more research and field studies are warranted in the state (USFWS, 2017).

In addition, the USFWS is currently evaluating the little brown bat (*Myotis lucifugus*), and the tricolored bat (*Perimyotis subflavus*) to determine if listing under the ESA is warranted (USFWS, 2017c).

Studies conducted by the NJDEP Division of Fish and Wildlife in 2018 identified one active American bald eagle nest in Paterson which is approximately 2.5 miles from the project area (Smith and Clark, 2018). Although the bald eagle was removed from the Federal List of Endangered and Threatened Wildlife in 2007, it remains protected through the Bald and Golden Eagle Protection Act of 1940, and the Migratory Bird Treaty Act of 1918.

2.13.2 State Endangered, Threatened & Special Concern Species

Based on comments received by NJDEP Division of Fish and Wildlife during the NEPA scoping period, there are no state endangered, threatened or special concern wildlife species or significant nongame wildlife habitats within the project area (refer to Appendix A-7). A review of the Landscape Project layer on NJ-Geoweb indicates suitable foraging habitat for the Great blue heron (*Ardea herodias*) within the project area.

2.14 Hazardous, Toxic & Radioactive Waste

A Phase I Environmental Site Assessment was prepared and is included in Appendix A-12. Based on a review of databases, including the National Priorities List (NPL), the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS), the Superfund Enterprise Management System (SEM), Resource Conservation and Recovery Information System (RCRIS), NJDEP Known Contaminated Sites (KCS), and the Toxic Release Inventory System (TRIS), there are no known contaminated sites within the project area.

A geotechnical survey, consisting of 23 soil borings, was completed in September and October 2011 along the Peckman River. Borings were conducted using a direct push (“GeoProbe”) and truck mounted rotary type drill rig. Soil samples were collected from surface to top of bedrock or 25 feet below ground surface, whichever was encountered first.

The 23 soil borings collected were analyzed for: 1) volatile organics+15 (VOA); 2) semi-volatile organics+25 (SVOA); 3) pesticides; 4) polychlorinated biphenyls (PCBs); and 5) Resource Conservation and Recovery Act (RCRA) metals. Analytical results were compared to the NJAC -7:26D – Non-Residential Direct Contact Soil Remediation Standard, 2017 (NRDCSRS). The reason for using this standard is that no residential areas were/are adjacent to these boring locations and the potential location of the flood control structures in these areas.

Of the five categories analyzed, VOAs, pesticides, and PCBs were found at levels below threshold levels or non-detect. Four SVOA compounds were detected but they did not exceed NRDCSRS thresholds. There was no pattern to the distribution of these detections and levels found. The soil borings where the SVOAs were detected were taken from the Township of Little Falls Department of Public Works (DPW) yard and the off-ramp from Route 46. Of the eight RCRA metals, only two, arsenic and lead, were detected in two samples. One sample came from a parking lot for a commercial office building and the other from the DPW yard. The arsenic detect barely exceeds the NJDEP threshold (22 parts per million verses NJDEP limit of 19 ppm). The lead detects from the DPW yard is 600 ppm and from the commercial office building parking lot was 403 ppm, both below the NJDEP threshold of 800 ppm. The detects at the DPW yard is likely the result of the activities undertaken at the yard and the presence of fill in this area. Similarly, the detect at the office building is most likely from backfill used at time of construction.

A number of structures are fifty years or older and are likely to have lead-based paint (LBP) and/or asbestos-containing materials (ACM).

2.15 Cultural Resources

As a federal agency, USACE has certain responsibilities for the identification, protection and preservation of cultural resources that may be located within the Area of Potential Effect (APE) associated with the proposed project (also known as the undertaking). Present statutes and regulations governing the identification, protection and preservation of these resources include the National Historic Preservation Act of 1966 (NHPA), as amended; the National Environmental Policy Act of 1969; Executive Order 11593; and the regulations implementing Section 106 of the NHPA (36 CFR Part 800, *Protection of Historic Properties*, August 2004). Significant cultural resources include any material remains of human activity eligible for inclusion on the National Register of Historic Places (NRHP). This work is done in coordination with the New Jersey Historic Preservation Office (NJHPO), federally-recognized Tribes and interested parties.

For the current study, a Phase I cultural resources investigation was completed that included a review of previous surveys including the 1982 survey of the Peckman River conducted by the US Army Corps of Engineers (Kraft 1979; Archaeological Survey Consultants 1981; Hunter et. al. 1982). The Phase I investigation that was completed for the current study also included documentary research, an architectural survey of 81 structures, and 80 shovel tests (Figure 28) (Hartgen Archeological Associates 2013). The survey compiled a list of archaeological sites within two miles of the study area and of previously documented historic properties within the study area boundaries (Table 5).

Archaeological Sites and Historic Properties

There are 26 previously recorded archaeological sites within a two mile radius of the study area. None of the previously recorded sites are located within the study area. Most are located at the northern end of the study area along the Passaic River. Based on the existing site information and results of previous surveys, the study area is considered archaeologically sensitive for Native American sites, as well as sites related to the historic development of the region. However, some portions of the study area have undergone prior disturbance from historic and recent development as well as rechanneling of the river (Hartgen Archaeological Associates, 2013).

Four historic properties were identified within the study area that are listed on or determined eligible for the New Jersey State and National Registers of Historic Places within the study area (Figure 29). These properties include:

- The Morris Canal (National Register-listed): A 102-mile long canal linking Phillipsburg to the west and Jersey City to the east dating to 1836-1920s. The canal crosses the Peckman River via an aqueduct about one-half mile south of Main Street.

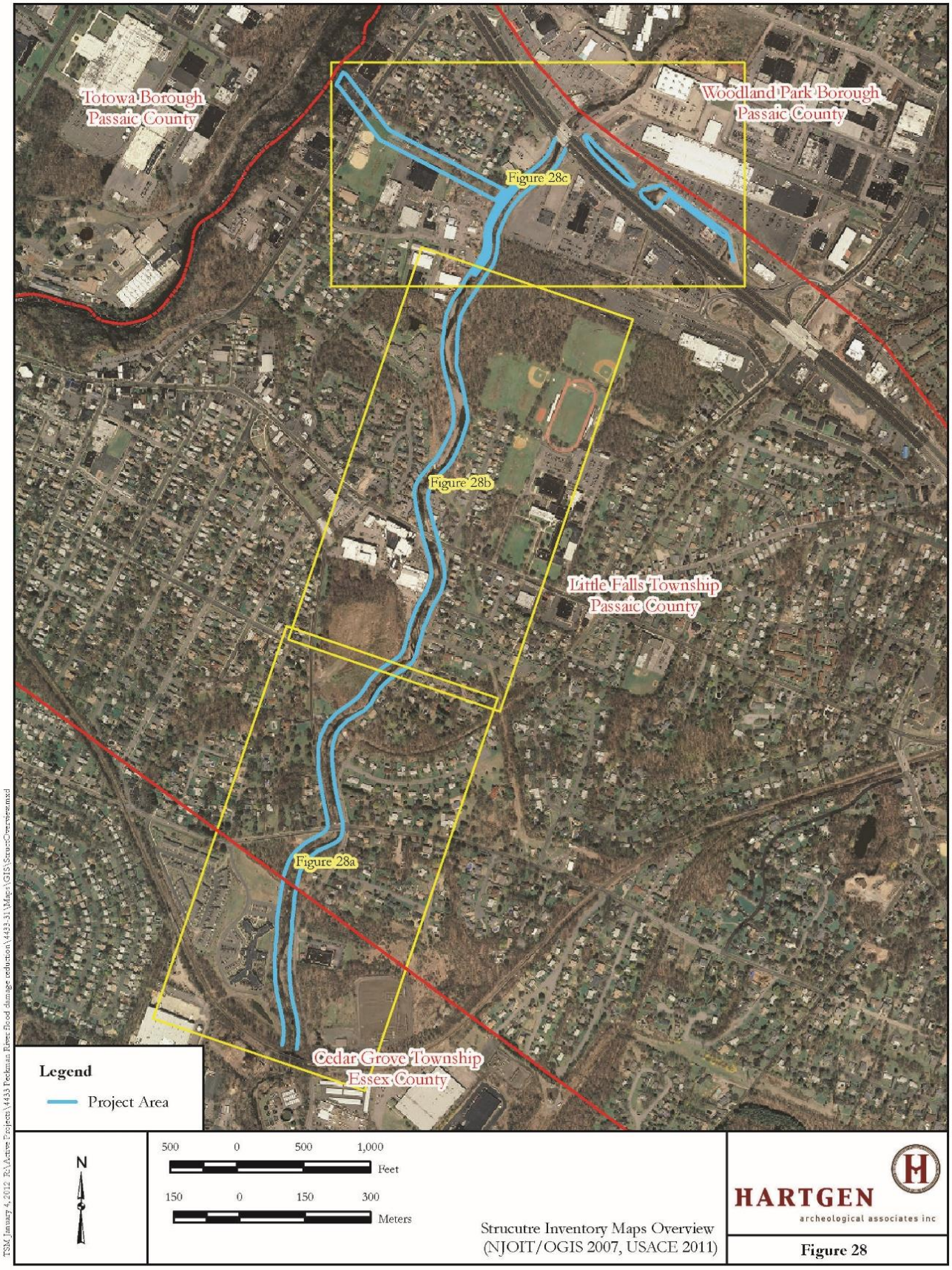

Figure 28. Phase I Archaeological Investigations and Structure Inventory Study Area (HAA 2013)

- The Little Falls Laundry (National Register-eligible): Began in 1912 as the Little Falls Washing Company, it became one of the largest and most modern commercial laundry facilities on the East Coast. It ceased operations in 1970. The complex consists of a main building built between 1917 and 1932, replacing the original 1912 building and two other buildings built in 1915 and 1925. The Laundry building is located at 101 Main Street along the Peckman River.

- The Route 46 Bridge over the Passaic River and Riverside Drive (National Register-eligible): The bridge is a 477 foot long concrete arch bridge built in 1939.

- The Jersey City Water Works Pipeline (National Register-eligible): This property consists of an aqueduct that crosses the Peckman River within the study area just south of Lindsley Road and Francisco Avenue. In the vicinity of the APE, the pipeline consisted of a 72-inch diameter pipe. Gatehouses that controlled the flow of water were found along the waterline at the corner of Lindsley Road and Cedar Grove Road. The pipeline itself extends from Boonton to the west, which is the site of the Jersey City/Boonton Reservoir to Jersey City to the east.

Table 5. New Jersey State Museum archaeological sites within two miles of the APE.

Site No.	Site Identifier	Description	Proximity to Project Area (nearest point)
28-Pa-111	"26-1-6-6-1"	Precontact; no information	8500 ft. (2590 m) west
28-Pa-109	"26-1-6-4-5,6"	Precontact; site findings include "arrowheads, spearheads, axes, pestles and potsherds."	9500 ft. west (2895 m) map has it on north side of river but description places it on south side of river
28-Pa-153	Van Der Kooy	Precontact; site findings include "arrowheads, axes, spears, knives, scrapers, hammerstones, broken bannerstones, and the usual chip materials. No pottery."	10,000 ft. (3048 m) west
28-Pa-110	"26-1-6-2-7"	Precontact; no information	8300 ft. (2530 m) west
28-Pa-108	"26-1-6-1-6"	Precontact; no information	9500 ft. (2895 m) northwest
28-Pa-105	"26-1-6-5-5"	Precontact; no information	8400 ft. (2560 m) west
28-Ex-58	Area 21 Santucci	Precontact: site finds include "broken pottery, arrowheads, fishspears, hammerstones, celt and axes."	11400 ft. (3475 m) west
28- Pa-106	"26-1-6-5-5,6"	Precontact; no information	8100 ft. (2469 m) west
28-Pa-105	"26-1-6-5-5"	Precontact; no information	7000 ft. (2134 m) west
28-Pa-107	"26-1-6-6-1"	Precontact; no information	5200 ft. (1585 m) west
28-Pa-154	Vreeland	Precontact; site findings include "turtle-back scrapers, blades of Coxsackie flint, and jasper chips. A few potsherds"	6000 ft. (1829 m) northwest
28-Pa-155	Vreeland Route 6	Precontact; site findings include "arrowheads, large spearheads, grooved axes, long pestles and other common artifacts, also the usual flake and chip material. Decorated pottery found"	5000 ft. (1524 m) northwest

28-Pa-57	Lower Preakness	Precontact; no information	9000 ft. (2743 m) northwest
28-Pa-114	"26-2-4-2-8,9"	Precontact; no information	1500 ft. (457 m) north
28-Pa-116	"26-2-4-2-5,6"	Precontact; no information	2500 ft. (762 m) north
28-Pa-115	"26-2-4-2-6"	Precontact; no information	3000 ft. (914 m) northeast
28-Pa-117	Little Falls	Precontact; ford across the Passaic	3500 ft. (1067 m) northeast
28-Pa-113	"26-2-4-5-3"	Precontact; no information	1000 ft. (304 m) northeast
28-Pa-169	Dowling	Precontact; Fishing camp with two nearby camps, a fish weir and an eel weir. Site findings from camps include: "fireplaces with a few arrowheads, drills and course pottery,… a few flat net sinkers"	3800 ft. (1158 m) northeast
28-Pa-94	"26-2-4-3-6"	Precontact; ford across the Passaic	2500 ft. (762 m) east
28-Pa-101	"26-2-4-3-3"	Precontact; ford across the Passaic	5500 ft. (1676 m) northeast
28-Pa-44	"26-2-5-2-6"	Precontact; site findings include "hatchets, celts, arrowheads, spear points (large) etc. Black flint chips. No pottery."	9000 ft. (2743 m) northeast
28-Ex-120	New Hospital Center Locus A Site	Precontact; three chert flakes	6500 ft. (1981 m) southwest
28-Ex-121	New Hospital Center Locus B Site	Precontact; tertiary jasper flakes and late stage chert core	6000 ft.(1829 m) southwest
28-Ex-96	"26-2-4-7-9"	Precontact; no information	4000 ft. (1219 m) south
28-Ex-130	Van Reyper/Bond House	Historic: associated with late 19th-early20th century extant house; items include nails, wood, glass.	7500 ft. (2286 m) southeast

Field Investigations

Field investigations carried out for this study resulted in the identification of five additional archaeological resources:

- Little Falls Laundry, Weir, and Headrace: Recently damaged by the flood water, portions of the former weir which diverted water into the headrace still stand. The weir and headrace were likely built in the 1920s as part of the laundry's expansion after the Sindle and Van Ness mills were no longer operational to utilize the water for their mill ponds to power distant mills. The headrace, headwall, and sluice gate mechanisms are still intact.

- Marley Mill Site: This site consists of a stone dam and retaining wall. There is no evidence of the actual mill structure. The mill was built in 1896 and was destroyed in a fire prior to 1907 and not rebuilt. The dam has been breached and most of it has been damaged or destroyed. The retaining wall was likely a later feature built for the nearby roadway and is not part of the site proper. The actual mill site lies under a portion of the St. Vincent nursing facility and has likely been destroyed or deeply buried under fill.

- Morris Canal Aqueduct: The remains identified within the study area include the interior canal walls on the east side of the river. Additional canal walls were also found to the east outside of the study area. No evidence was found of the central pier or the aqueduct's abutment's or canal prism on the west side.

- Seuchlung Slaughterhouse Bridge Abutment: the abutment is located on the west side of the Peckman River. This features did not possess additional research potential archeologically.

- Smalley Street Bridge: A small concrete feature that crosses the Peckman River north of East Main Street. It likely served as a still feature to protect the abutments for this former bridge. There is no evidence of the abutments. This feature does not possess additional research potential archeologically, and it is not considered an archeological site.

Architectural Survey

The architectural survey consisted of a field inspection of 81 properties within the study area. All structures built before 1962 were evaluated using the National Register criteria for significance. The survey determined the Morris Canal Aqueduct, the Little Falls Laundry, and Jersey City Water Works Valve House have retained their integrity and remain listed on or eligible for listing on the New Jersey State and National Registers. The Cedar Grove Railroad Overpass, was identified by this survey as potentially eligible for the New Jersey State and National Registers (Figure 25).

Geotechnical Survey

The results of geotechnical testing in the study area identified varying stratigraphic profiles along the project corridor. The majority of the borings indicated organic silt and soil underlain by fill material. In other areas, particularly in the middle portion of the project area immediately along the Peckman, the borings noted deep deposits of riverine sands and silt, up to eight feet deep in some locations. The sands are likely recent in origin. One area at the western end of the diversion culvert alignment in the location of an extant parking lot between Patterson Avenue and the Passaic River appears to contain deep fill deposits. This area was recommended for further investigations (see Figure 29).

2.16 Recreation

Specific areas supportive of active and/or passive recreational activities within the project area include the Little Falls Recreation Center, the Peckman Preserve, and the Morris Canal Greenway bike/walking trail.

The Little Falls Recreation Center includes a building that provides space for indoor recreational activities such as dance and fitness classes, a playground, two tennis courts, and two baseball fields (known as Duva Field) (Figure 5 in Appendix A-1).

The Peckman Preserve is a 12 acre tract of land along the left bank of the Peckman River that was acquired by Passaic County in 2005. No improvements have been made to the property since its acquisition. However, a study commissioned by the Passaic County Freeholders to evaluate potential improvements included a conceptual plan that consists of the installation of a bike path along the western perimeter of the park within the alignment of an unconstructed portion of the Morris Canal Greenway, and ecological enhancements and a boardwalk with educational signage within the preserve (Edgewater Design, LLC, 2010). In addition, the Passaic County Planning Department is proposing to install a footbridge over the Peckman River to connect the eastern and western spurs of the Morris Canal Greenway (Kelleher, 2017b).

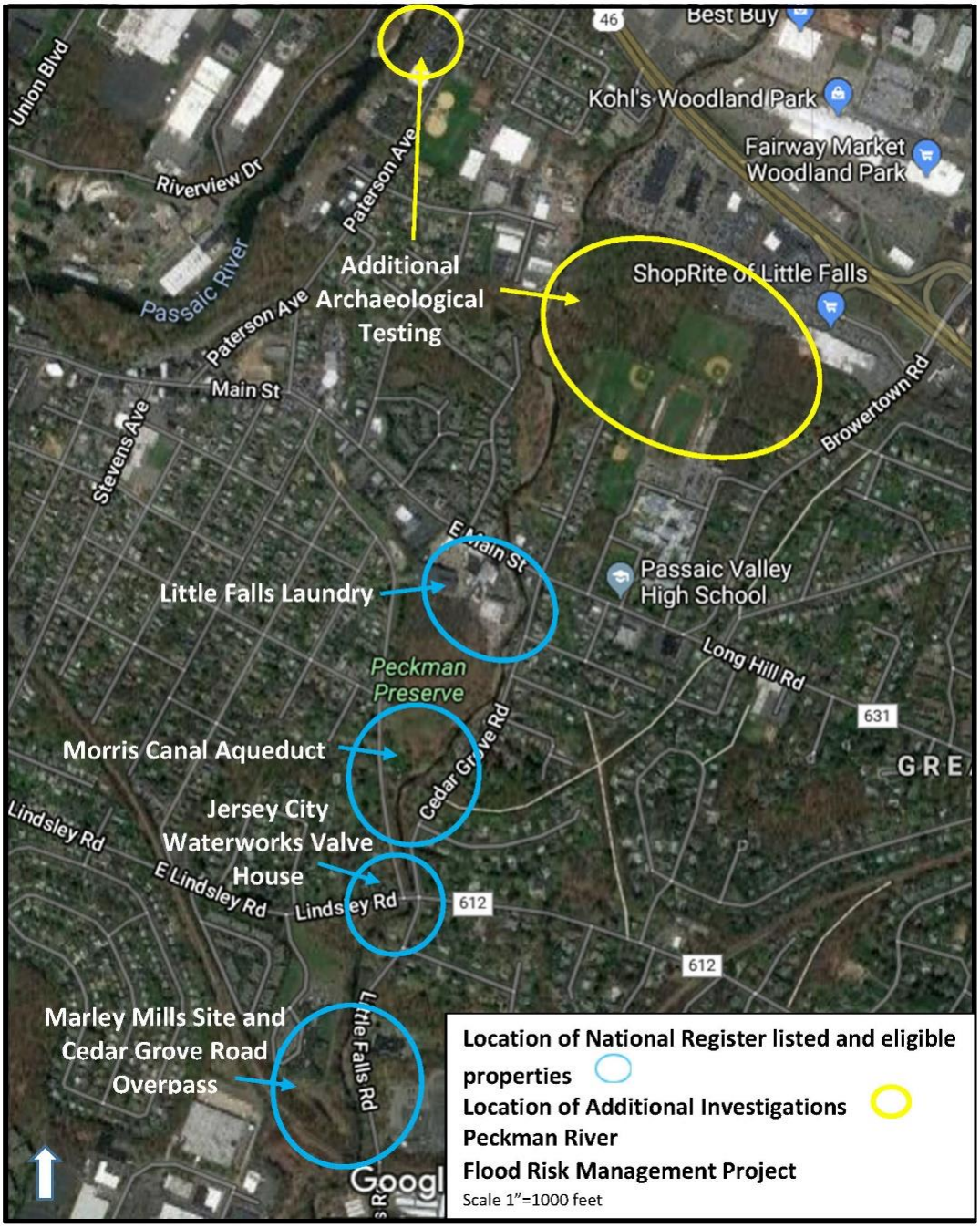

Figure 29. Location of identified historic properties and additional archaeological testing and monitoring (2018 imagery).

The Peckman River itself offers limited water-based recreational opportunities due to lack of public access points.

Great Notch Brook does not offer any water-based recreational opportunities within the project area.

The Passaic River is large and deep enough to provide water-based recreational opportunities although there are no public access areas to the river located within the project area. However, the Suchorsky Park, which is located in Little Falls, but is outside of the project area, has a boat launch to the Passaic River (Refer to Figure 2 in Appendix A-1).

2.16.1 Green Acres Program

The Green Acres Program, created in 1961 and administered by NJDEP, provides funds for the State or local municipalities to acquire and maintain lands for the purposes of recreation.

Under the Green Acres program, lands obtained or developed with Green Acres funding and lands concurrently held by a local government for recreation, open space and conservation purposes, regardless of the source of acquisition funds, must permanently remain in use for recreation, open space and conservation purposes. In general, lands subject to the rules of the program cannot be disposed of or diverted unless it can be demonstrated to the State that the modification will protect or enhance the use of the area. By definition, land that is used for purposes other than recreation, open space and conservation is considered a "diversion" while a "disposal" is the selling, donating, or some other form of permanent transfer of possession of parkland.

A review of the NJDEP Recreation and Open Space Inventory Database (ROSI) indicates that the Peckman Preserve was acquired with Green Acres Program funds. During the review of the 2018 DIR/EA, Green Acres Program staff noted that the parcel that comprises Little Falls Recreation Center including the Duva baseball fields and tennis courts is encumbered under the Green Acres Program. Other parcels noted by NJDEP during their review include a 0.82 acre parcel east of Browertown Road located within the footprint of the Old Morris Canal way that is designated as a bikeway, and 0.28 acre parcel that encompasses the Peckman River and the portion of land on the left bank of the Peckman behind townhomes along Turnberry Court (Appendix A-1 Figure 5).

No other properties encumbered by the Green Acres program are listed in the ROSI database within the project area.

2.17 Aesthetics & Scenic Resources

The aesthetic quality within the project area is influenced by heavy residential and business development. Much of the land along the river shorelines or wetland margins is developed with single-family residential dwellings and local business/industries. The visual setting of the project area is therefore characterized by moderate to high-density development along the Peckman and Passaic Rivers and Great Notch Brook.

There are no scenic byways, National Wildlife Refuges, National Parks, National Forests, National Natural Landmarks, or National Heritage sites within the project area. The Paterson Falls-Garret Mountain National Natural Landmark is located approximately three miles downstream from the project area (see Figure 2 in Appendix A). Neither reaches of the Peckman River, Great Notch Brook, nor the Passaic River within the project area are designated as wild and/or scenic per the Wild and Scenic Rivers Act of 1968.

2.18 Air Quality

2.18.1 Air Quality

The Clean Air Act (CAA), as amended, assigns USEPA responsibility to establish primary and secondary National Ambient Air Quality Standards (NAAQS) that specify acceptable concentration levels of six criteria pollutants: particulate matter (measured as both particulate matter less than 10 microns in diameter (PM10) and particulate matter less than 2.5 microns in diameter (PM 2.5), sulfur dioxide (SO_2), carbon monoxide (CO), oxides of nitrogen (NOx), ozone (O_3), and lead. Short-term NAAQS (1-, 8- and 24-hour periods) have been established for regulated emissions contributing to acute health effects, while long term NAAQS (annual averages) have been established for those emissions contributing to chronic health effects.

Federal regulations designate Air Quality Control Regions (AQXRs) in violation of the NAAQS as nonattainment areas. Federal regulations designate AQCRS with levels below the NAAQS as nonattainment and have been redesigned to attainment for a probation period through implementation of maintenance plans. According to the severity of the pollution problem, ozone and PM10 nonattainment areas can be categorized as marginal, moderate, serious, severe or extreme.

Passaic County located in the New York-New Jersey-Long Island Air Quality Control Region. Similar to most urban industrial areas, emissions from automobiles, manufacturing processes, utility plants, and refineries have impacted air quality in the project area. Based on the NAAQS for this region Passaic County is designated as moderate non-attainment areas for ozone and as a maintenance area for carbon monoxide.

2.19 Noise

Noise is generally defined as unwanted sound. The day-night noise level (Ldn) is widely used to describe noise levels in any given community. The unit of measurement for Ldn is the "A"-weighted decibel (Dba), which closely approximates the frequency responses of human hearing.

The primary source of noise in the project area is vehicular traffic on local roadways and local construction projects that may be underway, and operation of businesses. The project area is characterized as residential and business development, therefore existing sound levels are likely within this range.

Chapter 3: Plan Formulation

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints. The 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies (Principles and Guidelines, or P&G) and USACE Engineering Regulation (ER) 1105-2-100 "Planning Guidance Notebook" lay out an iterative six-step planning process used for all USACE Civil Works studies in developing and evaluating alternatives. This chapter presents a summary of problems and opportunities; inventory and forecast; and plan formulation, evaluation, comparison, selection, and optimization.

A Note About the Contents of this Chapter

Since release of the previous version of this report in May 2018, the Tentatively Selected Plan has been refined based on updated engineering and economic information described in Section 3.13. Much of this chapter describes initial planning activities undertaken through May 2018, the logic and conclusions of which are still valid. This chapter is organized as follows:

- Section 3.1 through Section 3.12 summarize plan formulation, evaluation, and selection undertaken through May 2018.
- Section 3.13 includes a description of plan optimization completed subsequent to release of the May 2018 DIFR/EA, through the October 2019 release of the Revised DIFR/EA.

A description of the Recommended Plan is presented in Chapter 4.

Display of Price Levels: Costs and benefits developed as part of initial plan formulation, evaluation, and comparison are included for historical reference; they do not reflect current price levels because they were calculated in previous fiscal years. They are noted with the price level that reflects previous fiscal years as appropriate. Costs and benefits developed during feasibility-level design (optimization) are shown in the current fiscal year price level.

3.1 Problems & Opportunities

A problem statement is the detailed description of a problem that helps guide the planning process. It informs the identification of the study's goals and objectives, and ultimately plan formulation, comparison, and selection.

Problem Statement: People, infrastructure, and property within the Peckman River Basin, especially in the communities of Little Falls and Woodland Park, experience significant risk to life safety and property flood damages because of flash flooding from the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River (Figures 30 and 31). The red pedestrian bridge featured in these photos crosses over the Great Notch Brook in the Plaza 46 Shopping Center parking lot in Woodland Park (Figure 32).

Figure 30. Pedestrian Bridge over Great Notch Brook at the commercial retail property, Woodland Park, New Jersey (2017).

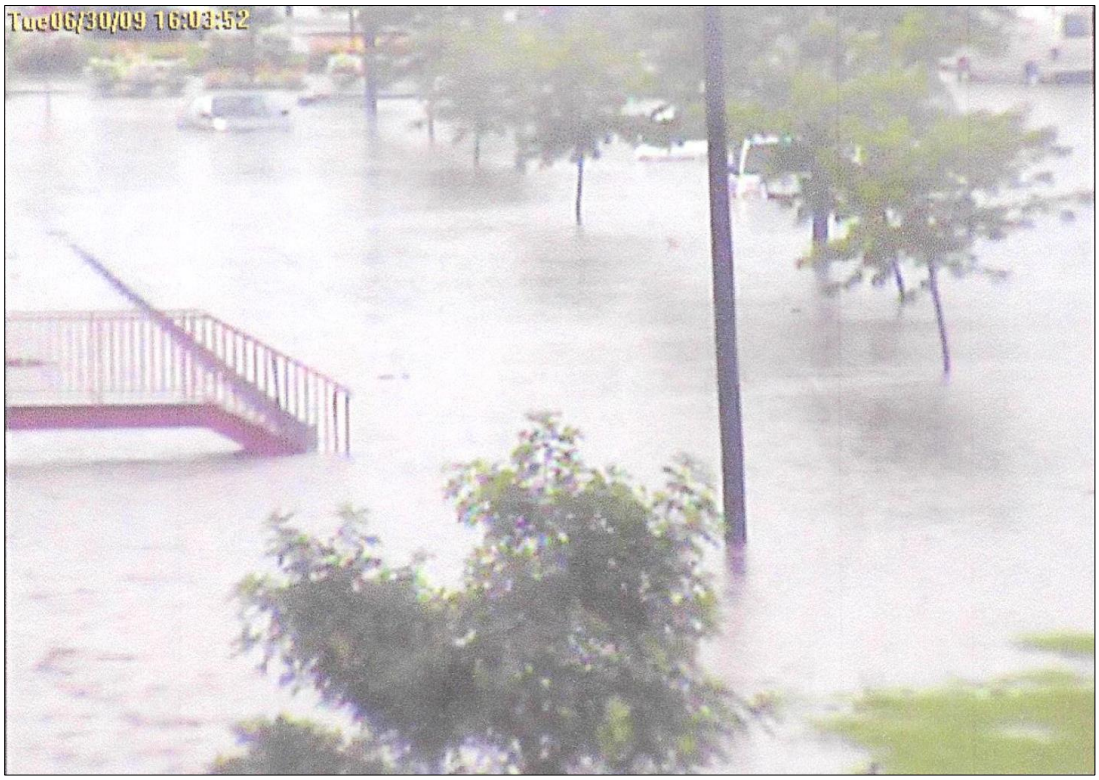

Figure 31. Pedestrian bridge over Great Notch Brook pictured in previous figure during the June 30, 2009 storm.

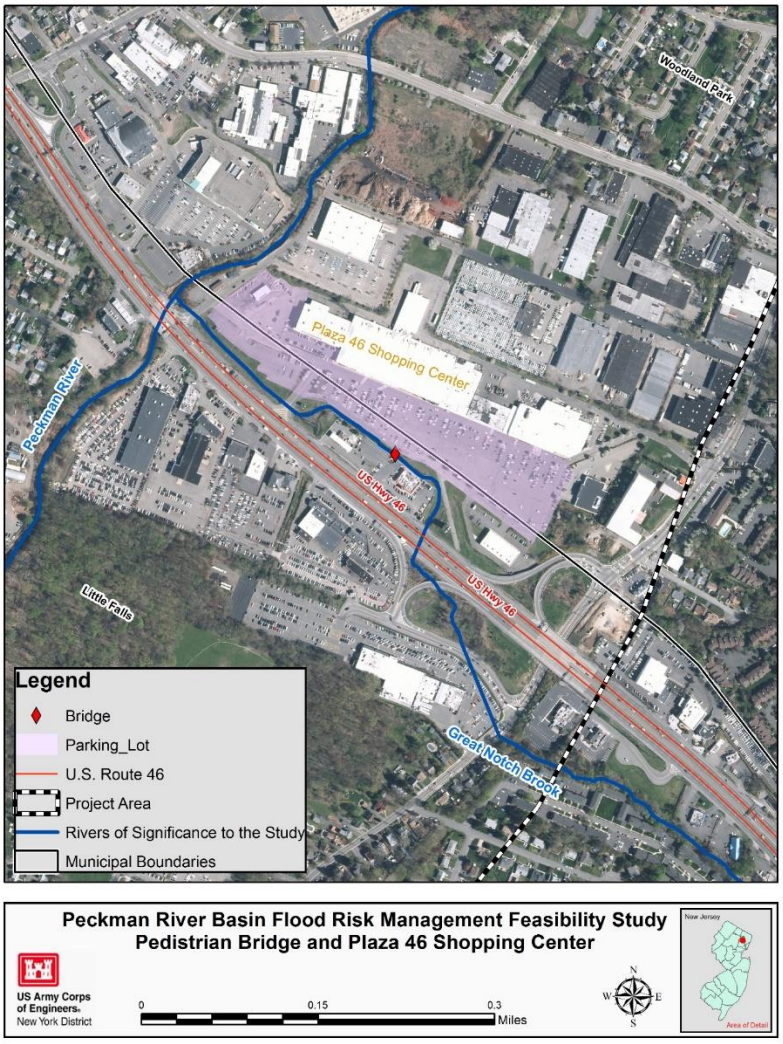

Figure 32. Location of red pedestrian bridge and Plaza 46 shopping center and parking lot.

One of the most damaging floods of record in the basin resulted from Hurricane Floyd on September 16-17, 1999, causing an estimated $12,100,000 (FY19 P.L.) in flood-related losses to towns in the basin. Hundreds of homes and businesses were flooded in Little Falls and Woodland Park. The Woodland Park business district was one of the hardest hit areas, with over three feet of flood water affecting structures. In Little Falls, businesses were inundated with over four feet of water, and the Jackson Park residential area suffered extensive flooding. Hurricane Doria in August 1971 caused an estimated $2,000,000 (FY19 P.L.) in flood-related damages and a severe flood in May 1968 reportedly caused over $18,600,000 (FY19 P.L.) in damages within the basin.

Because of the difference in drainage areas of the Peckman River and Passaic River Basins, and the differing characteristics of rainfall events, the project area is rarely flooded by simultaneous flash flooding from the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River. Based on a statistical regression analysis of a 30 year record of historical flows on the Peckman and Passaic Rivers, there is no reliable way to predict a flood stage on the Peckman River based on water levels on the Passaic River. The converse is also true in that there is no reliable way to predict a flood stage on the Passaic River based on what is happening on the Peckman River. About two thirds of storms do not cause simultaneous flooding of both rivers. The differences in the flooding mechanisms are explained below.

Flash Flooding

Flash flooding is the rapid flooding of low-lying areas due to heavy rainfall associated with intense thunderstorms, hurricanes, and tropical storms. The Peckman River Basin experiences frequent flash flooding caused by such high rainfall events. Rainfall can produce significant runoff into rivers and streams that can quickly exceed their channel capacity, and that of bridge and culvert openings. Flash flooding is most frequent along the relatively small Great Notch Brook, which is a tributary of the larger Peckman River. Storms with a ten percent annual chance of occurrence typically cause flooding along Great Notch Brook. Water from the Brook drains into the Peckman River, which typically experiences simultaneous high water during large storms (Figure 33). Flooding caused by drainage of flood waters from Great Notch Brook into the Peckman River is exacerbated when rain has saturated soils in the area.

Figure 33. Flash flooding in the Peckman River during Hurricane Floyd near Little Falls, New Jersey (1999).

The right bank of Great Notch Brook receives a portion of Peckman River inundation in the area of the shopping mall parking lot (Figure 28). Great Notch Brook flows into the Peckman River with the confluence on the west end of the parking lot immediately downstream of the Route 46 Bridge. Given the difference in drainage basin size for Great Notch Brook (0.6 square miles) and Peckman River (9.8 square miles) it is possible that more of the inundation may be caused by the Peckman River, but specific contributions of flooding cannot be easily determined.

Because of its larger watershed, flood elevations on the Peckman River typically peak about an hour after peak flood elevations are recorded on Great Notch Brook. Flood waters eventually travel from the Peckman River to the Passaic River. With its larger drainage area, the Passaic River often peaks approximately two or three days after peak flood elevations are recorded on the Peckman River. Flash flooding from Great Notch Brook and the Peckman River typically impact Little Falls and Woodland Park more than other municipalities in the Peckman River Basin.

Backwater Flooding

A description of backwater flooding mechanisms is presented in this section to fully describe all sources of flood risk in the study and project areas. As discussed in Section 1.4, USACE and NJDEP are currently completing an analysis of backwater and overbank flooding from the Passaic River in the region, under the authorization for the Passaic River Basin, New Jersey flood risk management study. Because of this, the scope of this study is limited to addressing flooding caused by the Peckman River and its tributaries.

Backwater flooding occurs when water from a river banks up into tributaries that feed into it, much like a traffic jam caused by road construction on a highway. Like flash flooding and overbank flooding, it is caused by rainfall that exceeds the channel capacity of rivers and streams. The Passaic River is a source of backwater flooding in the project area. Backwater flooding is worsened when rain continues to fall on the land and water piles up in Peckman River and its tributaries, and the tributaries cannot quickly discharge accumulated rainwater into the Passaic River. Backwater flooding from the Passaic River typically impacts areas along the river within Woodland Park. Backwater flooding does not affect Little Falls.

Overbank Flooding

A description of overbank flooding mechanisms is presented in this section to fully describe all sources of flood risk in the study and project areas. As discussed in Section 1.4, USACE and NJDEP are currently completing an analysis of backwater and overbank flooding from the Passaic River in the region, under the authorization for the Passaic River Basin, New Jersey flood risk management study. Because of this, the scope of this study is limited to addressing flooding caused by the Peckman River and its tributaries.

Overbank flooding occurs when waters overtop river banks and inundate areas behind the banks. Like flash flooding and backwater flooding, it is caused by rainfall that exceeds the channel capacity of rivers and streams. The Passaic River is a source of overbank flooding in the project area (Figure 34). Woodland Park and Little Falls are affected by overbank flooding in rare instances during relatively large storms.

Figure 34. Flooded parkway in nearby town of Singac (Little Falls Township, New Jersey) during the March 2011 Passaic River flood (2011).

Opportunities: Manage the risk of fluvial flooding in the Passaic River Basin caused by flash flooding on the Peckman River and its tributaries. Addressing this flooding may:

- Manage flood risks from associated fluvial flood events that impact communities, infrastructure, and the economy
- Support the resiliency of the Peckman River Basin's communities, infrastructure, and the economic consequences to the region and to the nation economy
- Communicate existing and potential future flood risks to local planners and public officials

3.2 Future Without-Project Conditions

The future without-project condition, or the No Action alternative, serves as the base condition to use as a comparison for all the other alternatives. The period of analysis used in the comparison of potential costs and benefits of alternative plans is 2027 through 2076.

In the absence of Federal action, flooding problems in the Peckman River Basin associated with rainfall events are expected to continue. Communities in the basin will continue to experience damages to structures, their contents, vehicles, and infrastructure caused by flash flooding in the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River. This would likely result in the continued maintenance and reconstruction of infrastructure and facilities, and repairs to houses and roads following storm events. Residents and businesses would be impacted by flooded roads and structures. They would be at continued risk of harm due to direct flood hazards and reduced access by emergency services during storm events.

Changes in global climate and weather patterns may potentially cause changes in rainfall patterns in the future. If climate change causes heavier rainfall events in the future, this may result in an increase in water in the basin, an increase in discharge, and increases in water surface elevations. Future without-project damages may increase in the future in the absence of the project and major changes to existing conditions.

Another future without-project condition is that some parts of Woodland Park will continue to flood from the Passaic River. The study authority for this project focuses only on flooding caused by the Peckman River, so addressing Passaic River flooding is outside of the scope of this study. The goal of the USACE Passaic River Mainstem, New Jersey flood risk management study is to address Passaic River flooding. As of this time, the Passaic River Mainstem study has been suspended, and it is unknown if a recommendation for federal action will be made. Parts of the Peckman River study area flood separately from both the Peckman and Passaic Rivers. Since this study focuses on the Peckman River flooding problem, there is residual risk within the study area for Passaic River flooding. Though the Passaic Mainstem study is currently suspended, there is potential for this study to reassume in the future to address the Passaic River flooding that occurs throughout northern New Jersey, including the Peckman River study area. Local efforts to manage and communicate flood risk may also mitigate flood damages.

3.2.1 Economic Damages

Average Annual Damages (AAD) in the future without-project condition from 2027 - 2076 were calculated at $17,225,000 (FY19 P.L.). Detailed information about the structure inventory, damage calculations, and economic modeling are provided in Appendix B.

3.2.2 Socioeconomic & Community Impacts

The most likely scenario for the future without-project condition would be the continuation of existing social and community conditions and trends, as well as economic growth within the project area. The Peckman River watershed is currently heavily urbanized and developed. Under without-project future conditions, the damage centers in Woodland Park and Little Falls would continue to be subject to flooding.

3.2.3 Land Use

The No Action alternative would not change short term land use, land cover and zoning. However, in the long term, properties along the Peckman River, particularly those in flood prone areas, are likely to sustain continued damage during future storm events. Without proactively addressing flood risks, damages will continue to accrue. Businesses and residences property values may decrease, or development may be prohibited, both which could lead to changes in land use, cover or zoning.

3.2.4 Environmental Resources

Topography, Geology and Soils

The No Action alternative would not result in any change to the topographic and geologic resources within the project area.

Water Resources

Under the No Action alternative, water quality and habitat would remain unchanged unless others take restorative actions to enhance aquatic habitat and water quality. In addition, there would be no changes to wetland communities within the project area.

Vegetation

The No Action alternative would have no effect on the plant communities that occur within the project area. There would be no short or long-term disturbance to any vegetation, and thus upland and wetland communities would remain as they are expect for changes associated with natural disturbance events – including future flooding events – and community succession.

Fish and Wildlife

Under the No Action alternative, fish and wildlife utilization of the project areas would be consistent with current conditions. The same is true for any state and/or Federal endangered, threatened or special concern species that may occur within the project area.

Cultural Resources

Under the No Action Plan, no direct adverse effects to historic properties are anticipated. However, the continued flooding of historic properties, such as the Little Falls Laundry, would likely result in deterioration of historic resources, leading to their loss of integrity and/or demolition.

Recreation

Parks and water dependent recreational opportunities within the project would remain the same under the No Action alternative. However, fluvial storm events could impact usability of the open space/park adjacent to the Peckman River through inundation or deposition of debris that could result in park closures.

Aesthetics and Scenic Resources

Under the No Action Alternative, aesthetic and scenic resources would remain unchanged from current conditions.

Hazardous, Toxic and Radioactive Waste

The No Action alternative would not change HTRW conditions within the project area.

Air Quality

Ambient air quality would remain unchanged under the No Action alternative.

Noise

Under the No Action alternative, noise conditions would remain unchanged when compared to existing conditions.

3.3 Planning Goals & Objectives

Planning goals and objectives were developed to meet the intent of the study authority, and to respond to project-specific problems. Planning objectives were identified based on problems, needs, and opportunities, as well as existing physical and environmental conditions present in the project area.

Planning Goals

Planning goals describe the overarching intent of the project, and helped in creating and evaluating alternative plans. The planning goals are to:

- Manage the risk of fluvial flood damages in the Peckman River Basin due to flash flooding in the Peckman River and its tributaries (Figure 35)
- Contribute to NED by managing the risk of fluvial flood damages in the Peckman River Basin
- Where possible, provide a plan that is compatible with future flood risk management and economic development opportunities

Figure 35. Flooded commercial area in Woodland Park, New Jersey.

Planning Objectives

Planning objectives state the intended purpose of the planning process. They are a statement about what solutions should try to achieve. Objectives are based on problems and opportunities. They are:

- Reduce the risk of fluvial flood damages in the Peckman River Basin due to due to flash flooding in the Peckman River and its tributaries from 2027 through 2076
- Reduce the risk to Peckman River Basin residents' life and safety from 2027 through 2076
- Support community resilience and cohesion in the Peckman River Basin by reducing economic losses from flooding, and maintaining the community and economic base from 2027 through 2076

These planning objectives focus on reducing the impacts of flood damages caused by flash flooding from the Peckman River and its tributaries. The study teams recognizes that the study areas also experiences flood damages due to overbank and backwater flooding from the Passaic River. The scope of this study is limited to addressing flooding caused by the Peckman River and its tributaries. However, the effects of Passaic River backwater flooding on project performance was considered as part of the study. The results of a joint probability analysis that considered the probability and extent of Passaic and Peckman River flooding in the study area is summarized later in this chapter.

3.4 Planning Constraints & Considerations

Unlike planning objectives that represent desired positive changes, planning constraints and considerations represent restrictions that should not be violated or avoided, if possible. The formulation and evaluation of alternative plans are constrained by technical, environmental, economic, regional, social, and institutional considerations.

Constraints

Constraints are restrictions that limit the extent of the planning process. They can be divided into universal constraints and study-specific constraints. Universal planning constraints are the legal and policy constraints to be included in every planning study. Study-specific planning constraints are statements of things unique to a specific planning study that alternative plans should avoid. Constraints are designed to avoid undesirable changes between the with- and without-project conditions. A constraint specific to the study is:

- Critical infrastructure: The community is served by important roads, bridges, and services (e.g., police and fire response). Plans were formulated to avoid major impacts to infrastructure.

Considerations

- The Route 46 bridge that spans the Peckman River was replaced in 2003. Potential ways to avoid or minimize modification to the bridge were considered.
- FEMA sometimes updates Base Flood Elevations (BFEs) for communities based on new technical information. The BFE is the computed elevation to which floodwater is anticipated to rise during a one percent storm, which is a storm with a one percent annual chance of occurrence. The BFE is the FEMA regulatory requirement for the elevation or floodproofing of structures. The relationship between the BFE and a structure's elevation determines the flood insurance premium. A change in BFE for an area may affect floodplain management activities, local building ordinances, and zoning codes. The chance of a significant increase in BFE in the area in the recent future is low, but was nevertheless considered during plan formulation.

3.5 Key Uncertainties

Limitations to the quantity and quality of information results in uncertainties. A noted uncertainty in this phase of the planning process is:

Nonstructural Participation Rate: Per USACE planning guidance, implementation of many nonstructural measures such as structure elevation, floodproofing, flood warning systems, and floodplain

development zoning changes/enforcement is voluntarily agreed to with property owners. However, acquisition, relocation, and permanent evacuation are not voluntary and must include the option to use eminent domain. For voluntary nonstructural measures, it was assumed that participation in a voluntary nonstructural project would be popular with many property owners in communities. Based on coordination with non-Federal and local interests, and current building strategies, an at- or near-100 percent participation rate was assumed during initial plan formulation.

3.6 Management Measures

Measures are features or actions that contribute to the planning objectives. Project-specific measures were developed to address problems and to capitalize on opportunities. They were derived from a variety of sources, including prior studies, the public scoping process, and coordination with the non-Federal sponsor.

3.6.1 Nonstructural Measures

Nonstructural features and actions reduce flood risk by removing structures and residents from flood hazards, either temporarily or permanently. They reduce flood damages without significantly altering the nature or extent of flooding. Nonstructural measures considered in the formulation of alternative plans include structure elevation, wet floodproofing, dry floodproofing, acquisition, evacuation plans, flood warning systems, and floodplain development zoning changes/enforcement. Various nonstructural techniques were considered as elements of a comprehensive solution.

Elevating (Raising) Structures. Elevation is the process of raising a structure, typically so that the main living area (main floor) will be above the BFE (Figure 36). In most cases, the process involves separating a structure from its foundation, raising it on hydraulic jacks, and holding it in place with temporary supports while a new or extended foundation is constructed below. The result is the living area is raised and only the foundation remains exposed to flooding. The new or extended foundation may consist of continuous walls or separate piers, piles, and columns, or some combination thereof.

Floodproofing. Floodproofing is the process of making adjustments in the design or construction of buildings to reduce potential flood damages. There are two categories of floodproofing: wet floodproofing and dry floodproofing. Dry floodproofing would provide flood risk management to a building by sealing its exterior walls and providing removable shields at structure openings to prevent the influx of floodwaters. Dry floodproofing is practical only for buildings with structurally-sound walls, and only where flood depths are relatively low. Wet floodproofing refers to the protection of a building in a manner that allows floodwaters to enter and exit freely, in such a way that internal and external hydrostatic pressures are equalized. This equalization of pressures reduces the loads imposed on a structure, and reduces the probability of structural damage or failure. Basement utilities subjected to flooding may be relocated to an above-grade utility room, where space permits, otherwise, the basement utilities may be surrounded by a watertight barrier.

Acquisition (Buy-Outs). Acquisition involves the purchase of property and its structures and/or the purchase of development rights. A buy-out plan would result in the permanent evacuation of the floodplain in areas of frequent and severe inundation. Buy-outs involve the acquisition of a property and its structures, either by purchase or by exercising the powers of eminent domain. Following acquisition, the structure and associated property development is either demolished or relocated. Acquired lands are typically restored to a natural condition and used for recreation or other purposes that would not be jeopardized by a flood hazard.

Figure 36. Example of an elevated home in Keansburg, New Jersey.

Flood Warning System. A flood warning system can afford residents advance warning of flooding and allow them time to make appropriate preparations. While a flood warning system does not prevent flooding and does not reduce damage to property that is left in the path of floodwaters, it can provide an aid in reducing property loss and increasing the safety of individuals. With the use of a flood warning system, property such as motor vehicles can be relocated to higher ground in time to prevent damage from rising waters. In addition, moveable items can be taken to higher floors within structures, where they will not be impacted. Finally, residents will have time to leave the area, if necessary, for their own safety.

Floodplain Development Zoning Changes/Enforcement. Through proper land use regulation, floodplains can be managed to ensure that their use is compatible with the severity of the flood hazard. Several means of regulation are available, including zoning ordinances, subdivision regulations, and building and housing codes. Their purpose is to reduce losses by controlling the future use of floodplain lands and would not be effective in mitigating the existing hazard. It should be noted that zoning is a local issue and is not within the jurisdiction of the Federal government. However, any Federal project will have a floodplain management plan component that includes requirements on the use of flood prone lands.

3.6.2 Structural Measures

Structural measures reduce flood risk by modifying the characteristics of the flood. They are physical modifications designed to reduce the frequency of damaging levels of flood inundation. Structural measures are often employed to reduce peak flows (flood storage); direct floodwaters away from flood

prone property (flood barriers); or facilitate the flow of water through or around an area (channel modifications or diversions). Structural measures considered in the formulation of alternative plans include diversion culverts, levees/floodwalls, channel modification, detention basins, road elevation, ringwalls, and clearing and snagging. Any barriers must not increase flooding from interior runoff that becomes trapped behind it. To address these requirements, any structural plan that includes a barrier may also require interior drainage facilities that may include pumps and ponding areas.

Diversion Culverts: A diversion culvert is a structure that allows water to flow under a road, railroad, or similar obstruction from one side to the other (Figure 37). Culverts come in many sizes and shapes, including round, elliptical, flat-bottomed, pear-shaped, and box-like. A diversion culvert can provide a detour for an existing waterbody.

Figure 37. Example of a culvert similar in size to the proposed Peckman River diversion culvert.

Levees: Levees are typically low, wide earthen embankments built to retain floodwater inside a channel (Figure 38). They generally consist of a trapezoidal shaped mound of earth with 1 vertical:3 height vegetated side slopes. Interior drainage facilities, located on the landward side of the levees, would be needed to collect, control, and disperse water trapped behind the barriers. Otherwise, floodwaters would pond behind the barrier and potentially breach the levee.

Figure 38. Example of a levee holding back flood waters.

Floodwalls: Floodwalls are structures composed of steel, concrete, rock, or aluminum (Figure 39). Interior drainage facilities, located on the landward side of the floodwall, would be needed to collect, control, and disperse water trapped behind the barriers. Otherwise, floodwaters would pond behind the barrier.

Figure 39. An example of a permanent floodwall in Middlesex, New Jersey.

Channel Modification: Modification of the cross-section of a channel of water along a length or lengths of that channel can sometimes improve flow and reduce or prevent fluvial flooding (Figure 40). Channel modifications can include dredging, deepening and widening, rechannelization, dam modifications, and elevating or widening bridges.

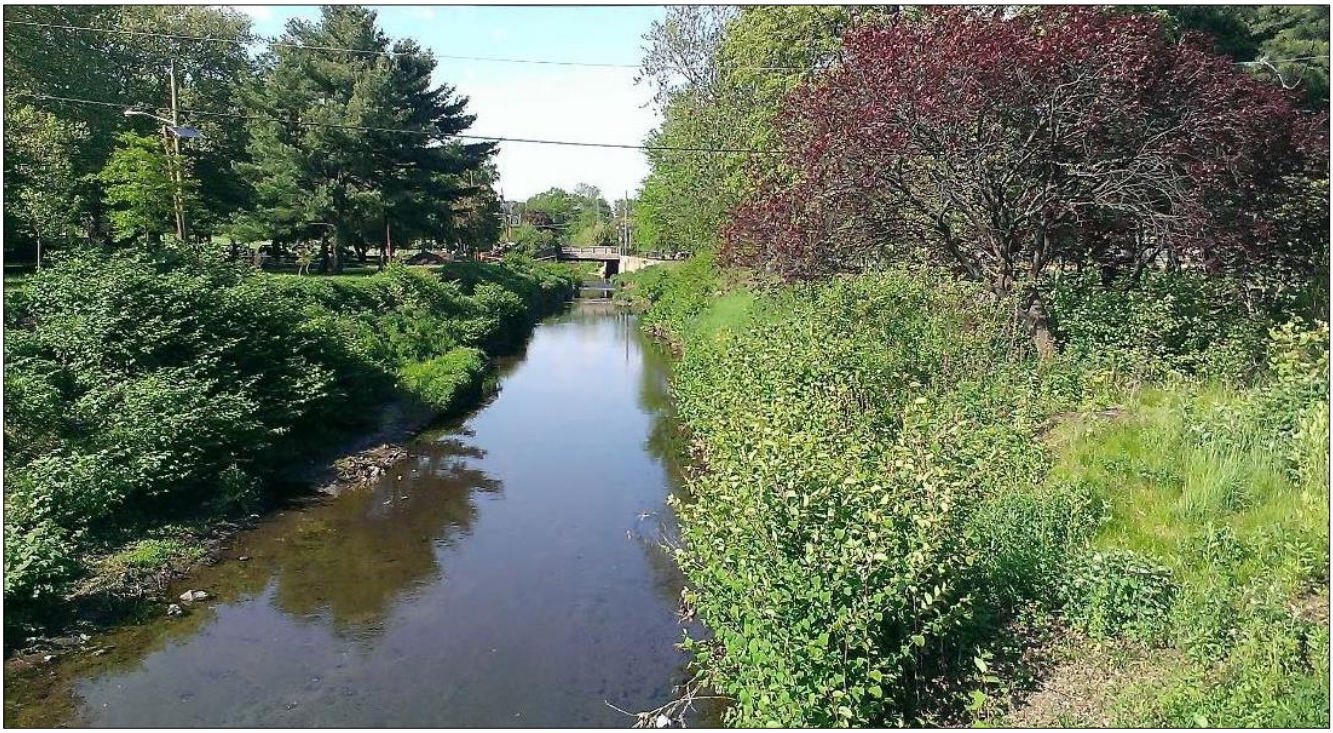

Figure 40. An example of a sloped grassed bank or trapezoidal channel.

Detention Basins: Detention basins may be used to reduce the peak flood flows by temporarily storing (detaining) floodwater, then releasing it at a substantially reduced flow to reduce peak flood flows. This reduces peak water surface elevations and helps to minimize flood damages downstream.

Road Elevation: Roads could be elevated to heights that would minimize or eliminate the impacts of flooding. Road raisings are often combined with other structural flood risk management measures.

Ringwalls: Ringwalls are intended to reduce the frequency of flooding to one or a group of structures on a small-scale basis. They can be temporary (deployable) or permanent.

Clearing & Snagging: Clearing and snagging includes the removal of vegetation along the bank (clearing) and/or selective removal of snags, drifts, or other obstructions (snagging) from natural or improved channels and streams.

Pumps: Pumps would remove water from the project area. Water would likely be pumped into the Peckman or Passaic Rivers. They would be complementary to other project features.

Ponding Areas: Ponding areas may be used to control water levels in a water body or diversion culvert. They are typically built by deepening an existing area of a waterbody.

3.6.3 Natural and Nature-Based Features

Natural and nature-based features (NNBFs) are habitats or features such as marsh, oyster reefs, and submerged aquatic vegetation that may reduce flood risk while providing ecosystem benefits.

3.7 Plan Formulation Strategy

The general plan formulation strategy is to maximize NED benefits while considering technical feasibility, environmental impacts, economic implications, social consequences, and technical criteria. This included an evaluation of the four P&G accounts of NED, regional economic development (RED), other social effects (OSE), and environmental quality (EQ), as fully described in Section 3.10.

Economic Implications (P&G Accounts NED and RED): Construction costs were estimated for each alternative. These costs were developed for screening purposes only and did not reflect detailed designs and environmental assessments accomplished later for the more developed alternatives. Economic benefits of the alternatives were developed for the with- and without-project conditions. This information was used to compare alternatives.

Social Consequences (P&G Account OSE): The public may experience negative impacts of property acquisitions, environmental impacts, visual aesthetics (floodwalls or levees), and inconvenience due to construction. Over the long term, the minimization of flooding or flood damage will greatly improve quality of life.

Environmental Impacts (P&G Account EQ): Impacts to the environment were evaluated for each alternative. Field data and literature were used to assess existing conditions and potential impacts.

Technical Feasibility: Consideration was given to all feasible nonstructural and structural measures. Sound engineering judgment was utilized in selecting the components for each alternative. Existing topography, wetlands, structures, roadways, and drainage patterns were some of the local features that had to be accommodated in the design process.

Technical Criteria: Alternative plans were developed to manage the risk from storm inundation. Detailed analysis of the alignment features could indicate that variations or uncertainty in some design conditions, such as overtopping, could present a risk of damage below the top elevation of the risk management structures. These uncertainties could combine to reduce the estimated economic benefits.

3.8 Screening & Combination of Measures

3.8.1 Screening of Measures

Management measures were retained for further consideration based on their ability to meet the following measures screening criteria:

1. Does the measure meet the planning objectives?
2. Does the measure avoid the planning constraint?

Measures eliminated from further consideration are shaded in Table 6**.**

Table 6. Screening of management measures.

Measure	Does the measure…			
	Objective 1: Manage the risk of flood damages	Objective 2: Manage the risk to life safety	Objective 3: Support community resilience and cohesion	Constraint: Avoid impacts to critical infrastructure
Elevating Structures	Yes	Yes	Yes	Yes
Floodproofing	Yes	No	Yes	Yes
Acquisition	Yes	Yes	No	Yes
Flood Warning System	Yes	Yes	Yes	Yes
Floodplain Management	Yes	Yes	Yes	Yes
Diversion Culverts	Yes	Yes	Yes	Likely
Floodwalls	Yes	Yes	Yes	Likely
Levees	Yes	Yes	Yes	Likely
Channel Modification	Yes	Yes	Yes	No
Detention Basins	Yes	Yes	Yes	Likely
Road Elevation	Yes	Yes	Yes	No
Ringwalls	Yes	Yes	Yes	Likely
Clearing & Snagging	No	No	No	Yes
Pumps*	Yes	Yes	Yes	Yes
Ponding Areas*	Yes	Yes	Yes	Likely
Natural and Nature-Based Features*	No	No	No	Likely

* May meet planning objectives and/or avoid the planning constraint in combination with other measures.

Elevating (Raising) Structures: Elevating structures would permanently remove them from flood hazards. It is assumed that homeowners and business owners would support the elevation of their structures. It is acknowledged that elevating structures would not reduce the problems of street flooding, automobile damage, lost income, and adverse effects on homes and businesses that are not elevated. The measure was included for further consideration.

Floodproofing: Floodproofing structures would permanently alter the design of structures. Dry floodproofing involves the sealing of building walls with waterproof compounds, so that the structure is watertight. Shields may be installed to seal off doors, windows, and other openings. Wet floodproofing includes techniques that can reduce flood damage to a building and its contents, while allowing it to flood. This includes actions such as installing flood vents, relocating contents to higher parts of the building, using flood-damage resistant building materials, and installing automatic shut-off valves on sewer and fuel lines. It is assumed that business owners would support this type of action, which would be limited to non-residential structures. It is acknowledged that floodproofing structures would not reduce the problems of street flooding, automobile damage, lost income, and adverse effects on homes and businesses that are not floodproofed. The measure was included for further consideration.

Acquisition (Buy-Outs): Acquisition of flood-prone properties may reduce flood risk throughout by permanently removing structures and residents' from the basin. This would possibly create additional open space that may be used for recreation. However, communities would be dispersed to other areas. It is assumed that acquisition and relocation of a significant portion of floodplain properties would be prohibitively expensive, and that public acceptability of a mandatory plan is unlikely. The measure was included for further consideration.

Flood Warning System: A flood warning system could allow residents to evacuate low-lying areas in advance of flood. The USGS is currently installing water level gages within the Peckman River, as part of a flood warning system. Two gages were installed in Little Falls in May 2017, with a third planned for installation. The flood warning system will provide information about water levels that can inform local leaders and residents about potential flooding in the project area. Because the USFS gages will provide a flood warning system for the community, the measure was dropped from further consideration.

Floodplain Development Zoning Changes/Enforcement: Floodplain management could help promote smart development of the floodplain. Zoning is a local issue and is not within the jurisdiction of the Federal government. However, any Federal project will have a floodplain management plan component that includes requirements on the use of flood prone lands. The measure was included for further consideration.

Diversion Culverts: Culverts could increase the conveyance capacity of the Peckman River and/or its tributaries. It can reduce flood risk by reduce water surface elevations and flood damages throughout the section of basin downstream of Route 46. It was acknowledged that costs for construction, road work, transportation disruption, utility relocation, and acquisition of real estate interests would be significant. Additionally, there is also a potential for impacts to occur to unrecorded cultural and historic resources during the construction period of a diversion culvert. The measure was included for further consideration.

Levees: Like floodwalls and ringwalls, levees may reduce flood risk throughout the basin by providing flood risk management to areas traditionally sustaining flood damages from flash flooding. However, their construction may include for the destruction of wetlands and impacts to jurisdictional waters; this may result in high environmental mitigation costs. In addition, costs for acquisition of real estate interests may be relatively high. The measure was included for further consideration.

Floodwalls: Like levees and ringwalls, floodwalls may reduce flood risk throughout the basin by providing flood risk management to areas traditionally sustaining flood damages from flash flooding. Because of their typically smaller footprint, they may result in less impacts to environmental resources and real estate costs relative to levees. The measure was included for further consideration.

Channel Modification: Channel modification may increase the conveyance capacity of the Peckman River and/or its tributaries. It could reduce channel blockages resulting from high sediment loads and bank material transported during flood events. This in turn would reduce the risk of flood damages by reducing water surface elevations and flood damages throughout the basin. Channel modification may result in destruction of wetlands and impacts to jurisdictional waters. This could result in high environmental mitigation costs. In addition, the costs for acquisition of real estate interests may be relatively high. The measures was included for further consideration.

Detention Basins: Basin may reduce flood risk by reducing water surface elevations and flood damages by temporarily detaining waters upstream of areas traditionally sustaining flood damages. Areas must have the potential to store enough water temporarily to sufficiently reduce water surface elevations and flood damages downstream. Because the basin is highly developed, no such sufficiently large area could be identified. The measure was dropped from further consideration.

Road Elevation: Elevating roads would significantly impact existing infrastructure and thus was dropped for consideration as a stand-alone feature. However, this measure could provide an efficient tie-in location for a structural alignment and to allow unimpeded traffic flow. It has been considered for further consideration as part of a plan with levees and floodwalls.

Ringwalls: Like levees and floodwalls, ringwalls may reduce flood risk throughout the basin by providing flood risk management to areas traditionally sustaining flood damages from flash flooding. Because of their typically smaller footprint, they may result in less impacts to environmental resources and real estate costs less than levees. The measure was included for further consideration.

Clearing & Snagging: Clearing and snagging of the Peckman River and its tributaries could reduce flood risks throughout the basin by increasing the waterbodies' carrying capacity. Minor snagging and clearing would not have a measurable flood management benefits, and thus would not meet Planning Objective #1. The measure was dropped from further consideration.

Pumps: Pumps alone were dropped for consideration as a stand-alone feature because they would not effectively manage flood risk on their own. However, pumps could allow for the efficient drainage of areas behind levees, floodwalls, and other structural measures and were thus considered for further consideration as part of a plan with levees and floodwalls.

Ponding Areas: Ponding areas would function generally in the same way as detention basin as a stand-alone feature, and thus was dropped for consideration on their own. However, they could improve the function and efficiency of a diversion culvert, and were thus considered for further consideration as part of a plan with culverts.

Natural and Nature-Based Features (NNBFs): Due to the relatively limited flood risk management benefits they would provide and the limited space to construct them, NNBFs were dropped for consideration on their own. However, they could improve the function and efficiency of other measures, and were thus considered for further alternative development as part of the alternatives as practicable.

3.8.2 Combination of Measures: Plan Formulation

Measures that warranted continued consideration were assembled into alternative plans. An alternative plan (also known as, "plan" or "alternative") is a set of one or more management measures functioning together to address one or more planning objectives. The remaining management measures were used individually or combined with others to form alternative plans. The following important points informed the scope and location of the alternatives:

- As described in Section 1.4, the scope of the study and thus the alternatives is limited to addressing flash flooding caused by the Peckman River and its tributaries. They do not include features that reduce backwater or overbank flooding from the Passaic River.
- As described in Section 1.6, flood damages in the basin are concentrated in the communities of Little Falls and Woodland Park. It was determined during initial plan formulation, as documented in the January 2002 Reconnaissance Report, that Federal investment in a flood risk management project would not be economically justified in the upstream municipalities of West Orange, Verona, and Cedar Grove.

Route 46 was identified as a logical dividing point in the formulation of structural alternatives. Differences in flooding mechanisms north and south of this point allowed for the development of separate scales of "upstream" and "downstream" (from Route 46) alternatives for comparison. Woodland Park, which is downstream/north of Route 46, experiences backwater flooding from the Passaic River; Little Falls, which is upstream/south, does not experience backwater flooding. In addition, the Peckman River's relatively close proximity (approximately 1,500 feet) to the Passaic River at Route 46 make it a logical geographic location for a diversion culvert. It was acknowledged that a diversion culvert would provide flood risk management benefits only downstream of Route 46. Other, additional measures would be needed to provide risk management to upstream communities for plans that include the diversion culvert.

3.9 Alternative Plans

The following alternatives were developed for initial plan formulation from the remaining management measures identified in Section 3.8.1 to meet planning objectives and avoid the planning constraint while reasonably maximizing NED benefits. These plans do not include the alternatives considered during feasibility-level design; see Section 3.13 for information about these plans. With the exception of the No Action alternative, they are made up of combinations of measures described in Section 3.8.1. For the purpose of comparing the performance of alternatives, the structural components of alternatives were evaluated at two percent flood event. In addition, the nonstructural components of alternatives were assumed to provide a level of performance at the one percent flood event.

- Alternative 1: No Action
- Alternative 2: Nonstructural Plan
- Alternative 3: Peckman River Diversion Culvert
- Alternative 4: Channel Modifications Upstream and Downstream of Route 46
- Alternative 5: Levee/Floodwall System Upstream and Downstream of Route 46
- Alternative 6: Levee/Floodwall System Downstream of Route 46
- Alternative 7: Channel Modifications Downstream of Route 46
- Alternative 8: Channel Modifications Upstream of Route 46 with Peckman River Diversion Culvert
- Alternative 9: Levee/Floodwall System Upstream of Route 46 with Peckman River Diversion Culvert (formerly the LPP)
- Alternative 10a: Nonstructural Measures (two percent floodplain) Upstream of Route 46 with Peckman River Diversion Culvert
- Alternative 10b: Nonstructural Measures (ten percent floodplain) Upstream of Route 46 with Peckman River Diversion Culvert

Varying levels of performance (design levels) of each alternative were considered. For example, different dimensions of the proposed Peckman River Diversion Culvert that would provide capacity for the ten percent, two percent, and one percent floods were considered during plan formulation and comparison. For brevity, the descriptions presented in this section do not fully describe the different scales of each alternative. This detail, as well as figures showing the locations and geographic extent of the alternatives are included in Appendix C-2.

Alternative 1: No Action. This alternative assumes no Federal action, and is the basis for comparison of the alternative plans. It serves to establish the likely existing and future without-project conditions, and reflects the continuation of existing economic, social, and environmental conditions and trends within the project area. Additionally, the No Action alternative acts as a baseline to which all other alternatives are compared, and is a requirement of the NEPA process. The No Action alternative reflects an absence of Federal action to manage flood risk in the Peckman River Basin due to flash flooding of the river and its tributaries.

Alternative 2: Nonstructural Plan. USACE policy requires the identification of an alternative plan consisting of only nonstructural measures. Differing iterations of nonstructural plans that include combination of the nonstructural measures described in Section 3.6.1 were investigated during initial plan formulation. As part of this initial analysis, structures were logically aggregated by their main floor elevations at heights corresponding to the water surface elevation of different flood events. The groupings used include: structures with a main floor elevation less than or equal to the 0.2, 0.4, one, two, four, and ten, 20, and 50 percent still water surface elevations.

All eight plan iterations included nonstructural measures designed to mitigate inundation up to and including the one percent flood event. The USACE National Nonstructural Committee Nonstructural Flood Risk Management Matrix flowchart was utilized to identify appropriate treatment techniques for each structure. The matrix tool has been used for other USACE feasibility studies with nonstructural

components, most recently for the Shrewsbury River Basin, Sea Bright, New Jersey, and Raritan Bay and Sandy Hook Bay, Leonardo, New Jersey coastal storm risk management feasibility studies. The tool evaluates the most appropriate nonstructural measure for each structure based on the structure's attributes (i.e., square footage, foundation type, number of stories, building materials). The tool identified structure elevations, wet floodproofing, dry floodproofing, ringwalls, and structure acquisitions (buy-outs) as the most appropriate treatments in the study area.

The target elevation for the first floor of all structures to be elevated will be at a height of one foot above the USACE-modeled one percent flood water surface elevation. USACE determined that the "plus one foot" height accurately reflects uncertainly of wave effects on water surface elevations in the study area. The BFE varies in the project area from +130 feet to +190 feet NAVD88, with the lowest BFEs located at the confluence of the Peckman and Passaic Rivers. Construction of structure elevations, wet floodproofing, dry floodproofing, and ringwalls measures would be implemented on a voluntary basis. That is, property owners would choose to participate in the nonstructural portion of the plan. As described in Section 3.5, an at- or near-100 percent participation rate is likely and thus was assumed for the purposes of initial plan formulation. Based on a preliminary economic analysis of costs and benefits of each of the eight plan iterations, an alternative plan including structures at or below the ten percent still water surface elevation was chosen as Alternative 2. Nonstructural measures were included in other alternatives, as described in this chapter.

Alternative 3: Peckman River Diversion Culvert. A 1,500-foot long, 35-foot wide diversion culvert would be constructed between the Peckman and Passaic Rivers (Figure 41). Its length would run from 550 feet upstream of the Route 46 bridge, northwest to the Passaic River. It would divert floodwaters from the Peckman River to the Passaic River during and after storms. The diversion culvert inlet at the Peckman River would consist of an in-line weir approximately 10 feet high and 130 feet long that would help divert the flow from the Peckman River into the culvert discharging it into the Passaic River. The diversion culvert would significantly reduce downstream peak discharges (i.e., flash flooding), and subsequently, downstream flood elevations and flood damages. The diversion would not reduce flood damages due to Passaic River backwater flooding the lower reaches of the Peckman River basin in Woodland Park. Due to the high velocities along the river and unstable banks, streambank erosion measures would be necessary. Streambank erosion measures include riprap and articulated concrete blocks. Approximately 1,000 feet of channel modifications in the Peckman River near the diversion culvert opening would be made. Approximately 2,500 linear feet of levees and/or floodwalls downstream of the ponding weir to the Route 46 bridge would be built. The levees and/or floodwalls would range in height from 3 to 6 feet above ground elevation. The top elevation of these features would be +139 feet NAVD88 near Route 46, and +150 feet NAVD88 near Browertown Road. Additionally, approximately 3,000 linear feet of levees and/or floodwalls would be built in the lower reach of Great Notch Brook to its confluence with the Peckman River.

Alternative 4: Channel Modifications Upstream and Downstream of Route 46. The Peckman River would be widened and dredged along its entire length in the project area (Figure 42). The sidewalls of the channel would be reinforced with concrete retaining walls and/or riprap. A 60-foot (base) concrete channel with concrete sidewalls would effectively convey flood discharge downstream to the confluence of the Passaic River. The channel modification would require approximately 15,000 feet of retaining walls along the lower reach of the Peckman River. This work may necessitate reconstruction of the Route 46, Lakawanna Avenue, and McBride Avenue bridges. Additionally, approximately 3,000 feet of levees and/or floodwalls would be built in the lower reach of Great Notch Brook to its confluence with the Peckman River. The levees and/or floodwalls would range in height between 5 and 10 feet above ground elevation. The top elevation of these features would be +139 feet NAVD88 near Route 46, and +150 feet NAVD88 near Browertown Road. Pump stations would be needed to ensure sufficient interior drainage of areas behind levees and/or floodwalls.

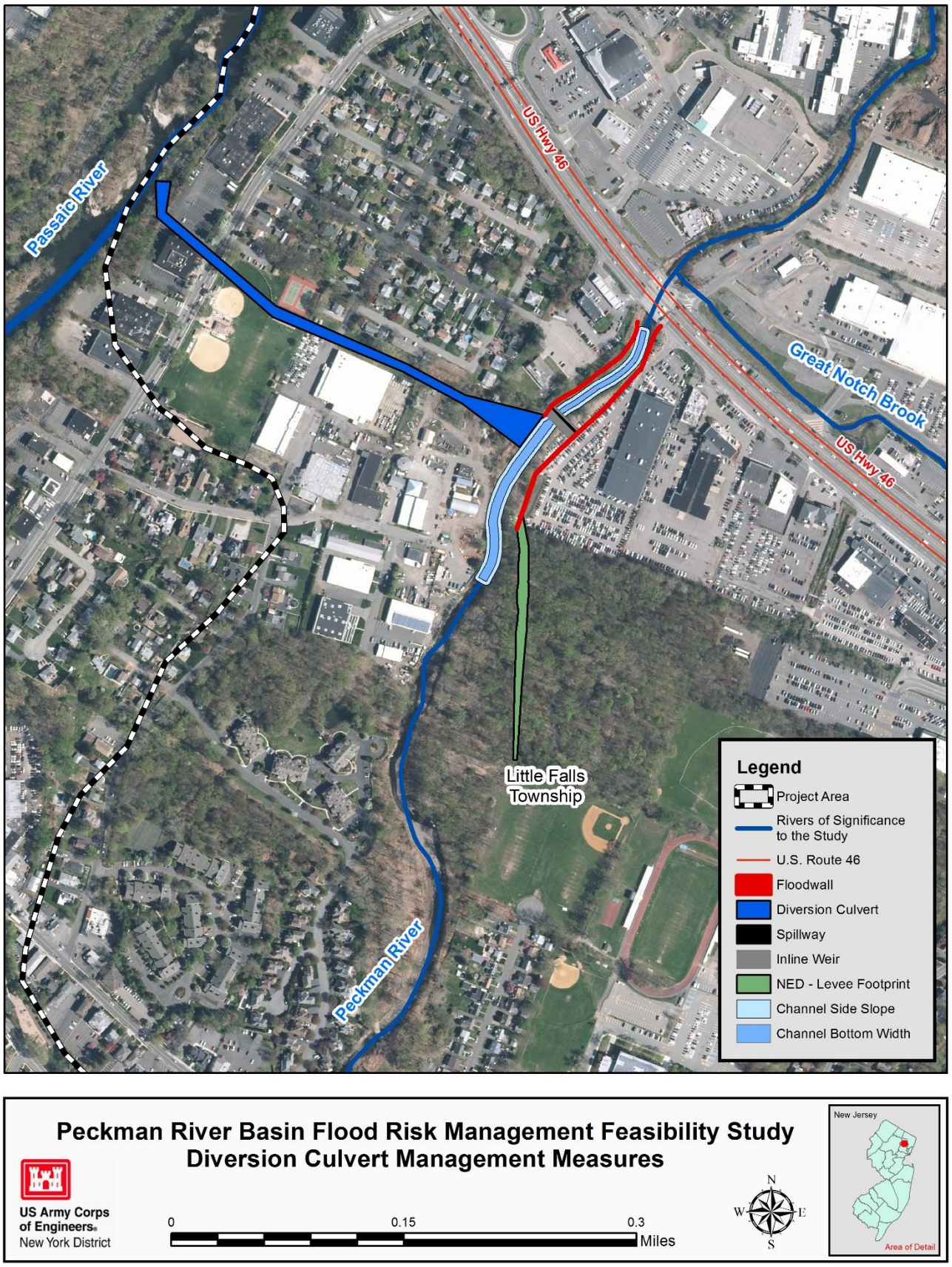

Figure 41. Features associated with the proposed diversion culvert.

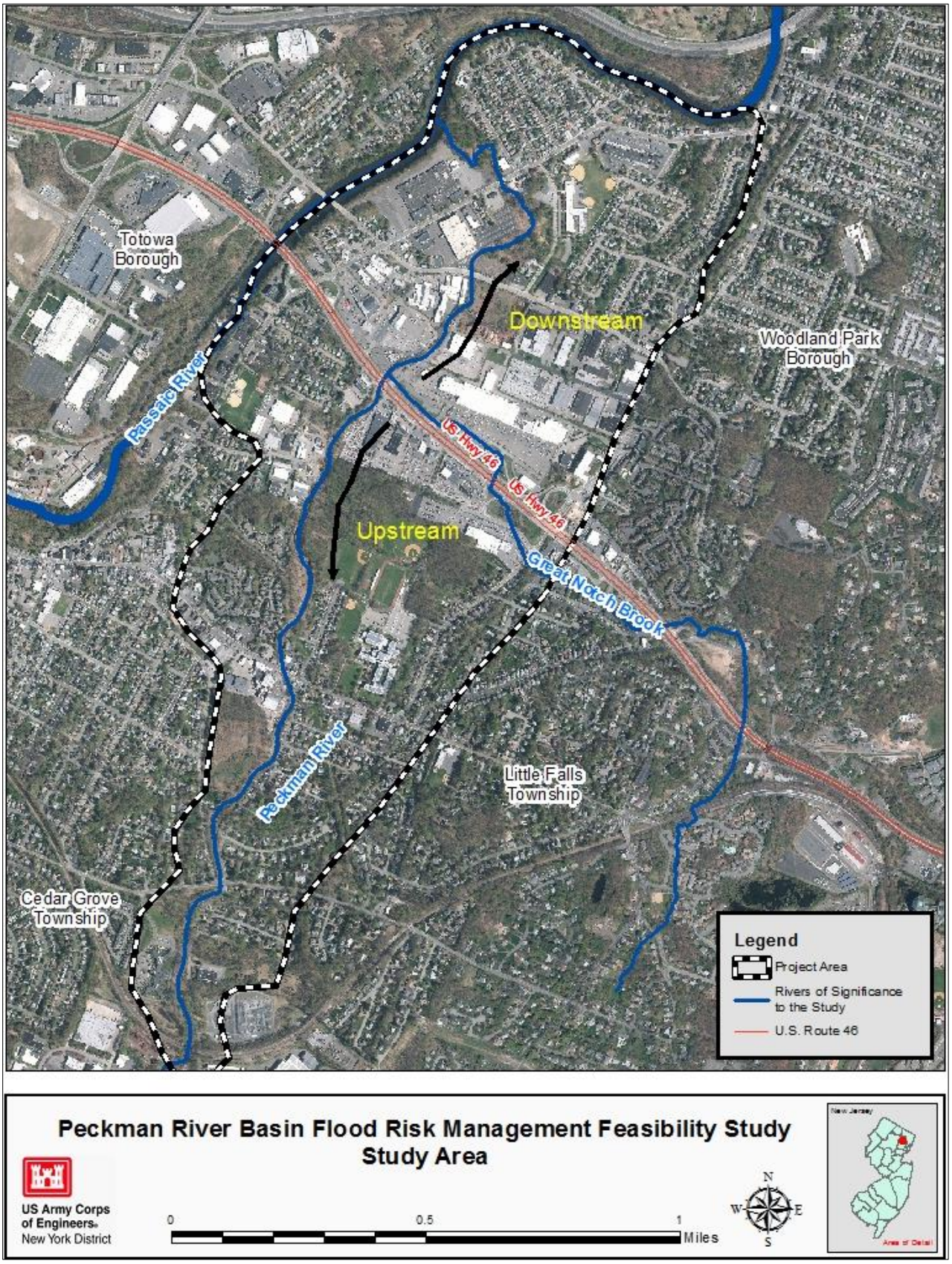

Figure 42. Upstream and downstream reaches of the Peckman River from the Route 46 bridge.

Alternative 5: Levee/Floodwall System Upstream and Downstream of Route 46. Approximately 12,000 feet of levees and/or floodwalls would be built on the Peckman River from the confluence of the Passaic River extending upstream for its entire length in the project area. It is assumed that adequate space is not available on most of the length of the river to construct levees without changing current land uses; floodwalls may be more appropriate for areas with limited space. The average height of the levees and/or floodwalls would be eight feet above ground elevation. Four automobile bridges along the Peckman River would need to be replaced during to this work. This work may also necessitate road closure gates and/or raisings at the Lakawanna Avenue and McBride Avenue bridges.

Additionally, approximately 3,000 feet of levees and/or floodwalls would be built in the lower reach of Great Notch Brook to its confluence with the Peckman River. The levees and/or floodwalls would range in height between five and ten feet above ground elevation. The top elevation of these features would be +139 feet NAVD88 near Route 46, and +150 feet NAVD88 near Browertown Road. Pump stations would be needed to ensure sufficient interior drainage of areas behind levees and/or floodwalls.

Alternative 6: Levee/Floodwall System Downstream of Route 46. Approximately 12,000 feet of levees and/or floodwalls would be built on the Peckman River from the confluence of the Passaic River extending upstream to the Route 46 bridge. The average height of the levees and/or floodwalls would be eight feet above ground elevation. This work may necessitate reconstruction of the Lakawanna Avenue and McBride Avenue bridges.

Additionally, approximately 3,000 feet of levees and/or floodwalls would be built in the lower reach of Great Notch Brook to its confluence with the Peckman River. The levees and/or floodwalls would range in height between five and 10 feet above ground elevation. The top elevation of these features would be +139 feet NAVD88 near Route 46, and +150 feet NAVD88 near Browertown Road. Pump stations would be needed to ensure sufficient interior drainage of areas behind levees and/or floodwalls.

Alternative 7: Channel Modifications Downstream of Route 46. The Peckman River would be widened and dredged from the confluence of the Passaic River extending upstream to the Route 46 bridge. The amount of channel excavation is approximately 80 percent less than that for Alternative 4. The channel modification would require approximately 12,000 feet of retaining walls along the upper reach of the Peckman River. This work may necessitate reconstruction of the Lakawanna Avenue and McBride Avenue bridges.

Alternative 8: Channel Modifications Upstream of Route 46 with Peckman River Diversion Culvert. The features described in Alternative 3 and Alternative 7 would be combined into this plan, excluding the channel improvement features along the Peckman River.

Alternative 9: Levee/Floodwall System Upstream of Route 46 with Peckman River Diversion Culvert (formerly the LPP). The features described in Alternative 3 would be built, in addition to approximately 9,000 feet of levees and/or floodwalls on the Peckman River from the Route 46 bridge extending upstream for the extent of the project area. The average height of the levees and/or floodwalls would be 8 feet above ground elevation. Due to the high velocities along the river and unstable banks, streambank erosion measures would be necessary. Streambank erosion measures include riprap and articulated concrete blocks.

Additionally, approximately 3,000 feet of levees and/or floodwalls would be built in the lower reach of Great Notch Brook to its confluence with the Peckman River. The levees and/or floodwalls would range in height between five and 10 feet above ground elevation. The top elevation of these features would be +139 feet NAVD88 near Route 46, and +150 feet NAVD88 near Browertown Road. Pump stations would be needed to ensure sufficient interior drainage of areas behind levees and/or floodwalls.

Approximately six structures near the bank of the Peckman River would require buyouts to accommodate the levees and/or floodwalls. Due to the high velocities along the Peckman River and unstable banks, streambank erosion mitigation measures would be necessary along the sections of the river. Channel modification is expected in some areas to accommodate riprap and articulated concrete blocks. Large diameter riprap and articulate concrete block are required to eliminate the erosion and possible undermining of the proposed levee and/or floodwall. Lastly, the alternative includes two bridge replacements, Main Avenue East and Lindsley Road, and an automatic hydraulic gate structure at E. Main Street. The gate would close to traffic during extraordinary storm events.

On November 24, 2014 (after the Alternatives Milestone), NJDEP (the non-Federal sponsor) requested that USACE examine Alternative 9 at the one percent flood level of performance, as the LPP. NJDEP favored this alternative because they were interested in providing risk management benefits at this level of performance. Additionally, the LPP offered a greater level of risk management, and provided benefits to a greater number of structures within Little Falls as opposed to the NED plan. Upon conducting this analysis, USACE found that the cost of the project increased from $139,000,000 to $233,000,000 to build to the one percent storm. At this point, the study team determined that this plan had too high of a cost to pursue, based on a comparison of costs and benefits of other alternatives. After this, the NED plan again became the Tentatively Selected Plan.

Alternative 10a: Nonstructural Measures (two percent floodplain) Upstream of Route 46 with Peckman River Diversion Culvert. The features described in Alternative 3 would be built, in addition to the construction of ringwalls that would encircle 51 structures (three residential, 48 non-residential), and implementation of nonstructural measures to structures within the two percent floodplain. A description of the formulation and selection of these nonstructural techniques is summarized in sub-paragraph “Alternative 2.” Table 7 summarizes the nonstructural components of the alternative.

Table 7. Nonstructural components of Alternative 10a.

Treatment	Residential	Non-residential	Subtotal
Elevation	71	0	71
Wet Floodproofing	27	2	29
Dry Floodproofing	17	12	29
Total	**115**	**14**	**129**

Ringwalls were individually considered in a last-added analysis. Considering current land uses and the nature of flooding, permanent barriers (vs. temporary barriers) are the most appropriate for the project area. Fifty one ringwalls are included in the plan.

Alternative 10b: Nonstructural Measures (ten percent floodplain) Upstream of Route 46 with Peckman River Diversion Culvert. The features described in Alternative 3 would be built, in addition to the construction of ringwalls that would encircle 47 structures (0 residential, 47 non-residential), and implementation of nonstructural measures to structures within the ten percent floodplain. A description of the formulation and selection of these nonstructural techniques is summarized in sub-paragraph “Alternative 2.” Table 8 summarizes the nonstructural components of the alternative.

Table 8. Nonstructural components of Alternative 10b.

Treatment	Residential	Non-residential	Subtotal
Elevation	64	0	64
Wet Floodproofing	3	1	4
Dry Floodproofing	1	2	3
Total	**68**	**3**	**71**

3.10 Plan Evaluation

The alternatives were evaluated and compared based on their economic performance; ability to meet planning objectives and avoid the planning constraint; consideration of the four P&G criteria; and consideration of the four P&G accounts.

3.10.1 Evaluation of Economic Performance

An estimate of Average Annual Costs (AAC) were considered against the Average Annual Benefits (AAB) for the alternatives (Table 9). This allowed for an evaluation of alternatives. The annual costs include interest during construction, which is the interest that accumulates on the construction expenditures until the project is completed and producing benefits.

Table 9. Economic performance of the initial array of alternatives (FY18[1] P.L.).

	First Cost	Average Annual Cost	Average Annual Benefit	Net Benefits	BCR
Alternative 1	N/A	N/A	N/A	N/A	N/A
Alternative 2	$200,928,000	$8,100,000	$17,403,000	$9,303,000	2.1
Alternative 3	$97,609,000	$4,100,000	$16,029,000	$11,929,000	3.9
Alternative 4	$274,231,000	$12,000,000	$16,776,000	$4,776,000	1.4
Alternative 5	$214,372,000	$9,300,000	$17,836,000	$8,536,000	1.9
Alternative 6	$145,499,000	$7,300,000	$6,789,000	($511,000)	0.93
Alternative 7	$106,540,000	$4,500,000	$14,477,000	$9,977,000	3.2
Alternative 8	$213,231,000	$9,400,000	$20,330,000	$10,930,000	2.2
Alternative 9	$267,448,000	$11,148,000	$19,324,000	$8,176,000	1.7
Alternative 10a	$206,812,000	$8,400,000	$20,148,000	$11,748,000	2.4
Alternative 10b	$154,394,000	$6,507,000	$19,363,000	$12,856,000	3.0

BCR: benefit-to-cost ratio / Average annual costs include interest during construction / Interest rate of 2.75 percent from 2027 through 2076 / Discount rate of 2.75 percent from 2027 through 2076

All plans but Alternative 6 provide positive net economic benefits – that is, the economic benefits outweigh the project costs. Of the remaining nine alternatives, some provide two to three times more net economic benefits than others. A relatively ranking of the alternatives by net benefits provided by each plan is shown in Table 10.

Table 10. Relative ranking of net benefits provided by the alternatives.

	Net Benefits	BCR
Alternative 1	N/A	N/A
Alternative 6	($511,000)	0.93
Alternative 4	$4,776,000	1.4
Alternative 9	$8,176,000	1.7
Alternative 5	$8,536,000	1.9
Alternative 2	$9,303,000	2.1
Alternative 7	$9,977,000	3.2
Alternative 8	$10,930,000	2.2
Alternative 10a	$11,748,000	2.4
Alternative 3	$11,929,000	3.9
Alternative 10b	$12,856,000	3.0

[1] Costs and benefits developed as part of initial plan formulation, evaluation, and comparison are included for historical reference; they do not reflect current price levels because they were calculated in previous fiscal years. They are noted with the price level that reflects previous fiscal years as appropriate.

Alternative 10b provides the greatest net economic benefits ($12,856,000) of any plan. Differentiation of benefits provided by the alternatives was considered during plan selection.

3.10.2 Evaluation of Contributions to Planning Objectives & Constraints

Alternatives were judged upon whether or not they make significant contributions to the planning objectives and sufficiently avoid planning the constraint; some do so more efficiently than others. A relative comparison of alternatives was undertaken, and ranked using a "low" (red), "medium" (yellow), "high" (green) system. The three study objectives were used to judge the alternatives: 1) to reduce the risk of flood damages, 2) to reduce the risk to life safety, and 3) to support community resiliency and cohesion. Alternatives that did not meet these objectives were marked as "low" (red) in Table 11, while those that partially met the objectives were marked as "medium" (yellow). Those that were fully successful at meeting the objectives were marked as "high" (green).

The study constraint that was used to judge the alternatives was “to avoid impacts to critical infrastructure.” Those alternatives that posed large problems with the constraint were marked as “high” (red), while those that posed small problems with the constraint were marked as “medium” (yellow). Those that fully avoided the constraint was marked as “Low” (green). Note that transportation infrastructure is grouped with critical infrastructure for the purpose of this evaluation.

Table 11. Consideration of planning objectives and constraints.

	Does the plan…			
	Objective 1: Reduce the risk of flood damages	**Objective 2: Reduce the risk to life safety**	**Objective 3: Support community resilience and cohesion**	**Constraint: Avoid impacts to critical infrastructure**
Alternative 1	Low	Low	Low	High
Alternative 2	Medium	Low	Medium	High
Alternative 3	High	Medium	Medium	Medium
Alternative 4	Low	Medium	Medium	High
Alternative 5	Medium	High	Medium	Low
Alternative 6	Low	Low	Low	Low
Alternative 7	Medium	Low	Low	High
Alternative 8	High	High	High	Medium
Alternative 9	Low	High	High	Low
Alternative 10a	High	High	High	Medium
Alternative 10b	High	High	High	Medium

The plans that include the Peckman River Diversion Culvert - Alternative 3, Alternative 8, Alternative 9, Alternative 10a, and Alternative 10b - generally provide more contributions to the planning objectives than other alternatives. Alternative 5, Alternative 6, and Alternative 9 avoid the planning constraint better than other alternatives.

3.10.3 Evaluation of Contributions to the P&G Criteria

The 1983 P&G requires that alternative plans are formulated and compared in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability.

Completeness is the is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planned efforts, including actions by other Federal and non-Federal entities. Project performance of the alternative plans is not dependent upon the completion or function of a project by another government agency or private investment. However, project performance may be affected by large amounts of debris and vegetation that may be present within the river channel, as was witnessed during the August 2018 flood event. Clearing and snagging is

the responsibility of local municipalities.

It was acknowledged that nonstructural measures on their own may provide only a small "piece of the puzzle" for risk management in the Peckman River Basin. Because of this, consideration and communication of residual risk is a key component of Alternative 2, Alternative 10a, and Alternative 10b, the plans with nonstructural components.

Effectiveness is the extent to which the alternative plans alleviate the specified problems and achieves the opportunities. The alternatives all achieve the study opportunities to:

- Manage flood risks from associated fluvial flood events that impact communities, infrastructure, and the economy
- Support the resiliency of the Peckman River Basin's communities, infrastructure, and the economic consequences to the region and to the nation economy
- Communicate existing and potential future flood risks to local planners and public officials

Alternatives were judged upon whether or not they make significant contributions to these opportunities; some do so more efficiently than others. In general, Alternative 1 and Alternative 2 would provide risk reduction to a much smaller geographic area than other alternatives. Alternatives that include limited spans of structural measures are less effective at providing risk management as compared to alternatives that include larger spans of structural measures, or combinations of measures.

It is assumed that alternatives that would require little or no change in community services, pathways, and land use would have minimal negative impacts on community cohesion and resilience. It is assumed that alternatives that include levees and/or floodwalls along the Peckman River would have greater impact on the landscape, environment, and land use than other alternatives.

All alternatives are equally effective at providing information for local planners; this study and report meet this opportunity.

Efficiency is the extent to which an alternative plan is the most cost effective means of achieving the objectives. Efficiency was measured through a comparison of benefit-to-cost ratios, reduced damages, and benefits from the project, as described in Section 3.10.1. This comparison showed that of the alternatives, all plans but Alternative 6 provide positive net benefits and thus were deemed economically efficient. The relative ranking of the alternatives by net benefits provided by each plan (Table 10) was used to determine which plans were more efficient than others in providing economic benefits to communities.

Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. The alternatives were formulated in accordance with applicable laws, regulations, and policies. The alternative plans are equal in that there are no known issues with laws, regulations, and policies that would preclude their implementation. Any proposed plan would require complete environmental compliance and coordination with resource agencies prior to construction. The alternatives were formulated in accordance with applicable laws and regulations. Therefore, they are equally acceptable.

Table 12 shows a summary of to what degree each alternative meets the P&G criteria on a subjective scale of Low-Medium-High.

Table 12. Summary of contribution of alternatives to the P&G criteria.

	Completeness	Effectiveness	Efficiency	Acceptability
Alternative 1	Low	Low	Low	High
Alternative 2	Low	Low	Medium	High
Alternative 3	High	Medium	High	High
Alternative 4	Medium	High	Low	High
Alternative 5	Medium	High	Medium	High
Alternative 6	Medium	Medium	Low	High
Alternative 7	Medium	Medium	Medium	High
Alternative 8	High	Medium	High	High
Alternative 9	High	High	Low	High
Alternative 10a	High	High	High	High
Alternative 10b	High	High	High	High

Alternative 8, Alternative 10a and Alternative 10b contribute highly to at least three of the four P&G criteria. Alternative 1, Alternative 2, Alternative 5, Alternative 6, and Alternative 7, do a poor job of contributing highly to at least two of the four P&G criteria.

3.10.4 Evaluation of Contributions to the P&G Accounts

The 1983 P&G requires that alternative plans are formulated and compared in consideration of four accounts:

- NED (National Economic Development): changes in the economic value of the National output of goods and services. To define which alternatives maximized the NED account, the net benefits of each alternatives (Tables 9 and 10), were ordered from lowest to highest. The four alternatives with the lowest net benefits were assigned a ranking of “low”, the three next lowest alternatives were marked as “medium”, and the four alternatives with the highest net benefits were marked as “high.”
- RED (Regional Economic Development): changes in the distribution of regional economic activity that result from each alternative plan. The economic benefits presented in Table 13 were used to define which alternatives maximized the RED account. The four with the lowest net benefits were marked as “low”, the three next lowest were marked as “medium”, and the four alternatives with the highest net benefits were marked as “high.”
- OSE (Other Social Effects): effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts. The Other Social Effects account includes things like environmental justice, community cohesion, and structural divisions through communities that could impact open communication between residents. Each alternative was marked as low, medium, or high on a case by case basis. Alternative 1 was marked as the only low alternative, because following the no-action alternative, the communities of Little Falls and Woodland Park would continue to flood and endure catastrophic damages. Alternatives 2, 3, 6, 7, 10a, and 10b were marked as “medium” because they address flooding problems primarily in Woodland Park and leave a substantial amount of residual risk in Little Falls. Alternatives 4, 5, 8, and 9 were marked as high because they offer structural solutions to both communities of Woodland Park and Little Falls, leaving very little residual risk of flooding.
- EQ (Environmental Quality): non-monetary beneficial effects on significant natural and cultural resources. The low, medium, high rankings of the alternatives in this account is a summary of the environmental analysis presented in Tables 14 and 15. Any alternatives that had a significant and unavoidable (SU) impact to environmental resources were marked as “low.” Any alternative that has a Less Than Significant with Mitigation (LTSM) was marked as “medium.” Alternative 1 was marked as “medium” because it neither has positive or adverse effects on environmental resources..

The accounts were the basis for the plan formulation strategy, as described in Section 3.7. Table 13 shows a summary of to what degree each alternative meets the P&G accounts on a subjective scale of Low-Medium-High. The levels of low, medium, and high represent the team's subjective, relative ranking of alternatives in how successful they are in each P&G account. Alternatives that did not meet the accounts were marked as "low" (red) in Table 12, while those that partially met the accounts were marked as "medium" (yellow). Those that were fully successful at meeting the accounts were marked as "high" (green).

Table 13. Summary of contribution of alternatives to the P&G accounts.

	NED	RED	OSE	EQ
Alternative 1	Low	Low	Low	Medium
Alternative 2	Medium	Medium	Medium	Medium
Alternative 3	High	High	Medium	Medium
Alternative 4	Low	Low	High	Low
Alternative 5	Medium	Medium	High	Low
Alternative 6	Low	Low	Medium	Medium
Alternative 7	High	High	Medium	Low
Alternative 8	Medium	Medium	High	Low
Alternative 9	Low	Low	High	Low
Alternative 10a	High	High	Medium	Medium
Alternative 10b	High	High	Medium	Medium

Alternative 3, Alternative 4, Alternative 5, Alternative 8, Alternative 9, Alternative 10a, and Alternative 10b contribute highly to at least two of the four P&G accounts. Alternative 1, Alternative 2, and Alternative 7, do not contribute highly to at least one of the four P&G accounts.

3.10.5 Evaluation of Environmental and Socioeconomic Benefits & Impacts

This section builds upon the EQ "non-monetary effects on significant natural and cultural resources" P&G account by further classifying the magnitude of impacts the preliminary alternatives are likely to have on the environmental and socioeconomic resources. Table 14 and Table 15 summarize the environmental impacts of each alternative.

For the purposes of the preliminary screening of the alternatives, the magnitude of impacts are categorized as:

- No Effect (No Effect): no noticeable adverse effect on the environment would occur.

- Less Than Significant (LTS): The impacts of the project do reach or exceed the defined threshold/criteria of significance or the effects are not adverse. No mitigation measures are required for a LTS impact.

  An example of this type of impact is air quality, where construction emissions from flood risk management projects such as have historically been below the de minimis values established for criteria pollutants. For other environmental resources such as water, vegetation, and fish and wildlife, this impact type is assumed when the area being affected by the action has undergone such significant anthropological modifications that the effect of the proposed action would not further decrease the function of the resource to a level where mitigation is necessary.

- Less Than Significant with Mitigation (LTSM): Mitigation measures in the form of avoidance, minimization, reducing the impact over time, and/or compensation are identified to reduce the potentially significant impact to less than significant level.

An example of a LTSM impact is moving a floodwall/levee further out of wetlands to avoid or minimize impacts, or compensating for the impacts through the purchase of wetland mitigation credits or creating, restoring, or enhancing wetlands.

- Significant and Unavoidable (SU): SU is applied to actions that cause substantial permanent adverse changes to any of the physical conditions within the area affected by the proposed action. Although implementation of mitigation measures may reduce the significance of the effects, they will not reduce the impact to a less than significant level. Unavoidable is defined as the impact is necessary in order for the proposed action to achieve its stated goal, in this case flood risk management.

The Water Resource column for Alternative 7, Alternative 8, and Alternative 9 in Table 14 is an example of this type of impact. The channel modifications and levees/floodwalls will significantly permanently change the character and function of the Peckman River, but is necessary to provide flood risk management.

Table 14: Summary of impacts of alternatives to environmental resources.

	Water Resources	Vegetation	Fish and Wildlife	Cultural Resources	Air Quality
Alternative 1	No Effect	No Effect	No Effect	No Effect	No Effect
Alternative 2	No Effect	LTSM	No Effect	LTS	LTS
Alternative 3	LTS	LTSM	LTSM	LTS	LTS
Alternative 4	SU	SU	SU	SU	LTS
Alternative 5	SU	SU	SU	SU	LTS
Alternative 6	LTSM	LTSM	LTSM	LTS	LTS
Alternative 7	SU	SU	SU	LTS	LTS
Alternative 8	SU	SU	SU	SU	LTS
Alternative 9	SU	SU	SU	SU	LTS
Alternative 10a	LTSM	LTSM	LTSM	LTSM	LTS
Alternative 10b	LTSM	LTSM	LTSM	LTSM	LTS

Table 15: Summary of impacts of alternatives to socioeconomic resources.

	Recreation	Aesthetics	Env. Justice	Transportation	Noise
Alternative 1	No Effect	No Effect	No Effect	No Effect	No Effect
Alternative 2	No Effect	LTS	No Effect	LTS	LTSM
Alternative 3	LTS	LTS	No Effect	LTS	LTSM
Alternative 4	LTSM	SU	No Effect	LTS	LTSM
Alternative 5	LTSM	SU	No Effect	LTS	LTSM
Alternative 6	No Effect	LTSM	No Effect	LTS	LTSM
Alternative 7	No Effect	LTS	No Effect	LTS	LTSM
Alternative 8	LTSM	LTSM	No Effect	LTS	LTSM
Alternative 9	LTSM	SU	No Effect	LTS	LTSM
Alternative 10a	LTS	LTS	No Effect	LTS	LTSM
Alternative 10b	LTS	LTS	No Effect	LTS	LTSM

3.11 Plan Comparison

The study team considered how well each alternative performed relative to others as related to economic performance, planning objectives, the planning constraint, the P&G criteria, and the P&G accounts. Table 16 summarizes the relative performance relative to these selection criteria on a subjective scale of Low-Medium-High. Note that those alternatives that avoided constraints very well were rated “high.”

Table 16: Summary of performance of the alternative plans.

	Economic Performance	Meets Planning Objectives	Avoids Planning Constraints	Contributes to P&G Criteria	Contributes to P&G Accounts
Alternative 1	Low	Low	High	Low	Low
Alternative 2	Medium	Low	High	Low	Low
Alternative 3	High	High	Medium	Medium	Medium
Alternative 4	Low	Medium	High	Medium	Medium
Alternative 5	Medium	Medium	Low	Low	Medium
Alternative 6	Low	Low	Low	Low	Low
Alternative 7	Medium	Medium	High	Low	Medium
Alternative 8	High	High	Medium	High	High
Alternative 9	Low	Medium	Low	Medium	Medium
Alternative 10a	High	High	Medium	High	High
Alternative 10b	High	High	Medium	High	High

The alternatives were grouped by flood management strategy for the purposes of plan comparison.

Strategy 1: Plans Focusing on Diverting Floodwaters to the Passaic River

Alternative 3, Alternative 9, Alternative 8, Alternative 10a, and Alternative 10b include the Peckman River Diversion Culvert. These plans generally do a better job of meeting planning objectives and contributing to the P&G criteria than other alternatives. Alternative 3, Alternative 8, Alternative 10a, and Alternative 10b provide greater net economic benefits than all other plans. Because of the Peckman River floodwalls included in Alternative 9, the plan provides relatively little economic net benefits relative to other culvert alternatives.

Strategy 2: Plans Focusing on Channel Modifications in the Peckman River

Alternative 4, Alternative 7, and Alternative 8 include modification of the Peckman River channel. Alternative 8 also includes the Peckman River Diversion Culvert. Alternative 8 provides the most economic net benefits of this group. Alternative 7 provide relatively moderate net economic benefits, while Alternative 4 does a relatively poor job of providing net economic benefits. They generally avoid constraints better than other alternatives, because channel modifications would be limited to within the Peckman River.

Strategy 3: Plans Focusing on Levees and Floodwalls along the Peckman River

Alternative 5, Alternative 6, and Alternative 9 include the construction of levees and floodwalls along the Peckman River The alternatives provide relatively low net economic benefits. Construction of levees and floodwalls would require land use changes that may not be acceptable to the community. The study team determined that this would be a major obstacle during plan implementation.

Strategy 4: Plans Focusing on Nonstructural Strategies

Alternative 2, Alternative 10a, and Alternative 10b are largely or totally composed of nonstructural measures. Alternative 2 provides moderate net economic benefits and avoids the planning constraint satisfactorily. However, they does not contribute as much to the P&G criteria and accounts compared to the other alternatives. The benefits and impacts of Alternative 10a and Alternative 10b are generally from the Peckman River Diversion Culvert, which are discussed previously in this section.

3.12 Plan Selection

The study team considered the costs, benefits, and trade-offs related to each alternative. It was agreed that plans that include the Peckman River Diversion Culvert provide the most economic and social benefits; acceptably avoid significant impact to the environment and communities; and contribute the greatest to the P&G criteria and accounts, as previously presented in this chapter. Because of this, all plans but Alternative 3, Alternative 9, Alternative 10a, and Alternative 10b were screened from consideration.

Of the four alternatives that include a diversion culvert, Alternative 9 was found to be the least acceptable alternative. The plan provides the least amount of net economic benefits. In addition, the plan's extensive levees and floodwalls along the Peckman River, have greater environmental and social impacts than the other plans. Because of this, the plan was screened from consideration.

Finally, Alternative 3, Alternative 10a, and Alternative 10b were compared (Table 17). The first cost of Alternative 3 is significantly less than Alternative 10a and Alternative 10b. Alternative 10a and Alternative 10b have relatively high costs due to the inclusion of nonstructural measures upriver of the Peckman River Diversion Culvert in Little Falls. The three plans provide similar net economic benefits, though Alternative 10b provides more than the other two plans. However, the nonstructural measures included in Alternative 10a and Alternative 10b reduce residual risk and risk to life safety. This is displayed as "with-project (residual) damages" in Table 17; Alternative 10a and Alternative 10b significantly reduce residual risk more than Alternative 3. For this reason, Alternative 3 was screened from consideration.

Table 17: Plan comparison: Alternative 3, Alternative 10a, and Alternative 10b ($1,000s, FY18 P.L.).

Alternative	First Cost	Without Project Damages	With Project (Residual) Damages	Annual Benefits	Net Benefits	Benefit-Cost Ratio
Alternative 3	$97,609	$20,626	$4,597	$16,029	$11,929	3.9
Alternative 10a	$206,812	$20,626	$478	$20,148	$11,748	2.4
Alternative 10b	$154,394	$20,626	$1,263	$19,363	$12,856	3.0

First cost includes interest during construction at 2.875 percent. Annual cost includes annual OMRR&R costs.

The first costs and net economic benefits of Alternative 10a and Alternative 10b were then compared. The first cost for Alternative 10a is approximately 34% more than Alternative 10b. In addition, Alternative 10a provides less economic benefits than Alternative 10b. For these reasons, Alternative 10b was identified as the Tentatively Selected Plan. In summary, the alternative provides the most economic and social benefits; acceptably avoids significant impact to the environment and communities; and contributes the greatest to the P&G criteria and accounts, as described in Section 3.10 (Figure 43). The plan is a combination of a diversion culvert connecting the Peckman and Passaic Rivers; levees and floodwalls; channel modifications; ringwalls; and nonstructural measures within the ten percent floodplain upstream of Route 46. The structural features are designed to manage flood risk up to the two percent flood event. The project will reduce the risk of flooding for those flood events that have up to a two percent chance of occurring in a given year. The plan provides the greatest NED benefits of any alternative ($12,856,000 in FY18 P.L.), with a BCR of 3.0.

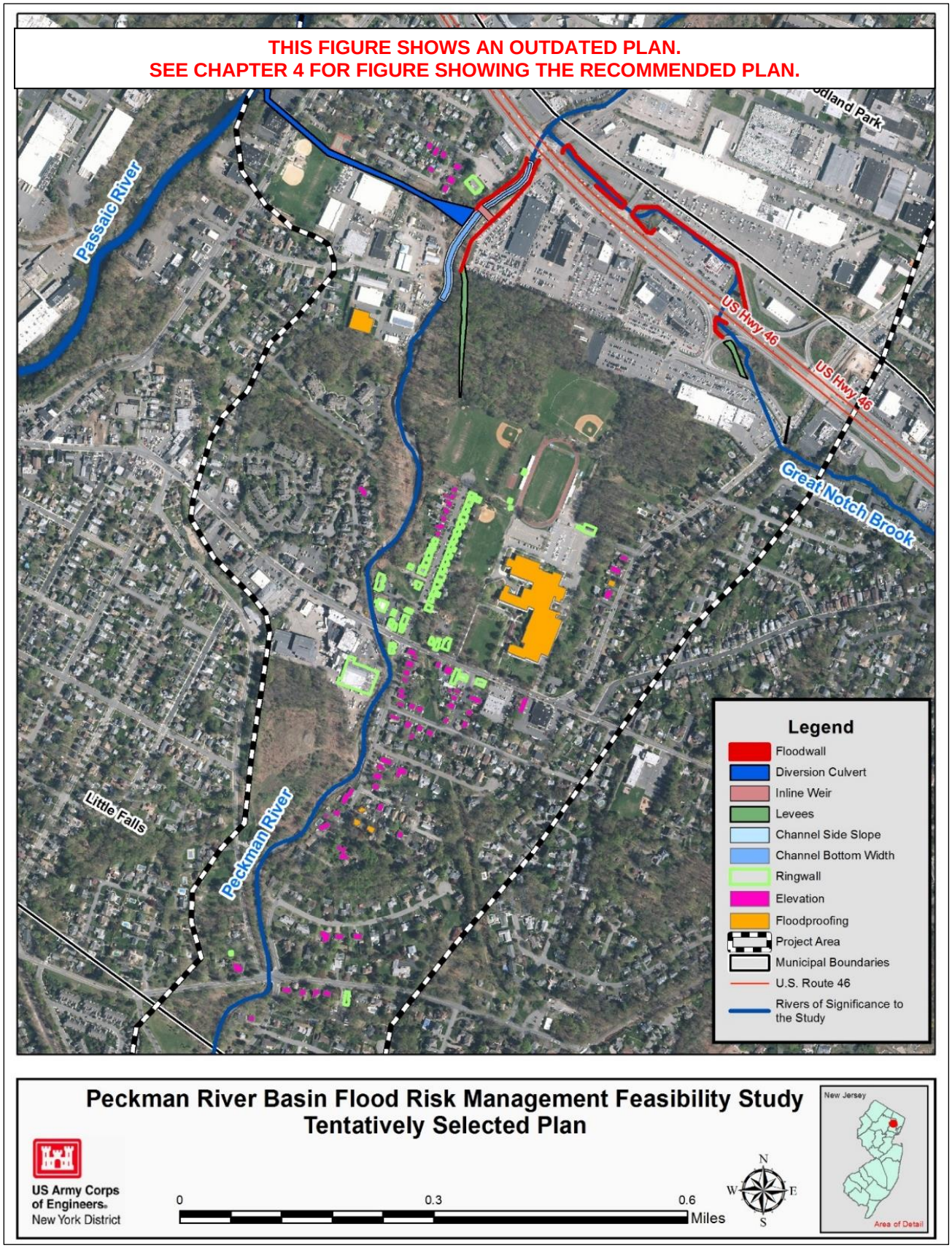

Figure 43. Components of the Recommended Plan presented in the May 2018 DIFR/EA.

3.13 Feasibility-Level Design (Plan Optimization)

Since release of the DIFR/EA in May 2018, additional engineering modeling, economic analysis, and detailed design and cost estimating were completed to reduce risk and uncertainty. This feasibility-level design effort, or "plan optimization," improved the definition of project costs, economic benefits, residual risk of flooding, and impacts to the environment. The results of initial plan evaluation and comparison summarized in Section 3.10 and Section 3.11 are still valid. Alternative 10b was refined as a result of feasibility-level design, as summarized in this section. The optimized plan is fully described in Chapter 4.

3.13.1 Engineering (Hydraulic) Modeling

An one-dimensional steady state USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) hydraulic model was used during initial plan formulation and selection, to understand existing and expected future flooding in the study area. During feasibility-level design, a two-dimensional unsteady state HEC-RAS model was used to further analyze flood dynamics in the study area. The two-dimensional HEC-RAS modeling results have led to a better understanding of existing and expected flood dynamics. A summary of the HEC-RAS modeling effort is found in Appendix C-2.

As described in Section 3.1, the study area experiences flood damages due to flash flooding from the Peckman River and its tributaries, and overbank and backwater flooding from the Passaic River. The scope of this study is limited to addressing flooding caused by the Peckman River and its tributaries. However, it was acknowledged during feasibility-level design that project performance may be affected by the effects of backwater flooding from the Passaic River. Specifically, backwater flooding into the Peckman River through the diversion culvert may affect project performance. To better understand the effects of Passaic River backwater flooding on project performance, backwater flooding was incorporated into the model; overbank flooding was not included, as it doesn't have a similar effect on project performance. In addition, a joint probability analysis was completed to calculate the likelihood and effects of simultaneous flooding of the Peckman and Passaic Rivers flooding the study area.

The two-dimensional HEC-RAS model results showed nuances of existing and expected flood water levels in Little Falls and Woodland Park. They showed that floodwaters on the right (east) bank of the river, downstream (north) of the East Main Street bridge flow overland more than previously understood. Consequently, the assumed efficiency of the diversion culvert's ability to capture floodwaters was reduced. Refinements to the plan were made to enhance project performance, as described in Section 3.13.2.

3.13.2 Plan Refinement

The two-dimensional HEC-RAS model results were the basis of refinements made to the plan. The following changes were made based on the better understanding of existing and expected flood dynamics. Appendix C-2 includes detailed information about plan refinements.

- Great Notch Brook levees and floodwalls. More overland flooding occurs downstream (north) of the East Main Street bridge flow occurs than was previously understood. The levees and floodwalls along the Great Notch Brook are not effective in reducing this overland flooding. Accordingly, the features were removed from the plan.
- Extension of right (east) bank levees near Little Falls High School. The modeling also showed the need to divert overflow floodwaters more efficiently into the Peckman River, and eventually the diversion culvert, near the East Main Street bridge. To achieve this, levees and floodwalls north of Little Falls High School between the track and baseball field were added to the plan.
- Peckman River channel modifications. The model results provided information about the need for additional spans of channel modifications upriver (south) of where initially located.
- Nonstructural measures and ringwalls. Changes to the structural components of the plan required refinement of the nonstructural components. The economic efficiency of different combinations of nonstructural measures, including the incremental economic justification of differing groupings of measures and structures was investigated. This resulted in changes to the number and location

of structures to be elevated or floodproofed. The number of structures to be elevated or floodproofed decreased due to the results of this analysis. In addition, all ringwalls were removed from the plan because they were found to not provide the most effective and appropriate flood risk management as previously thought.

Other plan refinements include changes to the number and dimension of diversion culvert weirs, and Peckman River levees and floodwalls associated with design refinements.

3.13.3 Economic Optimization Analysis

The study team focused an economic optimization analysis on the sizing of the diversion culvert, which is the most prominent and costly feature of the plan. Costs and benefits were calculated for two plans with different culvert sizes: 35-foot wide, and 40-foot wide. The Tentatively Selected Plan presented in the May 2018 DIFR/EA included a 35-foot wide diversion culvert, and is denoted as Alternative 10b-35. It includes the design refinements described in Section 3.13.2. A plan that includes a 40-foot wide diversion culvert (Alternative 10b-40) was considered to investigate the efficiency of a plan that could convey a greater volume of floodwater over time to the Passaic River. It includes the design refinements described in Section 3.13.2 as slightly modified to reflect the difference in culvert size. Appendix C-2 includes detailed information about these refinements.

A plan with a narrower diversion culvert was not considered. There is an inverse relationship between culvert width and levee height. The inclusion of higher levees in any plan was calculated to significantly increase project cost, and thus would not economically perform as well as plans with narrower culvert sizes.

The economic analysis reflects the two-dimensional HEC-FDA modeling results that reflect Passaic River backwater flooding on project performance. Because of this, the with-project (i.e., residual) vary from those developed and used for plan formulation and comparison (Table 9 of Appendix B). Project costs, and economic damages benefits for Alternative 10b-35 and Alternative 10b-40 were developed and compared as part of the economic optimization analysis (Table 18). The economic damages and benefits reflect the effect of Passaic River backwater flooding on project performance, as described in Section 3.13.1.

Table 18: Summary of economic optimization analysis ($1,000s, FY19 P.L.).

Alternative	Total Implementation Cost	Annual Cost	Without Project Damages	With Project Damages	Annual Benefits	Net Benefits	Benefit-Cost Ratio
10b-35	$84,690	$3,526	$17,225	$9,375	$7,849	$4,323	2.22
10b-40	$82,735	$3,449	$17,225	$9,459	$7,465	$4,316	2.25

Total implementation cost includes interest during construction at 2.875 percent. Annual cost includes annual OMRR&R costs.

The results of the economic optimization analysis illustrated that Alternative 10b-35 and Alternative 10b-40 provide very similar net economic benefits (Table 18). Typically, the plan with the greatest net economic benefits is selected as the preferred plan. However, USACE guidance allows the selection of a plan of lesser cost when the net economic benefits are similar. Because the plans provide very similar net economic benefits, Alternative 10b-40, as the less costly plan, was selected as the optimized Tentatively Selected Plan.

3.13.4 Detailed Design & Cost Estimating

Detailed design of Alternative 10b-40 was completed in order to improve accuracy of implementation costs, engineering effectiveness, and economic performance. Detailed project design and costs are

presented in Chapter 4. The design of the project will be refined during PED based on detailed site-specific information.

3.13.5 Summary of Plan Changes

Table 19 summarizes changes to the Recommended Plan made since May 2018.

Table 19: Summary of feasibility-level design plan refinements.

Feature	Alternative 10b (May 2018)	Alternative 10b-40 (October 2019)
Peckman River Diversion Culvert	35-foot wide, 1,500-foot long covered culvert located approximately 550 feet upstream of the Route 46 bridge	40-foot wide, 1,500-foot long covered culvert located approximately 550 feet upstream of the Route 46 bridge
Peckman River Diversion Culvert Weirs	One 6-foot wide by 2-foot high weir	Two weirs: 1) 19.25-foot wide by 6.5-foot high, and 2) 24-foot wide by 12.25-foot high
Peckman River Levees and Floodwalls	2,500 linear feet of levees and floodwalls	2,170 linear feet of levees and floodwalls
Peckman River Channel Modifications	1,000 linear feet of riprap and articulated concrete blocks	1,848 linear feet of riprap, articulated concrete blocks, and armoring
Great Notch Brook Floodwalls	3,000 linear feet of levees and/or floodwalls	Not included in plan
Little Falls High School Levees and Floodwalls	Not included in plan	1,207 linear feet of levees and floodwalls
Nonstructural Measures	Up to 71 structures in the ten percent floodplain upstream of Route 46	Up to 58 structures in the ten percent floodplain upstream of Route 46
Ringwalls	7 ringwalls around up to 47 structures	Not included in plan

Stated linear feet of diversion culvert, levees, floodwalls, and channel modification dimensions are approximate. Design details will be refined during PED.

3.13.6 Confirmation of Plan Selection

After release of the October 2019 version of this report, Alternative 10b-40 was confirmed as the Tentatively Selected Plan and is now documented as the Recommended Plan. The details of Alternative 10b-40 are found in Chapter 4.

Chapter 4: Recommended Plan: Alternative 10b-40*

4.1 Plan Components

The plan is a combination of a diversion culvert connecting the Peckman and Passaic Rivers; associated weirs; levees and floodwalls; channel modifications; and nonstructural measures within the ten percent floodplain upstream of Route 46 (Figure 44).

Figure 44. Recommended Plan: Alternative 10b-40.

Project performance. The plan is designed to manage flood risk up to the two percent flood event. The project will reduce the risk of flooding for those flood events that have up to a two percent chance of occurring in a given year. Details about project performance can be found in Chapter 7 of Appendix B "Economics."

Diversion Culvert. Upstream of Route 46, floodwaters would be diverted from the Peckman River to the Passaic River through a 1,500-foot long culvert located approximately 550 feet upstream of the Route 46 bridge. The 40-foot wide double box diversion culvert would be constructed using a "cut-and-cover" approach (Figure 45). The culvert inlet consists of two weirs that would divert the flow from the Peckman River into the culvert, discharging it into the Passaic River. The weirs would be 19.25-feet wide by 6.5-feet in height, and 24-feet wide by 12.25-feet in height. The diversion culvert would significantly reduce downstream peak discharges (i.e., flash flooding), and subsequently, downstream flood elevations and flood damages. Nearly all flood risk management benefits from the diversion culvert would be in Woodland Park. The culvert would not reduce backwater or overbank flooding from the Passaic River.

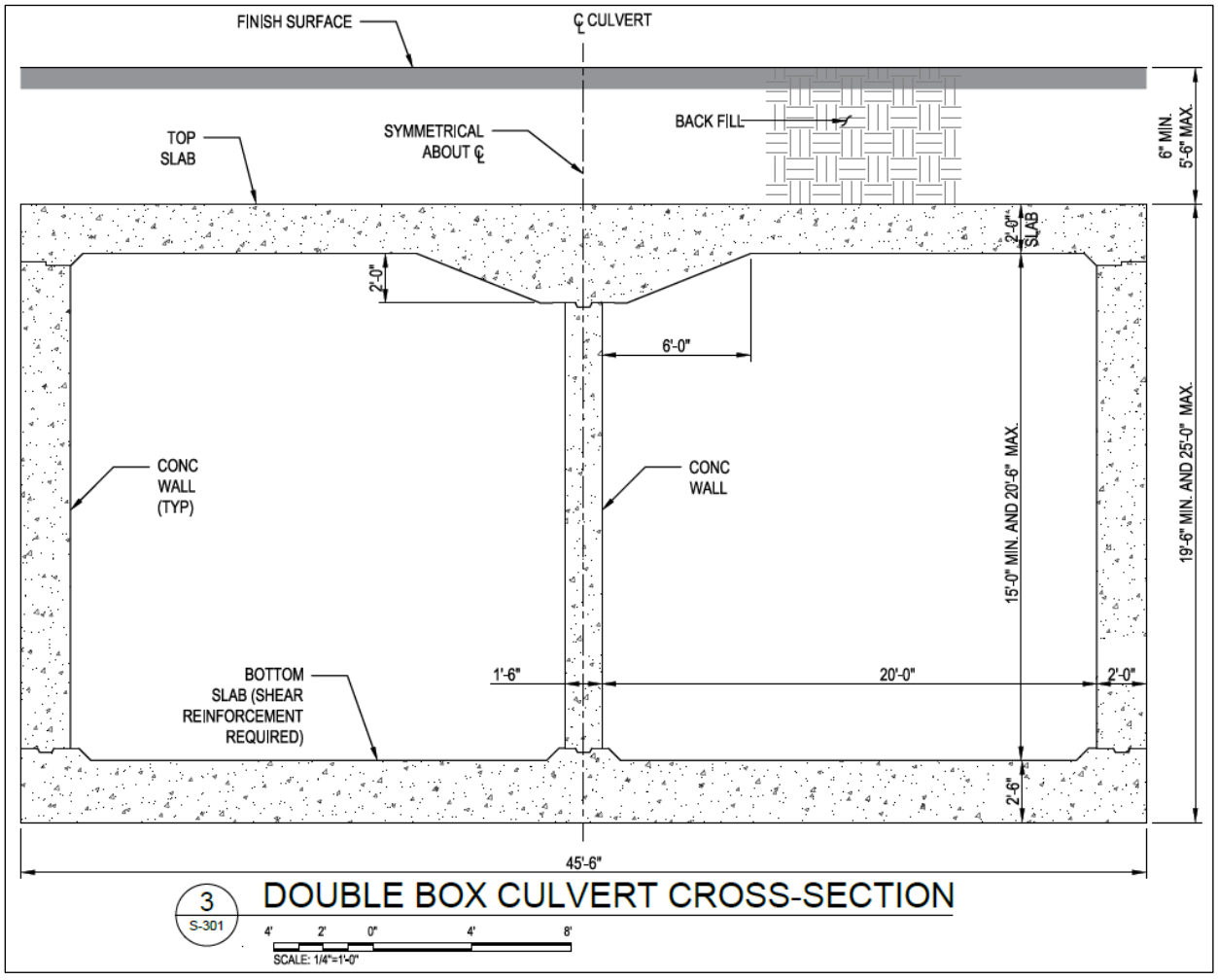

Figure 45. Typical diversion culvert cross section.

Levees & Floodwalls. Approximately 2,170 linear feet of levees and floodwalls would be constructed along the Peckman River downstream of the ponding weir to the Route 46 bridge (Figures 46 and 47). Approximately 1,207 linear feet of levees and floodwalls would also be built north of Little Falls High School between the track and baseball field.

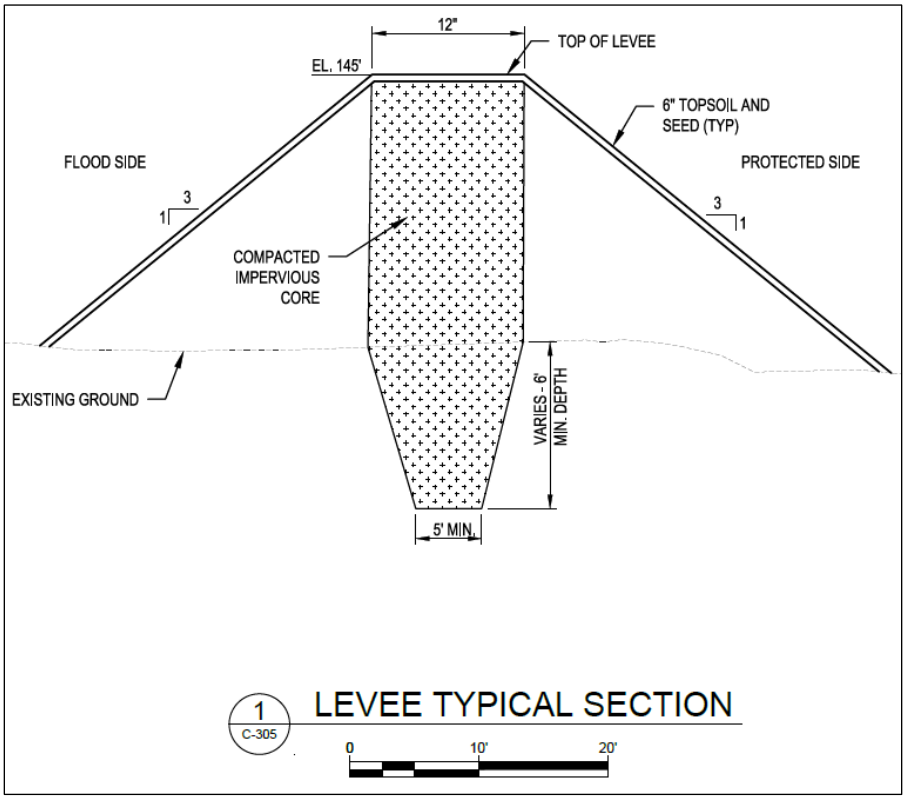

Figure 46. Typical levee cross section (not to scale).

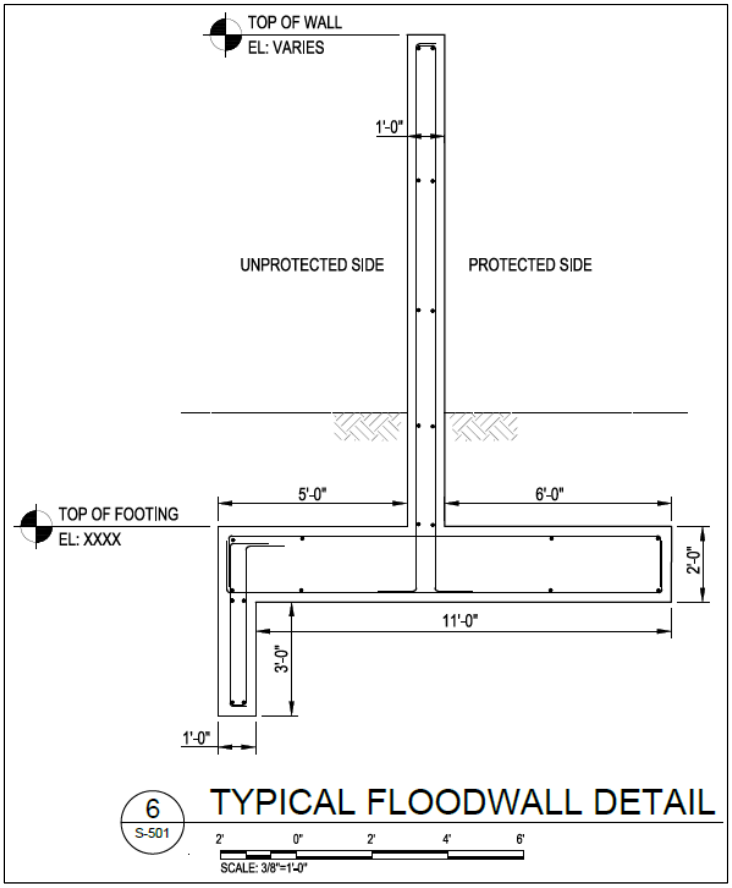

Figure 47. Typical floodwall cross section.

Channel Modifications. Due to the high velocities along the Peckman River and unstable banks, streambank erosion mitigation measures are necessary along the sections of the river. Channel modification is expected along 1,848 linear feet of shoreline to accommodate riprap. Large diameter riprap would eliminate the erosion and possible undermining of the proposed levees and floodwalls.

Nonstructural Measures. Up to 58 structures in Little Falls located in the ten percent floodplain near the Peckman River would be elevated or floodproofed (Table 20). The main objective of the nonstructural measures is to reduce flood damages through modifications of the existing structures. Structure elevations involve lifting structures so their first floor elevation is above the base flood elevation (also known as the one percent flood water surface elevation). The most appropriate wet floodproofing measures for the subject structures include elevating air conditioning and heating units, and filling basements so that they are not subject to flooding. Dry floodproofing measures would include making structures watertight by sealing walls and openings (i.e., doors and windows) with permanent or temporary shields.

Table 20. Nonstructural components of Alternative 10b-40.

Treatment	Residential	Non-residential	Subtotal
Elevation	16	0	16
Wet Floodproofing	29	9	38
Dry Floodproofing	4	0	4
Total	**49**	**9**	**58**

A detailed field assessment of each of the 58 structures included in the plan will be completed as part of PED to confirm the appropriateness of these nonstructural measures. Implementation of the nonstructural measures is based on the voluntary participation of property owners. As such, Table 20 presents the maximum scope of nonstructural measures included in the plan. Per USACE practice, it is assumed that Federal contracting vehicles will be used by the New York District to construct nonstructural measures. Based on the relatively small amount of structures in the plan, it is assumed that a single contractor will handle the work. Temporary real estate easements would be needed for construction, as detailed in Appendix E. Best practices promulgated by the USACE National Nonstructural Committee will be considered during design and construction. The New York District will continue coordination with the Committee through PED and construction.

Compensatory Mitigation. Mitigation is required due to unavoidable temporary or permanent environmental impacts to forested wetland, riparian habitat, and stream restoration. The following habitat types and extents will be permanently, directly impacted by the project: a) 1,848 linear feet of freshwater riverine system equaling to approximately 1.7 acres of open water; b) 0.48 acres of forested wetlands; c) 0.77 acres of riparian zone; d) 0.85 acres of streambank vegetation; and d) 1.5 acres of upland forest. Approximately 0.71 acres of forested wetlands and 1.37 acres of riparian zone will experience temporary impacts as a result of construction activities. These areas will be restored on site following construction completion.

In order to compensate for the permanent direct impacts approximately 1,848 linear feet of river equaling to approximately of 1.7 acres of open water habitat and 0.85 acres of native streambank vegetation will be restored. Included in the compensatory mitigation is 0.77 of riparian zone restoration. Based on USACE policy, no compensation for the loss of 1.5 acres of upland forest is proposed. The details of the mitigation plan are included in Appendix A-9.

Risk Communication. As described in Section 4.5.2 and Section 4.5.6, the project will not eliminate all flood risk to life and property. Because of this, it is essential that flood risk be communicated to residents. USACE, NJDEP, and local municipalities will work together to communicate flood risk, especially residual flood risk, as described in Section 4.5.6.

4.2 Plan Benefits

Benefits were calculated as the difference in damages for the without- and with-project conditions. Benefits were then amortized over a 50-year period (2027 through 2076) to identify equivalent annual benefits using the FY 20 P.L. and an interest rate of 2.75 percent. The plan would provide $9,440,000 in Average Annual Benefits (AAB), while incurring an Average Annual Cost (AAC) of $6,184,000 (FY 20 P.L.). The average annual net benefits of the plan are $3,292,000, with a BCR of 1.5 (FY 20 P.L.). The with project (residual) annual damages are $10,021,000 Equivalent Annual Damages (EAD) (FY 20 P.L.).

4.3 Plan Costs

The project costs were developed using the Micro-Computer Aided Cost Estimating System (MCACES), Second Generation (MII) program (Table 21, Table 22, and Table 23). The MII cost estimate used RSMeans, MII Cost Libraries, and vendor quotations. Moreover, the cost contingencies were developed through a standard Cost and Schedule Risk Analysis (CSRA). The summary of the results of this risk analysis, and more detail on the cost estimate, can be found in Appendix D.

The initial project cost is $146,188,000, with total annual costs of $6,184,000. The plan would be cost shared as 35 percent Non-Federal and 65 percent Federal. The project cost estimate is broken out by cost component (Table 21), annual costs (Table 22), and costs and benefits (Table 23) all costs presented at October 2019 price level. This includes planning, engineering and design, construction management, interest during construction, and operation and maintenance (contingencies are included). The real estate cost of the project is estimated to be $5,273,000. The project would necessitate the acquisition of 12.2 acres of property. Permanent easements totaling 11.35 acres, and 6.20 acres of temporary easements would also be required. In some instances, more than one estate may be required to be obtained over the lands of the same owner. Required Lands, Easements, and Rights-of-Way (LER) total 23.39 acres.

Table 21. Recommended Plan cost estimate (FY 20 P.L.).

Cost Component	Cost ($)
Lands and Damages	$4,777,000
Relocations	$496,000
Fish & Wildlife Facilities	$2,376,000
Channels & Canals	$21,627,000
Levees & Floodwalls	$11,437,000
Floodway Control & Diversion Structure	$65,067,000
Cultural Resource Preservation	$2,387,000
Buildings, Grounds & Utilities	$11,580,000
Planning, Engineering & Design	$17,245,000
Construction Management	$9,197,000
Total	**$146,188,000**

Table 22. Project annual costs (FY 20 P.L.).

Fully Funded Total Project Cost	$176,598,000
First Cost Total Project Cost	$146,188,000
Interest During Construction (32 month construction at 2.75%)	$5,246,000
Net Investments	**$151,434,000**
Annualized (2.75%, 50 years)	$5,609,000
Annual OMRR&R	$575,000
Total Annual Cost	**$6,184,000**

Average annual costs include interest during construction / Interest rate of 2.75 percent from 2027 through 2076

Table 23. Costs and benefits of the Recommended Plan (FY 20 P.L.).

Total First Cost	$146,188,000
Average Annual Cost	$6,184,000
Average Annual Benefits	$9,440,000
Annual Net Benefits	$3,292,000
Benefit-to-Cost Ratio	**1.5**

Average annual costs include interest during construction / Interest rate of 2.75 percent from 2027 through 2076 / Discount rate of 2.75 percent from 2027 through 2076

4.4 Operation, Maintenance, Repair, Replacement & Rehabilitation Considerations

Although the diversion culvert is self-sustaining for the most part, some periodic maintenance to remove accumulated sediment from the upstream side of the diversion weir and within the culvert will be required. The channel and culvert must be maintained to ensure that the hydraulic capacity of the project is preserved. Also, access to the project must be maintained for inspection and maintenance purposes. The project and areas immediately upstream and downstream would be inspected annually and the removal of debris, particularly from bridges before and after a storm event, would be performed.
To maintain the hydraulic capacity of this project, shoals, debris, encroachments and heavy vegetation should be removed from the channel by the non-Federal sponsor.

The culvert should be inspected yearly for cracks, damages, and sediment accumulation. Large sized sediment or significant volumes of sediment should be removed as soon as possible. Vegetation should be removed from the walls and drainage openings. No improvements or changes shall be made over, under, or through this project without prior determination by the New York District Engineer that the requested improvements or changes would not adversely affect the function of the improved channel and culvert.

4.5 Risk & Uncertainty Analysis

4.5.1 Economic Risk & Uncertainty

Risk and uncertainty has been explicitly factored into the economic analysis of this project (Appendix B). A statistical-risk based damage model, Hydrologic Engineering Center-Flood Damage Analysis (HEC-FDA), was used in this study to formulate and evaluate the project in a life-cycle approach. HEC-FDA integrates the engineering and economic analyses and incorporates uncertainty in both physical parameters and storms, which enables quantification of risk with respect to project evolution and economic costs and benefits of project implementation (Appendices B and D). The analysis indicated that equivalent annual project benefits can range from $5,744,000 to $12,727,000 and BCRs could range from 0.9 to 2.1, based on the results of modeling with inclusion of uncertainties in the economic and engineering inputs.

The hydrologic and hydraulic performance of a project may be described by annual exceedance probability, long-term risk and assurance, or conditional non-exceedance probabilities. The Recommended Plan effectively reduces almost certain probability of annual exceedance in virtually every reaches compared to the Without condition. In the future without project condition, long term risk in the 10 to 50 year range, exceedance is almost certain in all reaches. With the Recommended Plan in place, the probability of the target stage being exceeded at least once in a 10 year period is decreased by approximately 23 percent on average for all reaches. The Recommended Plan contains the specific event of exceedance for all reaches compared to not having a plan in place. Project performance is detailed in Appendix B “Economics.”

4.5.2 Residual Risk

Flood risk to people and structures at any location in a floodplain is the function of flood hazard at the location, and their exposure and vulnerability to the flood hazard. Residual risk is the flood risk that

remains after the selected plan is in place. It is the exposure to loss remaining after other known risks have been countered, factored in, or eliminated. The project will not eliminate all flood risk to life and property. Flood damages from fluvial flooding will not be totally prevented, only reduced. Equivalent annual benefits are $9,440,000. While there would still be properties and infrastructure that is vulnerable to fluvial flood damages, flood damage from the Peckman River would be significantly reduced with plan implementation. Post-disaster assistance and aid for owners of these properties may come from other Federal agencies, such as FEMA and USHUD, or from programs run by the State of New Jersey.

In the areas of Little Falls where elevations and floodproofing would be implemented, the fundamental risk associated with the proposed plan is that access routes would still become inaccessible due to flooding since the plan would not alter the floodplain and thus not reduce street flooding in the Township. This would result in the stranding individuals who choose not to evacuate when directed to prior to storms. Emergency services would likely not be able to reach stranded residents who are in need during high water events. Access to transportation routes and emergency services in Woodland Park would be improved through reduction of the floodplain due to construction of the diversion culvert and Great Notch Brook floodwall system. However, parts of Woodland Park would still be subject to flooding from the Passaic River.

The plan complements other ongoing efforts in the basin to manage flood risk. Local municipalities are currently implementing a flood warning system to warn residents in advance of high water events in the Peckman River. In addition, new construction is built to an elevation at least one foot above the BFE in accordance with local floodplain management regulations. Elevated homes are at less risk of damage from flooding from storms.

As mentioned in Section 3.2, some areas of Woodland Park will still be subject to Passaic River flooding even after the project is constructed. This is because the Peckman study is designed to only address flooding from the Peckman River, and not the Passaic River, even though some parts of the study area are flooded from both rivers. There is a separate USACE study (the Passaic Mainstem study) that was designed to address Passaic River flooding, but this study is currently suspended. If this study is to resume, there is potential for a recommendation to be made to improve flood risk management on the Passaic River that would have impacts in the Woodland Park section of the Peckman River study area. If this action is to occur, it would improve residual risk in the Peckman study area.

4.5.3 Risk to Life Safety

Communities in the Peckman River Basin have always experienced flooding from the Peckman and Passaic Rivers (Figures 48 and 49). Residents generally understand the severe implications of staying in harm's way when a storm is forecasted to affect the area. Because there is typically two to seven days' notice prior to major storms (e.g., hurricanes and tropical storms), residents are given sufficient warning to evacuate. However, residents typically have only a few hours warning before the arrival smaller storms and rain events that cause flash flooding on the Peckman River. Residents should evacuate prior to storms to avoid being stranded, which could pose a danger for their welfare. Emergency vehicles may not be able to reach residents in distress due to the flooding of roads and homes. In addition, there is an increased risk of fire in communities due to the potential compromising of electrical and natural gas systems. Loss of life can only be totally prevented by evacuating people well before expected flood events. The inherent erratic nature and unpredictability of a storm's path and intensity requires early and safe evacuation. A policy of early, total evacuation should be continued even with the project in place.

Section 7.2.1 of Appendix B "Economics" includes supplemental information about risk to life safety.

Figure 48. Closed road and traffic congestion as an effect of Hurricane Floyd (1999).

Figure 49. Flooding in Little Falls (2011).

4.5.4 Induced Flooding

The project includes the diversion of flood waters from the Peckman River into the Passaic River. The amount of flood water that will be diverted, even during large storm events, is relatively small in comparison to the Passaic River and its watershed. The project is not expected to induce flooding in communities along the Passaic River that are located downriver of the culvert outfall. Modeling results show no adverse impacts upstream and downstream of the project area.

4.5.5 Climate Change Adaptation and Resilience

Consistent with the objective of Engineering and Construction Bulletin (ECB) 2018-14 "Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects," a qualitative analysis for inland hydrology was conducted using the best available data for the Peckman River Basin. The quantitative analysis was conducted in three phases as specified within the ECB; Chapter 5 of Appendix C-1 "Hydrology" includes details of the work. The analysis indicates that projected moderate increases precipitation and peak streamflow, as well as increases in storm frequency and intensity in the future. However, due to lack of quantitative information the impact of climate change to the project hydrology is inconclusive. Increases and storm frequency and intensity in the future may lead to increases in stream flow and instances of elevated river stages in the Peckman River, which may lead to more frequent overtopping instances of the levee feature in the future. The design of the proposed diversion culvert is robust enough to handle larger storm events and is expected to perform as designed in the future.

4.5.6 Risk Communication

As described in Section 4.5.2, the project will not eliminate all flood risk to life and property. Flood damages from fluvial flooding will not be totally prevented by the project, only reduced. In addition, some areas of Woodland Park will still be subject to Passaic River flooding, as described in Section 3.2. This is because the project is designed to only address flooding from the Peckman River, and not the Passaic River. Because of this, it is essential that flood risk be communicated to residents. Risk communication is the process of informing people about potential hazards to their person, property, or community.

USACE, NJDEP, and local municipalities will work together to communicate flood risk, especially residual flood risk. Currently, local floodplain managers and emergency managers lead risk communication in their communities. USACE will provide these local managers with information about project effectiveness and residual flood risk to disseminate through existing channels. Other efforts may supplement ongoing and planned risk communication to enhance its effectiveness.

4.5.7 Nonstructural Participation Rate Uncertainty

Participation in the nonstructural components of the plan (elevations and floodproofing) is voluntary; therefore there is inherent uncertainty of benefits actually exceeding costs. A sensitivity analysis for participation rates for nonstructural measures was conducted to determine the economic feasibility of participation rates at hypothetical 25 percent, 50 percent, 60 percent, 75 percent, and 100 percent probabilities. Structure records were randomly selected to obtain the targeted number of individual records to match each rate, and thus the selection process is unbiased. Table 24 shows the results of a sensitivity analysis using a random selection of residential structures. For scenarios with up to a 50 percent participation rate, the net benefits are negative. However, net benefits are highly positive at and above a 60 percent participation rate. It is important to note that the costs used in determining net benefits and benefit-cost ratios include the costs of structural components of the plan. If costs were evenly split between structural and nonstructural measures there would be all positive net benefits for each probability and higher benefit-cost ratios. Based on coordination with non-Federal and local interests, and current building strategies, an at- or near-100 percent participation rate is likely.

Table 24. Nonstructural participation rate sensitivity (in $1,000s, FY 20 P.L.)

Participation Rate	Total FWOP	Total FWP	Annual Damage Reduced	Annual Cost*	Net Benefits	BCR
25%	$39,083.38	$33,136.18	$5,947.20	$6,183.00	-$235.80	0.96
50%	$68,212.33	$62,606.49	$5,605.84	$6,183.00	-$577.16	0.91
60%	$99,228.15	$70,772.92	$28,455.23	$6,183.00	$22,272.23	4.6
75%	$116,307.03	$79,194.02	$37,113.01	$6,183.00	$30,930.01	6.0
100%	$146,602.67	$82,308.59	$64,294.08	$6,183.00	$58,111.08	10.4

** Annual cost estimates include structural measures*

4.6 Economic, Environmental, and Other Social Effects

The 1983 P&G presents four accounts to facilitate evaluation and display of effects of alternative plans, as described in Section 3.7: NED, EQ, RED, and OSE. In reducing damages from future storm and flood events, the proposed project would contribute to NED if water levels do not exceed the final design height of the measures. The nonstructural components of the plan neither contributes to nor detracts from the EQ and RED accounts. As detailed in Chapter 5, there would be no significant environmental impacts due to implementation of the plan. The project will not have significant long-term impact on endangered, threatened and or special species of concern. Restrictions on tree and vegetation clearing, as well as in-water construction will help minimize impacts. Permanent impacts to forested wetlands and riparian habitat will be mitigated through the use of either mitigation banks or the use of the existing Peckman Preserve, in accordance with the Preserve's master plan. There is the potential for adverse effects to the Little Falls Laundry, a National Register-eligible property by proposed nonstructural measures as well as the potential to encounter intact archaeological sites along the diversion culvert alignment and floodwalls and levees along the Peckman River. The District will work in coordination with the NJHPO to avoid, minimize, or mitigate any determined adverse effect. Any other impacts would be minor and temporary.

4.6.1 Community Cohesion

Community cohesion refers to the aspect of togetherness and bonding exhibited by members of a community. This includes features such as a sense of common belonging or cultural similarity. There is a shared interest among residents of the Peckman River Basin to reduce fluvial flooding while maintaining their communities and connections. To support this goal, the municipal governments in Little Falls and Woodland Park are working with Federal and state agencies to help residents elevate their homes, move to higher ground, and create pocket parks. The Recommended Plan is consistent with residents' goals and actions to reduce flooding, and thus will support community cohesion in Little Falls and Woodland Park.

4.6.2 Community Resilience

Community resilience is the measure of the sustained ability of a community to utilize available resources to respond to, withstand, and recover from adverse situations (Figures 50 and 51). The proposed project would contribute to community resilience, as structures included in the plan would not be damaged as frequently or as severely as others in the area, and the community would be able to recover quickly after storms if water levels do not exceed the final design height of the measures. People would not be displaced for months or years because their homes were severely damaged by flooding. Businesses would be able to return quickly if they are not flooded, and people would be able to return to work.

Since only a subset of the Peckman River Basin is included in the plan, some property owners who experience flood damages and need help would not receive it via the proposed project. Other sources of Federal and non-Federal assistance for property owners are available via FEMA, USHUD, the State of New Jersey, and nonprofit organizations.

Figure 50. Residents clean up damaged homes after Hurricane Floyd (1999).

Figure 51. Flood damage in Little Falls after Hurricane Irene (2011).

4.7 Executive Order 11988

EO 11988 “Floodplain Management” requires Federal agencies such as USACE, when taking an action, to avoid short- and long-term adverse effects associated with the occupancy and the modification of a floodplain. The agency must avoid direct and indirect support of floodplain development whenever floodplain siting is involved. In addition, the agency must minimize potential harm to development in the floodplain and explain why the action is proposed. USACE implementation guidance for EO 11988 was issued as ER 1165-2-26 “Water Resources Policies and Authorities, Implementation and Executive Order, Engineer Regulation 11988 on Flood Plain Management.”

The wise use of floodplains concept, as described in EO 11988, was incorporated as a life safety consideration as part of the study. This approach was based on study objectives of applying qualitative rather than quantitative analysis; use of existing data/inventory; and professional judgment. The eight-step evaluation process outlined in EO 11988 is included here, with a discussion of how it was considered during plan formulation and selection.

Step 1: Determine if a proposed action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year, i.e., one percent flood). The Proposed Action is within the defined base floodplain.

Step 2: Conduct early public review, including public notice. USACE has coordinated with NJDEP, local municipalities, and the public during the course of the study. The October 2019 DIFR/EA allowed for a formal public review of the proposed action. This FIFR/EA presents the USACE’s recommendation for Federal action.

Step 3: Identify and evaluate practicable alternatives to locating in the base floodplain, including alternative sites outside of the floodplain. All practicable alternatives were identified by following the USACE six-step planning process. A wide range of measures and plans using available information, engineering analysis, professional judgment, and risk-informed decision-making were evaluated. Practicable alternatives considered, and the reasons they were screened from consideration are presented in Chapter 3.

Step 4: Identify impacts of the proposed action. As detailed in Chapter 5, there would be no significant environmental impacts due to implementation of the plan. The plan would support community resilience and cohesion by reducing flood risk to residents, businesses, and infrastructure.

Step 5: If impacts cannot be avoided, develop measures to minimize the impacts and restore and preserve the floodplain, as appropriate. The proposed project is the plan that maximizes NED benefits while being consistent with the requirements of EO 11988. The plan would avoid short-term and long-term adverse effects associated with the occupancy and modification of the existing floodplain.

Step 6: Reevaluate alternatives. Plan formulation, evaluation, comparison, and selection are detailed in Chapter 3.

Step 7: Present the findings and a public explanation. This FIFR/EA presents the USACE’s recommendation for Federal action.

Step 8: Implement the action. NJDEP is willing to enter into a PPA with the Federal government for implementation of the plan.

4.8 Environmental Operating Principles

The Environmental Operating Principles is an essential component of the USACE's risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure. The Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization
- Proactively consider environmental consequences of all USACE activities and act accordingly
- Create mutually supporting economic and environmentally sustainable solutions
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE's actions in a collaborative manner
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities

Plan selection took into account these principles to ensure the sustainability and resiliency of the NED plan while considering the environmental consequences of implementation. In addition to construction best management practices to maintain water quality standards, other opportunities to implement sustainable measures and/or materials (e.g. low volatile organic paint, recycled industrial materials) that are cost effective and comply with USACE construction standards will be further evaluated in the PED phase. Planting plans will utilize native vegetation that support pollinator species, have a lower susceptibility to disease or pests, and are more adaptable to climate change. In addition, the ability to potentially recycle/re-use material such as excavated material from the channel on-site where feasible for on-site restoration and/or proposed compensatory mitigation activities will be evaluated during the PED phase. The study team considered avoiding and minimizing adverse impacts to existing environmental resources and cultural resources within the project area to the extent practicable during the plan formulation process. Where impacts to these resources are unavoidable, compensatory mitigation will be performed. Continuous coordination with NJDEP, the Township of Little Falls, the Borough of Woodland Park, and the public will occur throughout the feasibility study to ensure an open and transparent process that respects views of individuals and groups. The project will be constructed in compliance with all applicable environmental laws and regulations.

4.9 Compliance with the National Flood Insurance Program

Communities participating in a flood risk management project with USACE are required to participate in FEMA's National Flood Insurance Program (NFIP) and to comply with the land use requirements of the program. The communities of Woodland Park and Little Falls participate in and are in compliance with the NFIP. They adhere to the 2010 Passaic County Hazard Mitigation Plan (Passaic County, 2010), in addition to promulgating their own land use zoning rule, and building codes.

Because the plan would manage flood risk it will inherently support the communities' compliance with the NFIP. All structure elevations and floodproofing would be completed in compliance with Federal, state, and local guidelines and requirements related to NFIP participation. The target elevation for the first floor of all structures to be elevated will be at a height of one foot above the USACE-modeled one percent flood water surface elevation. USACE determined that the "plus one foot" height accurately reflects uncertainly of wave effects on water surface elevations. Coincidentally, the target height is approximately one foot above the BFE, which the minimum standard for building in the one percent floodplain within Woodland Park and Little Falls. USACE has coordinated with FEMA Region II about the proposed project. It will notify FEMA Region II once the project is authorized for construction by the Congress. FEMA could update flood maps and flood profiles to depict post-project conditions, which may affect flood insurance rates for homeowners and business owners who would benefit from the project. It is important to note that flood insurance rates are not set by USACE or the State of New Jersey.

Chapter 5: Effects of the Recommended Plan*

This chapter discusses the potential positive and adverse environmental consequences of the Recommended Plan. The effects of the Recommended Plan are directly compared against the baseline future without-project / No Action alternative conditions as described in Chapter 3.

In summary, the Recommended Plan will permanently impact the following types of habitat: a) 1,848 linear feet of freshwater riverine system equaling to approximately 1.7 acres of open water; b) 0.48 acres of forested wetlands; c) 0.77 acres of riparian zone; d) 0.85 acres of streambank vegetation; and d) 1.5 acres of upland forest. Approximately 0.71 acres of forested wetlands and 1.37 acres of riparian zone will experience temporary impacts as a result of construction activities. These areas will be restored on site following construction completion.

In order to compensate for the permanent direct impacts, the District is proposing to restore approximately 1,848 linear feet of river equaling to approximately of 1.7 acres of open water habitat via the installation of three bendway weir fields along the outer bends of the river where severe bank erosion is occurring, and 0.85 acres of native streambank vegetation. Included in the compensatory mitigation is 0.77 of riparian zone restoration. Based on USACE policy, no compensation for the loss of 1.5 acres of upland forest is proposed.

For reference purposes, bendway weirs are rock structures that are embedded within and perpendicular to streambank along the outer bend of river meanders to help deflect flow away from the bank in order to reduce erosion. They do not extend across the entire width of the channel, but in a manner that redirects the channel thalweg more to the center of the channel. In addition to providing bank protection, bendway weirs provide in-channel aquatic habitat. Typically, a series of bendway weirs are used along a set the length of the effected streambank to maximize effectiveness. These series of weirs are often referred to as fields. For cost estimating purposes, it was assumed that four bendway weirs would make up one bendway weir field. As three bendway weir fields are proposed, a total of 12 individual bendway weirs were included in the cost estimate presented in Account 06 of the Cost Engineering Appendix (Appendix D). Refer to Appendix A-8 for a photo of the structures.

Compensation of permanent wetland impacts will be achieved through the purchase of mitigation credits at an approved mitigation bank or through the creation/restoration of 0.96 acres of wetland habitat. Construction of the Recommended Plan is expected to take approximately 2.5 years.

As mentioned in Chapter 2, streambank orientation is referred to as left or right based on a downstream viewpoint.

5.1 Topography, Geology & Soils

5.1.1 Geology & Topography

Grading may be required around individual building foundations or potentially the entire lot for the construction of nonstructural measures. The topographical changes are expected to be negligible.

Construction of the diversion culvert will employ a “cut and cover” method. This construction method is utilized for shallow tunnels where a section is first excavated and then covered over with enough overhead support system strong enough to carry the load of what is to be built over the tunnel. As the area will be returned to normal grade after construction, no changes to the topography of the area will occur. There are no topographical changes related to the channel modifications within the Peckman River; any excavation proposed is limited to a depth necessary to keep the riprap and articulated concrete block at the current riverbed elevation.

The topography in the location of the proposed levee is generally flat. The levee will have an average height of six feet with a side slope grade of 3:1. Therefore, the construction of the levee will change the topography in the immediate project areas. The modification to the topography in this area will be limited to the immediate footprint of the levee and is required to provide the necessary project performance.

The off-site compensatory vegetated streambank mitigation may require some topographical changes in the form of grading/filling to restore eroded streambanks and facilitate replanting. In addition, the District may perform wetland off-site mitigation if the purchase of mitigation credits is not an option. It can be expected that topographical modifications in the form of excavation may occur within any proposed mitigation areas to establish or enhance hydrological conditions conducive to supportive wetlands. These topographical modifications will be necessary to ensure success of the mitigation and are not expected to have long term adverse effects.

No short or long term adverse impacts to geology from implementation of the proposed action is anticipated.

5.1.2 Soils

No significant impacts to soils will occur as a result of implementation of the nonstructural measures in the Township of Little Falls.

The installation of the concrete weir within the Peckman River and the precast concrete culvert will constitute the conversion of natural soils to concrete. The channel modifications within the Peckman River will involve the excavation and fill of the channel bottom and substrate in order to install the riprap. These measures are meant to prevent scouring and erosion of soil during high flow events. In addition, the portion of the Passaic riverbed and right stream bank in the footprint of the stilling basin at the diversion culvert will be excavated and lined with concrete and rip rap to prevent scouring and erosion of soils.

The interior of the proposed levee will be constructed with an impermeable clay core to prevent seepage. Compacted fill material is typically used for the levee exterior. The in-situ soil will likely not meet the geotechnical specifications for levee construction and soil meeting the specifications will be imported from an approved, permitted, off-site source. Although the importation of soils will represent a change in the existing soil type within the immediate footprint of the levee, no changes to the soil beyond the levee footprint are proposed.

The bendway weir fields and vegetated streambanks proposed for compensatory mitigation will reduce erosion of the streambanks to which they are applied. Therefore, the compensatory mitigation will have a positive effect on soils.

Prime Farmland

The proposed action occurs in an urbanized setting that does not include any additional land uses related to agriculture or silviculture. Therefore, adverse impacts to Prime Farmland soils will not occur.

Hydric Soils

A portion of the levee is located within areas that have soils that meet hydric soil criteria. Because there are specific requirements for the type of soil used to construct potential levees, fill material that meets the construction specifications will be imported to construct the levee. This will constitute a change in soil type and will impact hydric soils. However, this impact is limited to the footprint of the levee as is necessary to achieve the desired project performance. No adverse impacts to hydric soils beyond the levee footprint are expected.

Mitigation

An erosion and sediment control plan will be developed and coordinated with the Hudson-Essex-Passaic Soil Conservation District prior to the construction of the proposed project. Best management practices including, but not limited to, silt fence, turbidity curtains and temporary seeding will be implemented to reduce soil erosion within the project footprint. Following completion of modifications and structures, temporary work locations will be restored to pre-construction conditions.

5.2 Land Use & Zoning

The proposed action will have a short term impact on residential and commercial land use around temporary workspaces during construction. Such impacts include restricted or limited access to specific locations on the property where construction is occurring. For example, during construction of the diversion culvert, there will be a temporary loss of use of the tennis courts and the baseball fields at Little Falls Recreation Center. The loss of use is expected to be approximately eight months. In addition, it is expected that there will potentially be a full loss of parking space in the parking lot at the office building near the discharge location for approximately four to six months during construction. The construction method being employed is a cut and cover method. Therefore, once construction is completed, the land use will be returned to pre-construction conditions.

With the exception of the parcels that comprise the Passaic Valley High School, the majority of the proposed levee and floodwall is situated on several properties in a manner that is not expected to interfere with their existing use. In the instance of the high school, the levee and floodwall alignment is situated between the southern boundary of the track and northern boundary of a baseball field. In order to maintain access to the baseball field, a closure gate will be installed that will remain open under normal conditions.

For safety reasons, it is expected that there will be a loss of use of the track and the two baseball fields during construction. Additionally, there will be a temporary loss of parking spaces in the portion of the High School parking lot near the levee alignment during construction. Construction of the levee and floodwall on the high school property is expected to take approximately seven months. Prior to construction, the District will coordinate with high school officials and the municipality to determine a construction schedule that will provide the least amount of disruption to school operation. In the long term a gate will be installed in the floodwall to allow access to the back baseball field.

Implementation of the channel modifications is not expected to modify existing land use. Permanent easements will be obtained to perform post construction inspection and maintenance.

Temporary construction easements will be acquired and the property owners will be compensated fair market value for the easements obtained. There will be no significant permanent changes in land use once construction is completed.. Properties on which the floodwalls and levees are located will be required to maintain a 15-foot vegetation free zone per USACE Engineering Technical Letter (ETL) 1110-2-583 Guidelines for Landscape Planting and Vegetation Management at Levees, Embankment Dams and Appurtenant Structures. In addition, the ETL 1110-2-583 also requires certain restrictions from property owners from installing permanent structures (e.g. sheds, above ground/underground pools) within the 15-foot vegetation free zone. In addition any portion of land used for riverine and riparian habitat mitigation will be subject to conservation easements that restricts use and development in perpetuity. Permanent easements for maintaining the vegetation free zone and habitat mitigation will be acquired and the landowner will be compensated fair market value for the easement obtained.

In general, the implementation of the proposed action will likely produce long term benefits by reducing flood risk and future damage to residential, manufacturing/ industrial, commercial/ office, transportation/ utilities land uses located within the project area.

The District is proposing to perform offsite stream restoration, and riparian mitigation, and possibly off-site wetland mitigation to compensate for wetland and riparian impacts associated with construction of the floodwalls and levee along the Peckman River and the outlet of the diversion culvert if the mitigation credits cannot be purchased. The District is proposing to use Peckman Preserve to conduct the riparian mitigation, some of the streambank vegetation mitigation and for potential wetland mitigation if mitigation bank credits are unavailable for purchase. The NJ Green Acres Rules typically consider the use of Green Acres encumbered lands for habitat mitigation sites as a change in land use unless the master plan for the subject property includes habitat restoration, creation and/or enhancement. The master plan developed for the Peckman Preserve focuses on passive recreation and includes the creation/restoration of wetlands within the park to enhance such recreational opportunities. Therefore any compensatory wetland and/or riparian mitigation conducted on this site of the project is in conformance with the anticipated land use of the park and is not in conflict with the NJ Green Acre Rules.

Mitigation

Disturbed areas will be restored and returned to pre-construction conditions through grading and native vegetation. A closure gate will be installed in the portion of floodwall located on the high school property to allow access to the baseball field behind the track. Any wetland and/or riparian mitigation performed within the Peckman Preserve will conform to the parks master plan. Property owners will be compensated for any temporary and permanent easements acquired to construct, operate and maintain the project.

5.3 Socioeconomics

The proposed action is not expected to adversely impact the socioeconomic environment of the area. During construction of the diversion culvert and the levee/floodwall, some of the property owners within the project area may be unable to fully utilize their property. Temporary easements will be required for construction and permanent easements will be required for maintenance, inspection and operational requirements. Property owners will be compensated for easements at their market value for the effect on the property.

Long term benefits achieved by the project include flood risk management benefits such as reduced damages to properties including business and residential structures; improved public health and safety; reduced traffic delays; and improved emergency access for the fire department, medical personnel and police protection.

5.3.1 Demographics

Long-term changes to population and demographics are not expected by construction of the proposed action. Residents and businesses located in the structures to be elevated or floodproofed may be temporarily relocated during construction. Residents of the one structure to be acquired will likely be relocated within the local area. Long-term changes to demographics will likely follow state and national trends.

5.3.2 Environmental Justice

Based on the cursory analysis, environmental justice considerations are not applicable to either the Township of Little Falls or the Borough of Woodland Park. Further, analysis of existing available data and coordination with the local stakeholders, have not identified any environmental justice micropopulations within the project area. Therefore, no adverse impacts to environmental justice populations will result from implementation of the project.

5.4 Existing Water Resource Projects

Local stakeholders within the project area have implemented efforts on their own to reduce flood risks. The Township of Little Falls is in the process of buying out residential structures within the municipality. However, these structure buyouts are impacted by Passaic River overbank flooding, not Peckman River flooding. Implementation of the Recommended Plan therefore have no effect on this effort as it is

unrelated to Peckman flooding and these structures are not historically flooded by Peckman River overbank flooding.

The Borough of Woodland Park has bought out several properties within its municipality due to flooding from the Peckman River. Implementation of the Recommended Plan may reduce the need for future buyouts related to Peckman River flooding within Little Falls and Woodland Park.

There have been a few clearing and snagging efforts within the Peckman River within Little Falls and Woodland Park over the years. The Township of Little Falls and Borough of Woodland Park have received a $150,000 grant to buy an excavator to allow Little Falls and Woodland Park to conduct their own snagging and clearing of the Peckman River, subject to engineering approval and the necessary permitting. The next snagging and clearing effort is currently being planned. Implementation of the Recommended Plan would have relatively minimal effects upon shoaling and the buildup of debris requiring clearing and snagging within the Peckman River.

5.5 Infrastructure

The proposed action will produce short term minor adverse impacts on the availability of infrastructure. There are minor impacts associated with construction traffic, construction induced changes to traffic flow and other inconveniences caused by the construction activities. Access to critical infrastructure such as emergency medical services, fire stations and schools will not be blocked due to the plan. Electric power, gas, water, and sewage service (as well as any other utilities) would be temporarily taken out of service during construction periods at individual building sites. This would be in accordance with local and utility codes for community/construction worker safety and fire prevention. Utilities would be returned to normal working conditions as soon as possible after construction completion at each of the proposed structures.

There would be a positive long term impact on infrastructure as a result of the proposed action. Because of the reduction in flood risk, damages to infrastructure would be minimized. Recovery from outages of services and utilities would be quicker due to reduced damages.

5.6 Transportation

Traffic will likely increase during construction as a result of the transportation of construction equipment and materials being transported to the site, as well as workers commuting to the project area.

As a portion of the nonstructural measures are located in residential areas, neighborhoods could experience a short duration of limited on-street parking. Businesses receiving nonstructural measures could experience limited parking space in on-site parking lots as well as on-street parking.

Given that the diversion culvert will cross under Paterson Avenue, a partial or full closure of the road may be required during construction. The construction contractor will develop a traffic plan that will be coordinated with the Township of Little Falls and Borough of Woodland Park to minimize impacts and disruption to traffic to the extent possible.

The nonstructural measures proposed within Little Falls only provide flood risk management to structures. Therefore, roads will continue to be subject to flooding as they are now. This could lead to road closures and detours that could cause traffic delays.

Mitigation

In order to minimize impacts to traffic during construction, traffic control and operations strategies that may be implemented during construction may include:

- Preparing a comprehensive construction traffic management plan. This plan will be developed by the contractor in the Construction phase and will be coordinated with the appropriate municipal and/or county officials and affected property owners as necessary

- Routing and scheduling construction vehicles to minimize conflicts with other traffic
- Strategically locating localized staging areas to minimize traffic impacts
- Establishing detours and alternate routes when it is important to close the work area to perform certain construction tasks or when diverting traffic will substantially reduce traffic volumes

5.7 Water Resources

5.7.1 Surface Water

The implementation of nonstructural measures in the Township of Little Falls will have no impacts to the Peckman River or associated tributaries.

Approximately 1,848 feet of the Peckman River will be modified through channel modifications related to the installation of the diversion culvert weir. Approximately 100 feet of the Peckman River will be converted to concrete as a result of the installation of the concrete weir itself. The remaining 1,748 feet of the Peckman River will be modified through the installation of riprap. In total, up to approximately 1.7 acres of open water within the Peckman River will be impacted. Excavation will be performed to accommodate the riprap and maintain existing bed elevation. There will be minimal excavation along the river banks to create a bank slope of 1V:2.5H, however the average top width of the Peckman River within the footprint of the channel modifications will not be significantly increased.

Base flow conditions were analyzed and confirmed that post construction water depths in the portion of the modified channel will not appreciably change from pre-construction conditions. The Recommended Plan will alter the hydrology of the Peckman River, however, by redirecting flows into the culvert during flood events and discharging the flow approximately 0.6 miles upstream from the Peckman River's natural confluence with the Passaic River. The weir will contain a two foot by six foot orifice to maintain normal baseflows and velocities.

In addition, the District is proposing to, the restoration of approximately 1,848 linear feet of river equaling 1.70 acres of open water habitat via the installation of three bendway weir fields along the outer bends of the river where severe bank erosion is occurring and 0.85 acres of native streambank vegetation. The proposed compensatory mitigation will provide fish and wildlife habitat while providing reducing erosion and sedimentation through bank stabilization. As the compensatory mitigation site is immediately upstream of the , ancillary benefits to its function and overall maintenance requirements may be achieved due to the reduction in erosion and sedimentation. The location of proposed mitigation is immediately upstream of the Recommended Plan footprint. Refer to Appendix A-8 for further information.

In order to minimize sedimentation to the Peckman River during construction activities of the Recommended Plan and compensatory mitigation, cofferdams will be installed so that work can be conducted in dry conditions.

Approximately 0.11 acres of substrate of the Passaic River will be modified as a result of the installation of rip rap at the discharge location of the diversion culvert. There will be no significant changes to the current patterns and flow to the Passaic River as a result of the implementation the diversion culvert.

Mitigation

Discussions of water resources mitigation, monitoring, and adaptive management are described in Section 5.7.2.

5.7.2 Water Quality and Aquatic Habitat

Implementation of the nonstructural measures in Little Falls will not have any impacts on water quality or aquatic habitat.

The diversion culvert will have negligible impacts on water quality and habitat.

Construction of the channel modifications associated with both the implementation of the flood risk management feature and compensatory riverine mitigation in the Peckman River will create short term, minor water quality impacts. With the installation of Best Management Practices, the impacts will be limited to the immediate project area. The existing substrate within the approximate 1,848 feet of channel will be replaced with riprap. The portion of the Peckman River in the vicinity of where the weir is proposed is relatively uniform with no distinct riffle and pool complexes. Uniform flow within the modified channel after construction is expected. However, it is anticipated that the river may form some in-stream meanders and pools as it recovers from the disturbance and the natural sediment deposition process occurs. The time it takes for pool and riffle complexes to re-form after a disturbance is dependent on the system and can range from months to years.

Overall, the significance of long term adverse impacts to water quality and aquatic habitat from implementation of the proposed action is somewhat lessened due to the amount of previous disturbance that the project area has experienced. As an example, approximately 55% of total length of river within the Recommended Plan footprint has undergone some type of alteration in the form of retaining wall and/or riprap installation along the river banks.

The proposed compensatory riverine mitigation comprising of bendway weirs and streambank vegetation will provide foraging, spawning and resting habitat as well as cover. Surveys conducted within the Mississippi River by the USACE St. Louis District in 1997 found higher densities and diversity of fish species within bendway weir fields than in natural, degraded reaches of the River (USACE, 1997). Surveys conducted by others also found that the structures can improve fish and aquatic invertebrate habitat through the establishment and maintenance of pools (Kinzil and Myrick 2009). The streambank vegetation will provide shade, cover and detritus used as food sources and spawning substrate for aquatic species.

The proposed stilling basin will have negligible impacts on aquatic habitat in the Passaic River. The diversion culvert discharges approximately 0.5 miles downstream of the water treatment plant and will not adversely affect the use of the Passaic River as a water supply.

Mitigation

During construction, standard erosion and sediment control Best Management Practices will be implemented to minimize adverse and significant impacts to water quality and aquatic habitat during in-stream work.

For the weir proposed in the Peckman River, a two foot by six foot orifice will be installed to maintain normal baseflows and fish passage.

In accordance with the USACE Civil Works Planning Policy, during optimization of the Recommended Plan, the District utilized the Environmental Protection Agency Rapid Bioassessment Protocols (EPA RBP) stream assessment worksheet to further inform the extent of impacts the Recommended Plan have on the functional value of the affected water resources and to identify the scope of compensatory mitigation required to reduce the magnitude of the impacts to below a significant level.

The EPA RBP stream assessment worksheet is an integral component of the New Jersey High Gradient Macroinvertebrate Index (NJ HGMI) and Northern New Jersey Fish Index of Biological Integrity models that were approved for regional use by the USACE Ecosystem Restoration Planning Center of Expertise in February 2014. Stream restoration measures that were evaluated during optimization include stabilization of eroded streambanks with native vegetation and the installation of in-channel structures called bendway weirs that are used to create pool and riffle complexes and direct flow away from

streambanks to reduce erosion. Based on the incremental cost analysis, the most cost effective plan identified the restoration of 1,848 linear feet of freshwater riverine system to include 0.77 acres of riparian zone.

Refer to Appendices A-8 and A-9 for further discussion regarding compensatory mitigation alternative selection process for water resources.

Monitoring and Adaptive Management

NJDEP, as the administering authority of Section 404 of the Clean Water Act, requires a minimum monitoring period of five years of any compensatory mitigation constructed. Therefore, the District will conduct monitoring for a minimum of five years not to exceed 10 years. Refer to Appendix A-10 for monitoring protocols and potential adaptive management measures.

5.7.3 Wetlands

The implementation of nonstructural measures in the Township of Little Falls, will have no adverse impacts on wetland resources.

The District has not conducted formal wetland delineation surveys in the project area and will not be conducting delineations until the PED phase. In absence of such surveys, the District utilized wetland mapping available on New Jersey Geoweb, U.S. Fish and Wildlife National Wetland Inventory mapping and a wetland delineation conducted by the Town of Little Falls on a tract they own within the levee alignment. to determine potential wetland impacts.

Approximately 0.48 acres of forested wetland will be permanently adversely impacted through direct fill to construct the channel modifications and levee. This impact will be compensated for to reduce the impact to insignificant. Further discussion of the compensatory mitigation is below in the Mitigation section. Approximately 0.71 acres of forested wetlands will be temporarily impacted as a result of levee/floodwall construction and the channel modifications related to implementing the Recommended Plan. The 0.71 acres will be restored following construction completion. Therefore, adverse impacts are minor.

Based on field investigations and a review of the topography overlain on the Township of Little Falls commissioned wetland delineation, the wetlands are hydrologically connected to a tributary of Great Notch Brook and are not hydrologically connected to the Peckman River. Therefore, indirect adverse impacts to the wetland complex as a result of the levee are not expected.

Approximately 0.85 acres of streambank vegetation will be removed during construction of the channel modification and will not be restored in order to maintain project function, maintenance and inspection. The majority of the vegetation is comprised of invasive species such as Japanese knotweed and tree of heaven. Off-site compensatory mitigation in the form of 0.85 acres of restoring native vegetation to streambanks will reduce the impact to insignificant. Refer to the Mitigation section below for further discussion.

Mitigation

During optimization, the location of the levee was moved closer to the Peckman River to reduce the direct impacts to the forested wetland complex within the tract of land behind the high school.

The temporary impacts to wetland resources during construction will be mitigated through on-site restoration by re-establishment of native vegetation and vegetation supportive of pollinator species (e.g. bees, monarch butterfly), and restoration of topography to maintain the hydrology of the site.

To compensate for the permanent loss of the 0.48 acres of forested wetland habitat the District will either purchase mitigation credits from a New Jersey State approved wetland mitigation bank, conduct off-site compensatory mitigation, or use a combination thereof. The Pio Costa wetland mitigation bank currently operates within the service area in which the Peckman River is located. The District will purchase mitigation credits from the bank during the PED phase pending availability.

In the event that forested wetland mitigation credits are unavailable for purchase from either the Pio Costa wetland mitigation bank or from another state approved mitigation bank, the District is proposing to conduct off-site compensatory mitigation.

Federal mitigation rules typically require wetland compensation to be consistent with a minimum of 1:1 ratio based on functional value using ecological models. However, as the anticipated wetland impacts will be less than one acre, as coordinated within HQUSACE, the District will utilize ratios to determine the compensatory mitigation amount. The NJDEP is the administering authority of the Section 404 of the Clean Water Act and utilizes a ratio based system of compensatory wetland mitigation.

Therefore, should off-site compensatory mitigation option be necessary, the District will follow the NJDEP ratio of 2:1 to create/restore 0.96 acres forested wetland habitat within the Peckman River Watershed. The District had proposed utilizing the Peckman Preserve in the May 2018 DIFR/EA based on initial coordination with NJDEP Green Acres staff. The NJDEP submitted a letter dated June 5, 2018 commenting on the May 2018 DIFR/EA (Appendix A-7), which included a reaffirmation for the possible use of the Peckman Preserve provided that Passaic County as the landholder submit for a Change in Use. Subsequently during the review of the October 2019 Revised DIFR/EA, the NJDEP submitted updated comments via a letter dated November 27 2019 letter (Appendix A-7) stating that after Departmental review of the current New Jersey Freshwater Wetland Rules, it was determined that the Rule prohibit the use of Green Acre encumbered lands for wetland mitigation. As a result, should a mitigation bank not be available at the time mitigation is required, the District will work with NJDEP to identify an appropriate site that complies with all state rules and meets the objectives of wetland mitigation.

Regarding mitigation for streambank vegetation, an incremental cost analysis (ICA) determined that restoring 0.85 acres of streambank with native vegetation is the most cost effective plan. Refer to Appendices A-8 and A-9 for further discussion on mitigation and the ICA process.

Monitoring and Adaptive Management

Monitoring of the on-site mitigation for temporary wetland disturbances and any off-site compensatory mitigation will be conducted on a bi-annual basis for a minimum of five years. Criteria evaluated to determine success includes evaluating hydrological and soil conditions, measuring tree and shrub growth, and comparing percent areal coverage of native vegetation with invasive vegetative species. Depending on the results of the monitoring efforts, adaptive management techniques will be employed to ensure success of the mitigation. Refer to Appendix A-10 for the full description of the monitoring procedures and potential adaptive management measures that could be used to achieve mitigation success.

5.8 Vegetation

5.8.1 Uplands and Riparian Zone

Upland Vegetation

During construction of the nonstructural measures, any clearing of vegetation will be limited to what is necessary to construct the specific measure. Therefore, vegetation immediately adjacent to the structure receiving non-structural treatments may need to be removed. This impact is expected to be negligible

and no mitigation is proposed. The disturbed area will be reseeded with native grass species following construction completion.

Approximately one to 1.5 acres of upland forest will be cleared to construct the levee along the Peckman River and the 15 foot vegetation free zone on either side of the levee. As the upland vegetation being impacted does not serve as an immediate transition area to wetlands and the USACE does not have a policy requiring the compensation of loss of upland vegetation, no compensatory mitigation is proposed.

Riparian Zone Vegetation

Approximately 2.14 acres of riparian zone vegetation will be removed during construction of the floodwalls along the Peckman River and the channel modifications. Approximately 1.37 acres of the impacted riparian zone will be restored on-site following completion of the channel modification construction. The remaining 0.77 acres will be compensated through offsite restoration at the Peckman Preserve.

Mitigation

Upland Vegetation

Any temporary disturbance to upland vegetation will be compensated through general on-site restoration of native plantings and plantings that support pollinator species where appropriate.

Riparian Zone

New Jersey Flood Hazard Area Control Act (NJFHACA) requires mitigation for impacts to riparian zone resources. The 2008 Final Rule for Federal Compensatory Mitigation for Losses of Aquatic Resources and the USACE's Civil Works Planning Guidance Notebook provide pathways for riparian zone mitigation as part of an overall watershed approach. The District will evaluate the appropriate level of compensatory riparian zone mitigation that may be required during optimization of the Recommended Plan. Per the NJFHACA Rules, riparian zone mitigation can consist of the following:

- Removal of any impervious surface within 100 feet of streambank
- Herbicide application for invasive species management
- Clearing/grubbing of invasive plant species
- Planting native trees and shrubs within 100 feet of streambank

Approximately 1.37 acres of riparian zone will be restored on-site after construction of the channel modifications. For the remaining 0.77 acres that cannot be mitigated for on-site, the District completed an ICA that determined that restoring 0.77 acre of riparian zone meets the no net loss objective. Refer to Appendices A-8 and A-9 for discussions of the impact and mitigation assessment and the ICA. The District is proposing to perform the off-site compensatory riparian mitigation within the Peckman Preserve.

The State also allows for the purchase of riparian zone credits from state approved mitigation banks. There are currently no riparian mitigation banks that operate within the service area in which the project is located. However, the District will evaluate the status of such banks during the PED phase.

Monitoring and Adaptive Management

As no compensation for upland vegetation is proposed, any vegetation planted as part of general site restoration will be subject to the USACE's standard one year contractor warranty period. During this time, the construction contractor will be required to perform activities such as watering and weeding to ensure survivability of the plant material. The District will inspect the vegetation for successful establishment and the contractor will be required to replace any plant material that has not survived during this one year warranty period. As the replanting is part of general site restoration and not compensatory mitigation, no other post construction monitoring or adaptive management actions are proposed.

For compensatory riparian mitigation, in addition to the one year contractor warranty period, vegetation the District will monitor the vegetation biannually in the spring and fall for a minimum of five years as required by the NJDEP. Monitoring will not exceed 10 years. Refer to Appendix A-9 for full description of the monitoring procedures and potential adaptive management measures that could be employed to achieve mitigation success.

5.8.2 Wetlands

Given that none of the nonstructural measures proposed in the Township of Little Falls will occur in wetlands, there will be no adverse impacts to wetland vegetation.

The construction of the levee and the 15 foot vegetation free zone along the Peckman River and installation of the stilling basin along the right bank of the Passaic River may convert approximately 0.48 acres of mature forested wetland vegetation to maintained lawn and rip rap. Approximately one acre of forested wetland vegetation may be cleared for construction of the levee along the Peckman River. This would be considered a temporary impact.

Mitigation

As mentioned in Section 5.7.3, compensatory wetland mitigation options include either the purchase of wetland mitigation credits or off-site compensatory mitigation through the creation and/or restoration of forested wetlands. Should the District construct an off-site compensatory wetland site, native wetland vegetation will be used. Refer to Appendix A-9 for full description of proposed mitigation.

Monitoring and Adaptive Management

In addition to one year contractor warranty period, vegetation planted as part of wetland mitigation will be monitored by the District for a minimum of five years not to exceed 10 years. Monitoring and adaptive management of wetland vegetation is discussed in Appendix A-8.

5.8.3 Invasive Species Management

Within the project area, Japanese knotweed is the dominant invasive plant species and will require a comprehensive management plan to prevent its unintended spread to other locations outside the immediate project footprint during construction.

The comprehensive management plan will be developed during the PED phase and will outline measures to be taken immediately before, during and after construction. Types of measures that will be assessed include: 1) herbicide applications followed by mowing and/or excavation of Japanese knotweed before initiating construction; 2) implementing proper disposal techniques such as bagging waste containing plant parts; and 3) inspection and removal of any plant parts on equipment to prevent the accidental dispersal of it to other construction sites.

The non-Federal sponsor is ultimately responsible for the long term management of the mitigation site to assure its success once the District has determined that the mitigation site has achieved the mitigation objectives and concludes its involvement with the site. During the PED phase, the District will work with the non-Federal sponsor to identify potential local environmental groups that could assist the non-Federal sponsor in continuing any necessary monitoring and management of invasive plant species.

During the post construction monitoring period of the open water and wetland mitigation, it is assumed there will also be adaptive management actions such as herbicide applications occurring to ensure success of the mitigation.

5.9 Aquatic Resources & Wildlife

5.9.1 Fishery Resources

Implementation of the nonstructural measures in Little Falls will have no temporary or permanent beneficial or adverse impacts to fishery resources.

The construction of the weir and channel modifications within the Peckman River is expected to have temporary adverse impacts to fishery resources due to noise and turbidity from equipment operating in the stream and along the banks. The turbidity caused by construction activities could hinder predation efficiency of sight feeding fish within the river. However, any juvenile or adult fish within the project area are expected to be mobile enough to leave the area. In addition, the initial loss of aquatic macroinvertebrate species resulting from channel modifications will eliminate a food source for fish until the area is recolonized by macroinvertebrate species.

During flood events, fish may be carried into the diversion culvert. The diversion culvert is sloped to facilitate complete drainage, therefore it is not expected that fish will become trapped in the culvert as the water level recedes once in the culvert following storm events.

The majority of species caught during fish surveys are tolerant of degraded water quality and habitat. Subsequent of construction completion, the species most tolerant of impaired conditions are expected to be the first to utilize the area. In addition, although the substrate of the Peckman River is predominantly comprised of cobble and gravel with areas of boulders, the uniform nature of riprap is expected to cause a shift in the type of species that inhabit the channel modification segment to those that are more adapted to hard substrate. Such species include bluegill, sunfish and white sucker, and largemouth bass (Fischenich, 2009) (Wang and Reyes, 2008).

Construction of the riverine mitigation is expected to have similar temporary adverse effects to fish as the construction of the Recommended Plan channel modification. However, long-term benefits to fish species are anticipated from the implementation of the riverine mitigation.

The stilling basin located at the culvert outlet in the Passaic River is not expected to have any long term negative adverse impacts on fishery resources.

Mitigation

The use of erosion and sediment control best management practices will minimize sedimentation and turbidity that can negatively impact fish species and their habitat. In addition, an in-water work restriction from May 1 through July 31 as recommended by the New Jersey Division of Fish and Wildlife will be observed. The in-water work restriction will be extended to April 1 through July 31 if pickerel are present. This determination will be made by pre-construction fish surveys that will be done as part of creating baseline conditions to determine the success of riverine compensatory mitigation measures. A two foot by six foot wide orifice will be installed within the weir to maintain fish passage.

The bendway weirs and streambank vegetation proposed as compensatory riverine mitigation will enhance foraging, resting and spawning habitat for fish species. Further discussion of the mitigation measures are located in Section 5.7.2 and Appendix A-8.

Monitoring and Adaptive Management

The District will monitor the recovery of fishery resources annually for a minimum of five years using the NNJ FIBI as described in Section 5.7.2 and in Appendix A-9.

5.9.2 Benthic Resources

Implementation of the nonstructural measures in Little Falls will not have any adverse impacts on macroinvertebrate species.

Construction of the channel modifications within the Peckman River will have moderate impacts to benthic species. Mortality of aquatic macroinvertebrates as a result of the excavation of the channel and the installation of the riprap along the channel bottom and side slopes will occur. Temporary increases in turbidity and suspended sediments near and downstream of the construction activities could cause direct mortality or indirect decreased reproductive success in benthic species of the short-term. The conversion of the channel bottom and side slopes to riprap and In addition, loss of streambank vegetation, however modest, will represent a loss in food supply, cover and spawning material.

Recolonization of disturbed river channels by aquatic invertebrates is site specific and is dependent on factors such as the proximity of a source of colonizers, the stability of the substrate and other physical conditions. Typical colonization methods include oviposition, drift or crawling and in general can occur within a few months to one year (Giller, 1998)(Simpson, Keirn, Matter and Guthrie, 1982). As the riverine compensatory mitigation site is immediately upstream of the channel modification and will also need to undergo recolonization following construction, the recruitment process for the channel modification is expected to take closer to the one year timeframe. Although the substrate of the Peckman River is predominantly comprised of cobble and gravel with areas of boulders, the uniform nature of riprap is expected to cause a shift in the type of species that inhabit the channel modification segment to those that are more adapted to hard substrate. Such species include midges and caddisflies (Miller and Bingham, 1991)(Fischenich, 2009).

As with the construction of the channel modifications, mortality of aquatic macroinvertebrates will result from excavation and fill activities related to construction of the bendway weir fields as well as the streambank vegetation. The recolonization process within the compensatory mitigation site is expected to occur within a few months due to recruitment from undisturbed portions of the mitigation site.

Mortality of benthic species within the immediate footprints of the stilling basin within the Passaic River is expected during construction activities. However, this impact is expected to be negligible.

Mitigation

The use of erosion and sediment control best management practices will minimize sedimentation and turbidity that can negatively impact benthic resources and their habitat. In addition, the in-water work restriction from May 1 through July 31 required by NJDEP to protect fishery resources will provide similar protection to any benthic resources that also spawn during this timeframe. During optimization, the District will evaluate ways riprap can be installed to create habitat for aquatic macroinvertebrates. For example, riprap may be sized and placed in a manner to create interstitial spaces that these species use to as refuge during flood events. The bendway weirs and streambank vegetation proposed as compensatory riverine mitigation will enhance foraging, resting and spawning habitat for benthic resources.

Monitoring and Adaptive Management

The District will monitor the recovery of aquatic macroinvertebrates on an annual basis for a minimum of five years using the NJ High Gradient Macroinvertebrate Index as described in Section 5.8 Water Quality and Habitat. A survey will be conducted prior to construction to establish baseline conditions. Adaptive management measures related to macroinvertebrate habitat are also described in Appendix A-9.

5.9.3 Birds

The construction of the Recommended Plan and any associated mitigation will create short-term minor adverse impacts to migratory bird species. However, since bird species are highly mobile, they are expected to move away from the project area during construction. Furthermore, outside the breeding season these species do not permanently remain in any one location. Implementation of vegetation clearing restrictions will benefit ground and tree-dwelling migratory birds during the breeding season. Therefore, adverse impacts to migratory bird species are expected to be short term and minor, limited to

the period of construction. Following construction, bird species are expected to resume their normal habits consistent with post-construction habitat availability in and within the vicinity of the project area.

Mitigation
In order to comply with the Migratory Bird Treaty Act, a clearing restriction of shrubs and trees from April 1 through August 31 will be implemented during to avoid adverse impacts to any potential nesting birds that are covered under this act. The proposed riparian, streambank restoration, and wetland mitigation will benefit birds by restoring or enhancing foraging, shelter and nesting habitat.

Monitoring and Adaptive Management
Riparian zone and wetland mitigation will be subject to monitoring for a period of five years to ensure that success of the mitigation. Refer to Section 5.8 for the discussion of monitoring and adaptive management measures requirements. No specific monitoring plan will be developed for birds. However, bird species observed during mitigation monitoring investigations may be documented.

5.9.4 Mammals
Implementation of the nonstructural measures in Little Falls will not have significant temporary or permanent long term adverse effects to mammals.

Construction activities associated with the channel modifications and the levee construction along the Peckman River will result in temporary disturbance of habitat (e.g. vegetation and tree removal) that may cause the temporary displacement of these species due to increased human activity and habitat alternations. There is also a possibility of mortality to less mobile, burrowing and/or denning species of mammals. Tree clearing restrictions implemented to protect migratory bird and endangered and threatened bat species will provide some protection for tree-dwelling mammal species. Following construction, mammals are expected to resume their normal habits consistent with post-construction habitat availability in and within the vicinity of the project area.

The conversion of wetland and upland forest habitat to construct the levee along the Peckman River to maintained lawn will represent a long-term loss in a habitat type within the immediate project area. However, the majority of species inhabiting the project area are generalists that are adapted to a wide range of environmental conditions. In addition, off-site compensatory mitigation conducted by the District will provide habitat for these species. Therefore, significant adverse permanent impacts are not expected.

Mitigation
The re-establishment of upland, riparian and wetland vegetation as described in Sections 5.7 Wetlands and 5.8 Uplands and Riparian Corridor will provide foraging and cover habitat supportive of wildlife.

Monitoring and Adaptive Management
No specific monitoring plan will be developed for mammals. However, species observed during mitigation monitoring field investigations may be documented.

5.9.5 Reptiles and Amphibians
Implementation of non-structural measures within the project area will not have significant adverse temporary or permanent impacts on amphibian or reptile species.

The diversion culvert is located in disturbed upland habitat and will not adversely affect reptile and amphibian species. In addition, the stilling basin proposed along the right bank and riverbed of the Passaic River is small compared to the available habitat. Therefore, adverse effects will be negligible.

The use of the area located within the footprint of the levee along the Peckman River by reptile and amphibian species is not well documented. Construction activities to replace the levee and mitigation may cause mortality of individuals or less mobile species that reside in the project area. More mobile species will be temporarily displaced from the area and are expected to relocate to other, undisturbed locations of the project area. Following construction, reptile and amphibian species are expected to resume their normal habits consistent with post-construction habitat availability in and within the vicinity of the project area. Long term impacts from the levee along the Peckman River include effects on movement patterns of some amphibians and reptiles, and loss or modification of habitat. However, given that the levee is inset from the river the impacts will be minor.

Mitigation

The re-establishment of wetland, upland and riparian vegetation as described in Sections 5.7 and 5.8 will provide foraging and cover habitat supportive of reptiles and amphibians.

Monitoring and Adaptive Management

No specific monitoring plan will be developed for reptile and amphibian species. However, species observed during mitigation field surveys may be documented.

5.10 Threatened & Endangered Species

5.10.1 Federal Endangered, Threatened & Special Concern Species

The implementation of non-structural measures in the Township of Little Falls will not have any short term or long term adverse impacts to Federally endangered and threatened bat species or bald eagle. Although any tree clearing will be minimal, a tree clearing restriction from April 1 through September 30 will be implemented during construction to minimize any adverse impacts to these species during construction.

Tree clearing activities in the forested tract where the levee along the Peckman River is proposed could potentially remove Indiana bat and northern long eared bat summer roosting habitat. This is especially the case since northern long-eared bat maternity colonies are known to occur in the Borough of Woodland Park. In order to avoid adverse impacts to both species, a tree clearing restriction will be implemented during construction. This is a standard protocol in this region that does not require formal consultation with the USFWS. Informal ESA Section 7 consultation was completed as part of the Fish and Wildlife Coordination Act (FWCA) Report. USFWS concurred with the proposed tree clearing restrictions that will be implemented during construction in their Final FWCA Report dated October 30, 2018. Refer to Appendix A-4 for further information.

Because a known bald eagle nests are within approximately five miles from the project area, and bald eagles have been observed within and near the project area, the District will continue coordinating with the USFWS during PED and construction. If deemed warranted, the District will include recommendations for avoiding disturbance at foraging areas and communal roost sites as outlined in the National Bald Eagle Management Guidelines in the construction specifications. Should the guidelines be required and it is determined during construction that the recommendations cannot be followed, the District will initiate further consultation with the USFWS.

Mitigation

A tree clearing restriction extending from April 1 through September 30 will be implemented during construction to protect the Indiana bat and northern long eared bat. Alternatively, if clearing must occur within this timeframe, informal consultation with the USFWS will occur to determine if a presence/absence survey is required. A preference to tree species that provide roosting habitat for Indiana bat and northern long eared bat will be given during the development of mitigation plans.

Adherence to the April 1 through July 31 tree and shrub clearing restriction during will protect any bald eagles within project area. In addition, the District will continue to coordinate with the USFWS to determine if recommendations for avoiding disturbance at foraging areas and communal roost sites as outlined in the National Bald Eagle Management Guidelines will be required during construction.

The re-establishment of native vegetation within the project area and mitigation sites will restore bat and bald eagle habitat.

5.10.2 State Endangered, Threatened & Special Concern Species

Per NJDEP, there are no known occurrences of state-identified threatened or special concern species nor are there critical habitats within the project area. However, State endangered, threatened and special concern bird species may occur as transients within the project area. Impacts associated with the project area are similar to what was discussed in Section 5.10.1.

Mitigation

The April 1 through August 31 tree and shrub clearing restriction associated with Migratory Bird Treaty Act compliance will prevent adverse impacts to any state endangered, threatened and special concern species. A preference to tree species that provide roosting habitat for Indiana bat and northern long eared bat will be given during development of mitigation plans.

Monitoring

No post construction monitoring will be conducted for any State endangered, threatened, or special concern species.

5.11 Hazardous, Toxic & Radioactive Waste

Based on the review of the databases and the results of the geotechnical survey and associated soil testing, there are no anticipated impacts to the project elements from HTRW. The structural measures can be constructed with minimal additional protocols for excavation and movement of the lead impacted soil. The SVOA impacted soils should not need additional protocols during excavation. Prior to construction, additional soil borings may be taken to the areal extent of the lead impacted soil or at other segment locations not previously subjected to soil borings to determine if additional management controls are required.

In accordance with ER 1165-2-132 “HTRW Guidance for Civil Works Projects,” if additional soil borings indicate the existence of any materials regulated by CERCLA within the project area that would be affected by construction, any necessary actions to remove these materials would be the responsibility of the non-Federal sponsor and are a full non-Federal cost. The non-Federal sponsor would be required to remove these materials prior to any construction activities being undertaken within the identified contaminated area.

According to USACE policy, no elevation or floodproofing can occur to structures with asbestos, ACM, or LBP if the proposed actions may affect these contaminants. Prior to any actions being conducted, the asbestos, ACM, or LBP that may be disturbed by the elevation or floodproofing activity must be removed. For all structures proposed for nonstructural activities, an asbestos investigation will be conducted to confirm the presence/absence of damaged or friable asbestos, ACM, or LBP. If damaged or friable asbestos, ACM, or exposed LBP are confirmed on a property and will be impacted by the implementation of nonstructural measures, the property owner and/or non-Federal sponsor will be obligated, at their sole expense, to conduct all necessary response and remedial activities in compliance with all applicable local, state, and Federal laws and regulations. Asbestos, ACM, and LBP that would not be affected by construction of the recommended nonstructural element(s) would not need to be removed prior to construction.

5.12 Cultural Resources

The Area of Potential Effect (APE) for the Recommended Plan represents the physical extent of the undertaking within which direct and/or indirect effects of the construction, operation and maintenance of the project, could be caused to the character or use of a historic property. For this project, the APE consists of the locations of the levees, floodwalls, diversion culvert, weir, and structures for floodproofing (see Figure 40). Currently no staging areas have been identified but those areas would be considered part of the APE as well. In addition, if wetland or other required mitigation cannot be accomplished within the bounds of the current proposed project, the mitigation locations outside the project area will form an additional APE or expand the current APE.

As currently proposed, the Recommended Plan will have no effect on the Marley Mill Dam site, the New Jersey Waterworks Valve House, or the Morris Canal Aqueduct alignment and extant features would also not be effected. Non-structural measures are proposed for homes in the vicinity along Cedar Grove Road and Charles Street, however the Morris Canal Aqueduct will not be affected by those measures. The Recommended Plan will also have no adverse effect on the Route 46 Bridge.

The channel modification and installation upstream and downstream of the Route 46 Bridge would not have an adverse effect on archaeological sites. The geotechnical survey indicated that this area has been disturbed therefore intact archaeological remains are not likely to survive within the APE for these features of the project.

The wooded area upstream of the Route 46 Bridge, adjacent to the shopping mall on the right bank of the Peckman River and the Little Falls High School were not included in the Phase I survey. As currently proposed, a levee/floodwall would be constructed in this area. Prior to any construction, a Phase I cultural resources survey will be required in this area. If any potentially eligible archaeological sites are identified, a subsequent Phase II would be required as well. Coordination with the NJHPO and any identified interested parties would be conducted to determine if sites can be avoided or if avoidance is not possible, to minimize or mitigate any adverse effects from the project (see Appendix A-5).

Along the culvert alignment from the Peckman River to the Passaic River, the geotechnical survey and shovel tests indicated no potential to recover intact archaeological deposits. One location, however, near the Passaic River under an existing parking lot, was not surveyed. This area will require mechanically assisted archaeological investigations during the Pre-construction, Engineering, and Design (PED) phase to determine if intact archaeological deposits are present and to conduct additional testing as necessary (see Appendix A-5).

As currently proposed, the Little Falls Laundry may be affected by the proposed non-structural measures. As part of the pre-construction, engineering and design, the nature of the proposed non-structural measures will be developed and continued coordination with the NJHPO will be conducted to avoid, minimize and/or mitigate potential adverse effects to the historic property (see Appendix A-5).

Based on the Phase I survey, the houses and commercial structures included in the survey, with the exception of the Little Falls Laundry, are not eligible for the National Register of Historic Places. It is assumed that the survey, which focused on the Township of Little Falls, surveyed the buildings and structures proposed for non-structural measures. If any buildings and/or structures identified for non-structural measures were not included in the Phase I survey, an additional survey will be required to determine the affected buildings' eligibility and the effect, in coordination with the NJHPO, the proposed measure would have on any historic properties if identified (see Appendix A-5).

Mitigation

In accordance with Section 106 of the NRHP and its implementing regulations (36 CFR 800) the District is addressing potential adverse effects to historic properties through a Programmatic Agreement (PA). A

preliminary draft Programmatic Agreement was prepared and released for public review and comment in 2018 with the DIFR/EA (see Appendix A-5). A revised draft PA based on the updated TSP and Recommended Plan has been coordinated with the NJSHPO and was provided to the Delaware Tribe of Indians, the Delaware Nation, and the Little Falls Historical Society for review and comment. The PA has since been revised based on comments received from the NJSHPO Requirements of the draft Programmatic Agreement currently include:

- Archaeological testing of the alignment of the levee that was not included in the Phase I survey as well as staging and access and mitigation areas;
- Archaeological testing of a portion of the diversion culvert in the vicinity of the parking lot along the Passaic River;
- Determination of effect of non-structural measures proposed at the Little Falls Laundry and efforts to avoid, minimize and/or mitigate any potential adverse effect;
- Additional archaeological and/or architectural investigations, as necessary, to identify and evaluate, if identified: 1) archaeological sites that might be affected by the construction of the project including the elevation of homes and construction of access roads and staging areas; and 2) buildings and structures not included in previous surveys; and
- Continued coordination with, at a minimum, the NJHPO and identified interested parties.

The PA will guide the actions the District will take through the Pre-Construction Engineering and Design and Construction phases of the project to ensure impacts to historic properties are avoided, minimized or mitigated and that the work is carried out in consultation with the NJSHPO and other identified consulting parties.

5.13 Recreation

The nonstructural measures in Little Falls will have no beneficial or adverse impacts on recreation. Because nonstructural measures are the only flood risk management measure being proposed in the Town of Little Falls, the Peckman Preserve will still be subject to flooding. No improvements to the park have been made since its acquisition in 2005 and conceptual plans.

The alignment of proposed diversion culvert is located within existing tennis courts and a baseball field that are part of the Township of Little Falls Recreation Center. These recreational amenities will be unavailable for use during construction. A cut and cover method will be employed, therefore the baseball field and tennis courts will be restored once construction is completed. The Little Falls Recreation Center is outside of the one percent floodplain and is not a candidate for nonstructural measures. Therefore the Recommended Plan will not have any long term beneficial effects.

The Peckman River does not support any water-based recreation within the project area. In addition, it does not support any recreational or commercial fisheries. There are no access points for recreational fishing with the proposed footprint of the diversion culvert weir and channel modifications.

The Passaic River is supportive of water based recreation such as canoeing or kayaking. A boat launch is located along the Passaic River approximately 1.5 miles upstream of the discharge location of the proposed diversion culvert. However, the Beattie Dam serves as a barrier preventing boaters from traversing downstream towards the project area. The Passaic River is stocked with northern pike, a recreational fish species, within the vicinity of the discharge location of the diversion culvert. However, there are no access points for recreational boating and/or fishing within the proposed discharge location. Therefore, the Recommended Plan will not have significant adverse impacts on water related recreation.

Mitigation

Specific mitigation measures that will be evaluated may be implemented to reduce the limited short-term and long-term effects of the Recommended Plan on recreation include:

- Situating construction access and staging areas away from the park facilities such as the tennis courts and athletic fields to the greatest extent practicable. This evaluation will occur during the Preconstruction Engineering Design Phase
- Erecting temporary fences and other physical barriers to control movement through construction areas and maintain a safe distance for pedestrians
- Installing signage that informs residents and others using affected recreational spaces of the proposed action's purpose and closure duration

5.13.1 Green Acres Program

Under the Green Acres program, lands obtained or developed with Green Acres funding and lands held by a local government for recreation and conservation purposes must permanently remain in use for recreation and conservation purposes. In general, lands subject to the rules of the program cannot be disposed of or diverted unless it can be demonstrated to the State that the modification will protect or enhance the use of the area. By definition in the Green Acres Rules, land that is used for purposes other than recreation and conservation is considered a "diversion" while a "disposal" is the selling, donating, or some other form of permanent transfer of possession of parkland.

As mentioned in Section 2.14, the Little Falls Recreation Center is encumbered by Green Acres Rules. Although the diversion culvert will be underground, Green Acre encumbrances include the sub-surface. Based on comments received by Green Acres Program staff during the 30 day review of the 2018 DIFR/EA, the sub-surface impact from the diversion culvert would constitute as a diversion that would require compensation.

The Green Acres encumbered parcel near Turnberry Court is currently anticipated to be used for access to construct the channel modifications. The impact will be temporary in nature and will be restored with native vegetation upon completion of the project. Although it is not expected to be considered a diversion, further coordination with Green Acres Program staff will be required in PED Phase.

No structural or nonstructural measures will be implemented within or adjacent to the Peckman Preserve. As a result, the park will continue to be inundated during flood events. However, as the park is meant for passive recreation, no long term adverse impacts are expected.

The District is proposing to utilize the Peckman Preserve to, streambank restoration, and riparian mitigation to compensate resource impacts associated with the floodwalls and levee along the Peckman River and the outlet of the diversion culvert. The NJ Green Acres Rules typically consider the use of Green Acres encumbered lands for habitat mitigation sites as a change in land use unless the master plan for the subject property includes habitat restoration, creation and/or enhancement.

The master plan developed for the Peckman Preserve focuses on passive recreation and includes the creation/restoration of wetlands within the park to enhance such recreational opportunities. Therefore the streambank restoration and riparian mitigation proposed on this site of the project will be in conformance with the anticipated land use of the park and is not expected to be in conflict with the NJ Green Acre Rules. The proposed compensatory mitigation work at the Peckman Preserve will enhance the passive recreational opportunities at the park and will be in conformance with the master plan of the park. Further coordination with Passaic County as the owner of the Preserve and NJ Green Acres Program staff will occur in the PED phase.

Mitigation

Typically, compensation for diversions are in the form of replacement and or monetary compensation. As applications for diversions are the responsibility of the municipality, the District will coordinate with the Township of Little Falls and representatives from the Green Acres Program during the PED Phase to

verify if compensation for the impact the culvert will have on Green Acres encumbered land will be required.

Disturbed areas will be restored and their use returned to pre-construction conditions. The wetland and riparian mitigation performed within the Peckman Preserve will conform to the master plan for the park.

5.14 Aesthetics & Scenic Resources

The construction of the Recommended Plan will have short-term minor and long-term adverse impacts to aesthetics. In the short-term, the presence of construction equipment and active construction activities throughout the project area will result in minimal temporary impacts to each construction site's immediate aesthetics and scenic resources. However, the majority of the proposed action is located in areas comprised of business and industrial land use.

Negligible to potentially minor effects to aesthetics may occur through the implementation of nonstructural measures within the project area. For structures where elevation is proposed, the average height from ground level is four feet which could potentially make the structure more prominent within the viewshed. In addition, the structures that have been deemed as candidates for elevation may be intermingled with structures where a different nonstructural measure has been identified as appropriate. This will result in non-uniformity in overall structure height within the neighborhood. However, the measures proposed are necessary to provide the required flood risk management benefits. Nonstructural measures that effect the exterior of the homes, including elevation, will be implemented in a manner that compliments the structure and overall character of the neighborhood.

The levee and floodwall will have minor adverse effects to aesthetics and will mostly be visible high school and the several residences along Browertown Road near the far eastern segment of the proposed levee No vegetation is proposed on the high school property to act as a screen for the levee and/or floodwall. However, the levee will be stabilized with grass and stamped concrete and/or paint can be applied to the floodwall to enhance its aesthetics.

The channel modifications to the Peckman River will give the river an engineered appearance. Vegetation along the top of banks within the riparian zone will be restored to help reduce the visual impact. This impact will be greatest immediately after construction, but will reduce over time as vegetation matures. In addition, the aesthetics of the project area are already reduced to a degree by sediment deposition, eroded river banks and existing armoring measures implemented to reduce erosion. Therefore, the impact is considered minimal. The stream restoration measures proposed as compensatory mitigation for the channel modifications will enhance aesthetics through the stabilization of eroded streambanks with native vegetation.

The diversion culvert will be underground. Therefore, once construction is completed, the area will be restored to previous conditions. The proposed weir within the Peckman River is located in an area where the land use consists of a car dealer parking lot and the Little Falls municipal department of public works yard. Therefore, the impacts to aesthetics will be negligible.

The portion of the Passaic riverbank where the rip rap stilling basin is proposed is located near a parking lot. The viewshed of the stilling basin from the opposite bank is obscured by mature vegetation along the opposite bank as well as a vegetated a gravel bar that has formed in the river. In addition, there are no structures located on the opposite bank that could potentially see the stilling basin. Therefore, no long term adverse impacts to aesthetics are expected.

The bendway weirs and live stakes will initially have an engineered appearance following construction. However, over time (approximately two years), a more natural appearance will occur as sediment accumulates within the weirs and the vegetation grows. Overall, the proposed wetland, in-stream and

riparian mitigation will enhance the aesthetics of the project area by replacing invasive vegetative species with native species and reducing streambank erosion. Therefore, impacts to aesthetics are insignificant.

Mitigation

Mitigation measures that will be implemented to minimize impacts to aesthetics include:

- Replanting disturbed areas outside of the 15-foot vegetation free zone associated with the floodwall/levee with native vegetation. The District will consider the use of tree stock ranging from 8-14 foot in height in lieu of saplings; and
- Stabilizing the levee with grass.

5.15 Air Quality

The project will produce temporary localized emission increases from the diesel powered construction equipment working onsite. The localized emission increases from the diesel-powered equipment will last only during the project's construction period and then end when the project is over, thus any potential impacts will be temporary in nature.

As stated in the Air Quality Section (Section 2.17), Passaic County has been designated as: 1) a 'moderate' nonattainment area for the 2008 8-hour ozone standard; 2) in maintenance for the 2006 PM2.5 standard; and 3) in maintenance of the 1971 CO standard. The County is part of a larger Ozone Transport Region. Ozone is controlled through the regulation of its precursor emissions, which include NOx and VOCs. VOCs are emitted at a fractional rate compared to NOx emissions. SO_2 is a precursor for PM2.5. Because of these designations and since the project is a Federal Action taken by USACE, this project triggers a General Conformity Review under 40 CFR §93.154. General Conformity ensures that Federal Actions do not have a negative impact on SIPs. For the pollutants to be emitted as part of the project, the annual de minimis levels are: 100 tons for NOx, 50 tons for VOC, and 100 tons for CO_2, PM2.5, and SO_2 (each pollutant separately). Projects that do not have any annual emissions exceeding these threshold levels are considered to be in conformity with the SIP.

The Project's General Conformity-related annual emissions are significantly below all of the de minimis levels. Therefore, by rule (40 CFR §93.153 (b)), the Project is considered de minimis and will have only a temporary impact around the construction activities with no long-term impacts and no negative effects on the applicable SIP. Documentation of the emissions calculations is included in Appendix A-6.

Mitigation

Because the impact on air quality will be less than significant, no mitigation measures will be required outside of existing air quality regulations. NJDEP outlines requirements applicable to construction, such as controlling fugitive dust and open burning. All persons responsible for any operation, process, handling, transportation, or storage facility that could result in fugitive dust will take reasonable precautions to prevent such dust from becoming airborne. In addition, construction will be performed in full compliance with current New Jersey Air Pollution Control requirements (N.J.A.C. 7:27-1-34), with compliant practices and/or products. These requirements include the following:

- Control and Open Prohibition of Burning (N.J.A.C. 7:27-2.3B)
- Control and Prohibition of Air Pollution from Diesel-powered Motor Vehicles (N.J.A.C. 7:27-14 and N.J.A.C. 7:27-15)
- USACE and its contractors will use BMPs during construction and comply with all applicable air pollution control regulations

5.16 Noise

The implementation of the proposed action will result in an increase in short-term minor adverse impacts related to noise. The specific impact of construction activities on the nearby receptors will vary depending on the type, number, and loudness of equipment in use. Excavators and other heavy equipment, truck

removal of excavated material, and the delivery of riprap and concrete to workspaces will be the primary sources of noise. Individual pieces of heavy equipment typically generate noise levels of 80–90 dBA at a distance of 50 feet. With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of active construction sites. The zone of relatively high noise levels typically extends to distances of 400–800 feet from the site of major equipment operations. Locations more than 800 feet from construction sites seldom experience substantial levels (greater than 62 dBA) of noise.

Property owners within the footprint and vicinity of the nonstructural measures and the diversion culvert will experience appreciable amounts of noise from heavy equipment during construction. The total construction duration for nonstructural measures is approximately 1.4 years. However, the nonstructural measures are proposed within different neighborhoods of Little Falls. Therefore, the noise won't be concentrated to one specific location for the total estimated construction duration. In addition, the construction duration of specific individual nonstructural measures vary depending on the type of measure being implemented. Therefore, the extent of impacts is expected to be minor. The approximate construction duration of the diversion culvert is approximately two years. However, the work will not be concentrated in one location. Residences closest to the portion of the diversion culvert footprint near the Peckman River may be subject to construction noise for approximately one year until the work shifts further west towards its terminus at the Passaic River.

With the exception of the far eastern end of the levee and floodwall, the majority of the levee/floodwall is located within an undeveloped tract and is mostly isolated from businesses and residences. Moderate temporary adverse effects related to noise near the high school and the residences along Browertown Road near the eastern terminus of the levee are expected during construction.

There will be no permanent or ongoing sources of noise from the proposed action. Noise will end with the construction phase; therefore, there will be no long-term or significant impacts on the noise environment.

Mitigation

No specific mitigation measures are proposed. However, construction activities will adhere to the applicable noise ordinances within the municipalities in which the construction is occurring to minimize adverse effects to neighboring properties.

5.17 Comparison of Environmental Consequences of the No Action Plan and the Recommended Plan

Topography, Geology and Soils

No Action: Topography, geology and soils would remain unchanged under the No Action Plan.
Proposed Action: Minor topographical changes will occur within the immediate project footprint as a result of grading to create the channel modifications and construction of the levee. The proposed action will not have any significant adverse effects on soils as scour protection in the form of riprap will be installed to prevent erosion.

Land Use and Zoning

No Action: Land use and zoning would remain unaffected by the No Action Plan. However, in the long term, properties along the Peckman River, particularly those in flood prone areas, are likely to sustain continued damage during future storm events.
Proposed Action: The proposed action will serve to protect current land uses when combined with other past, current, and future flood risk management measures implemented in the basin.

Socioeconomics

No Action: Flooding damages would continue within the project area.

Proposed Action: Implementation of the proposed action will manage fluvial flood risk for up to the 2-percent flood within the project area. As there are no communities that meet Environmental Justice criteria, there are no adverse, disproportionate effects as it relates to environmental justice.

Infrastructure

No Action: Flood damages would continue within the project area.

Proposed Action: Although there would still be properties and infrastructure that are vulnerable to fluvial flood damages, annualized Peckman River flood damage would be reduced by approximately 94 percent with plan implementation.

Transportation

No Action: Disruption to transportation would continue to occur under the No Action Plan.

Proposed Action: Minor temporary impacts would occur during construction of the diversion culvert. In the long-term, the Recommended Plan will reduce disruption to traffic through flood risk management.

Water Resources

No Action: Water quality and habitat would remain unchanged. There would be no changes to wetland communities. The river would still be subject to flooding around the U.S. Route 1 bridges.

Proposed Action: Approximately 1,848 linear feet of the Peckman River equaling to approximately 1.7 acres open water habitat will be modified into a trapezoidal channel for flood risk management purposes. An additional 1,848 linear feet of the Peckman River will be restored/enhanced as part of compensatory mitigation. Minor temporary impacts to water quality are expected to occur within the immediate project footprint during construction of the channel modifications and compensatory mitigation actions. This will be minimized through the use of best management practices such as cofferdams and turbidity curtains. There will be a modification of aquatic habitat within the footprint of the channel modification through the installation of riprap.

Wetlands

No Action: No changes to wetland communities in the project area would be expected.

Proposed Action: 0.48 acres of forested wetlands will be permanently directly impacted through fill activities. Compensatory mitigation in the form of the purchase of mitigation credits from a state approved wetland mitigation bank or off-site mitigation through the creation/restoration of 0.96 acres of forested wetland habitat will be evaluated in the PED Phase. Approximately 0.7 acres of forested wetland will experience temporary impacts and will be restored on-site upon completion of construction.

Vegetation

No Action: Upland, riparian and wetland communities would remain as they are except for changes associated with natural disturbance events – including future flooding events – and community succession.

Proposed Action: Approximately one acre of upland forest and 2.14 acres of riparian vegetation will be directly impacted through implementation of the proposed action. Of the 2.14 acres of riparian zone impacted, approximately 1.37 acres is considered to be temporary and will be restored on-site upon construction completion. The remaining 0.77 acres will be permanently impacted and will be compensated for through off-site mitigation at the Peckman Preserve via planting native vegetation within 100 feet of the streambank. Other than planting related to general site restoration, no mitigation is being proposed for upland vegetation loss.

Fish and Wildlife

No Action: Fish and wildlife utilization of the project areas will be consistent with current conditions. The same is true for any state and/or federal endangered, threatened or special concern species that may occur within the project area.
Proposed Action: Implementation of the proposed action will predominantly have temporary impacts on fish and wildlife resources, with the impacts occurring during construction. Mammal and bird species are expected to leave the area during construction but are expected to return following construction completion and site restoration.

Hazardous, Toxic and Radioactive Waste

No Action: With the exception of the possible introduction of pollutants such as oil and/or general debris during flood events, the No Action Plan would not have any effect on HTRW sources.
Proposed Action: The Recommended Plan will not be affected by HTRW sources as there are no known HTRW sites within the project area.

Cultural Resources

No Action: Effects to historic properties would remain unchanged.
Proposed Action: Implementation of the proposed action could result in adverse effects to historic properties. However, implementation of the terms of the Programmatic Agreement and coordination between the District and the NJSHPO shall help to avoid or minimize adverse effects.

Recreation

No Action: Parks and other recreational opportunities within the project area would remain the same under the No Action alternative.
Proposed Action: There will be a temporary loss of use of the tennis courts and baseball fields. Long-term permanent impacts will not occur.

Aesthetics

No Action: Aesthetic and scenic resources would remain unchanged from current conditions.
Proposed Action: Construction activities will have short term minor adverse impacts to the aesthetics within and near the vicinity of the proposed action project footprint. Therefore, no long term adverse impacts resulting from Recommended Plan implementation will occur.

Air Quality

No Action: Ambient air quality would remain unchanged when compared to existing condition under the No Action alternative.
Proposed Action: Localized increases in emissions from construction equipment will occur during implementation of the Recommended Plan. However, project emissions are below the General Conformity de minimis levels. No long term adverse impacts to air quality will occur with implementation of the proposed action.

Noise

No Action: Noise conditions would remain unchanged when compared to existing conditions.
Proposed Action: An increase in noise will occur during construction of the proposed action. No long term significant adverse impacts to noise will occur from implementation of the Recommended Plan.

5.18 Summary of Mitigation

The various mitigation measures being considered to avoid, minimize, reduce or compensate for the adverse environmental impacts expected from implementation of the proposed action are summarized in Table 25.

Table 25. Summary of mitigation.

Land Use • Disturbed areas will be restored and their use returned to pre-construction land uses.
Soils • Implementation of Erosion and Sediment Control Best Management Practices (BMPs) during construction, including the installation of a cofferdam within the Peckman River to construct the weir component of the diversion culvert.
Water Resources • Implementation of Erosion and Sediment Control Best Management Practices (BMPs) during construction, including the installation of a cofferdam within the Peckman River to construct the weir component of the diversion culvert. • Restoration of 1,848 linear feet equaling to 1.70 acres of open water habitat via installation of bendway weirs and 0.85 acres of native streambank vegetation.
Wetlands • Implementation of Erosion and Sediment Control BMPs • Restoration of 0.71 acres of forested wetland habitat temporarily impacted by construction through the replanting of native vegetation. • Compensation of 0.96 acres of forested wetland habitat through either the purchase of wetland mitigation credits or off-site mitigation.
Vegetation • Compensation of a total 2.14 acres of riparian zone vegetation (0.77 acres of compensatory and 1.37 acres of restoration of temporary impacts) through creation/restoration of riparian zone with native vegetation. • 1.67 acres of forested wetland vegetation (0.96 acres through compensatory wetland mitigation; 0.71 acres through restoration of temporary impacts). • Restoration of 0.85 acres of native streambank vegetation. • Use of more mature tree stock to reduce maturation time.
Aquatic Resources and Wildlife • Tree and shrub clearing restriction from 1 April through 31 August to comply with the Migratory Bird Treaty Act • Tree clearing restriction from 1 April through 30 September to protect Endangered and Threatened bat species. • Re-establishment of native herbaceous, shrub and tree species in disturbed areas and compensatory mitigation sites. • In water work restriction from May 1 through July 31 to be extended to April 1 through July 31 if pickerel is present. • Restoration of 1,848 linear feet of stream via installation of bendway weirs and 0.85 acres of streambank vegetation. • Purchase of 0.48 acres of forested wetland mitigation credits or creation/restoration of 0.96 acres of forested wetland habitat.
Federal and State Endangered, Threatened and Special Concern Species • Implementation of a tree clearing restriction from 1 April through 30 September to protect roosting bat species. • Including tree species used by bats for summer roosting in mitigation plans.
Cultural Resources • A Programmatic Agreement between the District and the NJSHPO has been prepared to guide future identification and evaluation of effects of the undertaking on historic properties (Appendix A-5), including: ○ Evaluate effects of proposed non-structural measures on Little Falls Laundry and other structures/buildings not evaluated in the Phase I survey;

○ Mechanically assisted archaeological testing of the western end of the proposed diversion culvert; and ○ Phase I survey in area of levees/floodwalls across from diversion culvert
Recreation • Erecting temporary fences and other physical barriers to control movement through construction areas and maintain a safe distance for pedestrians • Installing signage that informs residents and others using the effected recreational spaces of the proposed actions purpose and closure duration.
Aesthetics and Scenic Resources • Replanting disturbed areas with native herbaceous, shrub and tree material after construction.
Transportation • Preparation of a Construction Traffic Management Plan. • Routing and scheduling construction vehicles to minimize conflicts with other traffic • Strategically locating localized staging areas to minimize traffic impacts; and • Establishing detours and alternate routes when it is important to close the work area to perform certain construction tasks or when diverting traffic will substantially reduce traffic volumes.
Air Quality • Because the air emissions are below de minimis levels for NOx, VOC, PM2.5 and SO2, no specific mitigation is required. Construction will be performed in compliance with current New Jersey Air Pollution Control requirements (N.J.A.C. 7:27-1-34).
Noise • Construction will occur within the timeframes allowed as per local noise ordinances.

5.18.1 Compensatory Mitigation

As discussed in Sections 5.7.2 Water Quality and Aquatic Habitat and 5.7.3 Wetlands, compensatory mitigation is being proposed for impacts to freshwater riverine and forested wetland resources.

USACE guidance requires mitigation plans be selected based on an analysis that determines the most cost effective plan through an incremental cost analysis (ICA). Based on the ICA, the most cost effective plan identified the restoration of a 1,848 linear feet of freshwater riverine system in the form of the installation of three bendway weir fields where severe bank erosion is occurring, revegetating 0.85 acres of streambank with native vegetation, and 0.77 acres of riparian zone. Refer to Appendix A-8 for additional details on the impact/mitigation assessment and A-9 for details on the CE/ICA analysis.

As coordinated within the HQUSACE, an ICA was not performed to determine compensatory mitigation measures for the wetland impacts due to the impacts being under one acre. For cost estimation purposes, the District assumed creating 0.96 acres of forested wetlands.. Effort assumed in the cost estimate includes invasive species management in the form of herbicide application, excavation to create the topographical conditions conducive to supporting the hydrologic regime for wetlands, planting native forested wetland species, and anti-herbivory measures.

As Federal mitigation requirements do not establish a definitive monitoring duration, the District will follow the NJDEP requirements which mandate a minimum five year monitoring period. Fish and macroinvertebrate surveys will occur on an annual basis. Monitoring of stream bank plantings included as the riverine compensatory mitigation and any off-site compensatory wetland mitigation implemented if credits are not purchased will occur in the spring and fall annually. The non-federal sponsor will be responsible for the monitoring. Monitoring is not to exceed ten years. Should success of the compensatory mitigation measures be achieved in less than five years, monitoring will either cease or be continued by the non-federal sponsor at their cost. Refer to Appendix A-10 for additional details on the proposed mitigation, monitoring and adaptive management measures. First Cost, Monitoring and Adaptive Management Costs for the proposed compensatory mitigation are included in Table 26.

Table 26: Riverine Habitat Mitigation Cost Summary (FY 20 P.L.).

Mitigation Feature	Cost
Construction	$2,249,196
Monitoring (5 years)	$86,000
Adaptive Management	$224,919

Chapter 6: Cumulative Impacts*

The Council of Environmental Quality (CEQ) defines cumulative effects as the impact on the environment, which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency or individual takes the action.

The geographical area considered in the cumulative impact analysis includes the Peckman River watershed and 5.5 miles of the Passaic River extending from the portion that flows through Little Falls to the Paterson Falls (Refer to Figure 2 in Appendix A-1), in contrast to the impacts analysis within the project area in Chapter 5 of this report. The determination of the geographical scope was based on feedback received from interested parties throughout the course of the study and the presence of significant resources near the project area.

As stated in previous sections of the report, the Peckman and Passaic Rivers have experienced numerous modifications. In addition to the cumulative impacts associated with those disturbances, the cumulative impacts analysis evaluates the impacts associated with past, present and reasonably foreseeable future actions listed in Table 27 through Table 29. Identification of these actions were completed through internet research, the NEPA scoping process and coordination with study stakeholders. In addition, Passaic County updated their Hazard Mitigation Plan (HMP) in 2015. The HMP identifies flood risk management measures each municipality has undertaken, is in the process of implementing or will be implementing. For the purposes of the cumulative impact analysis, the actions identified in both Passaic County HMP is herein incorporated by reference (Passaic County, 2010).

Table 27. Status of other USACE actions within the cumulative impact geographic scope.

Project Name	Description	Location	Status
Passaic River Mainstem and Tributaries	General Re-evaluation Study	Passaic River Basin	Currently suspended

Table 28. Flood risk management actions taken by others.

Project Name	Description	Location	Responsible Entity	Status
Home Buyout	Acquisition and removal of homes within floodplain Purchase and removal of 59 homes in Singac section of Town of Little Falls	Town of Little Falls	Federal Emergency Management Agency (FEMA)	Ordinance passed in May 2017
Home Buyout	Acquisition and removal of homes within floodplain	Borough of Woodland Park	Borough of Woodland Park	Ongoing
Clearing and Snagging	Removing debris and sediment from Peckman River. Fallen trees	Town of Little Falls/Borough of Woodland Park	Passaic Valley Sewerage Commission	January 2017
USGS Stream gage installation (flood warning system)	Installation of three river gages within the Peckman River	Town of Little Falls	United States Geological Survey	First and second gage installed May 2017
Home Buyout	Acquisition and removal of four homes along the Passaic River	Norwood Terrace Totowa	Totowa Borough	Acquisition and demolition completed in 2016.

Table 29: Other actions within the defined cumulative impact geographic scope,

Project Name	Type	Description	Location	Responsible Entity	Status
Peckman Preserve	Open Space Preservation.	Preservation of 12 acres of land.	Along the left bank of the Peckman River in Little Falls	Property acquired and maintained by Passaic County	Property acquired in 2005, Plan developed in 2010, not constructed
Route 3, Route 46, Valley Road & Notch/Rifle Camp Road interchange Improvement Project	State transportation improvement project	Reconstruction of existing interchanges.	Township of Little Falls, Borough of Woodland Park and City of Clifton	New Jersey Department of Transportation	Final Design and Construction. Construction of Phase A began in 2015 and is scheduled to be completed in 2019. Phase B is in the final Design Phase.
Autumn Pointe Townhome Development	Residential Development	Construction of a 24 unit Townhome complex. Falls	Township of Little Falls	Private developer	Construction initiated in 2017, is on-going.
Planting in Singac Neighborhood	Ecosystem restoration	Planting trees in footprint of removed homes along the Passaic River	Township of Little Falls	Town of Little Falls and Rutgers University	2016
Peckman River Footbridge	Recreational development	Installation of a pedestrian bridge over the Peckman River to connect the eastern and western spurs of the Morris Canal Greenway.	Township of Little Falls	Passaic County	Conceptual Plans presented at public meeting July 2017. Permits submitted to NJDEP in early 2018.
Paterson Falls	Debris Removal	Diversion of Passaic River through wastewater facility located at falls to clean debris deposited along river banks and within the river near the falls.	City of Paterson	Passaic Valley Sewerage Commission and Eagle Creek Renewable Energy.	Project was conducted in 2016.
Peckman River Cleanup	Trash removal	Removal of litter, invasive species management	Verona Township	Verona Environmental Commission	Annual event occurring in the summer since 2014.

6.1 Land Use

The Recommended Plan will not contribute to significant adverse cumulative effects to land use. The Recommended Plan, when combined with other past, current and future flood risk management measures implemented in the basin will serve to protect current land uses.

6.2 Topography, Geology & Soils

The proposed action will not have any significant adverse cumulative impacts to topography, geology or soils. The Recommended Plan and other actions within the Peckman River Basin, and the Passaic River will be required to prevent soil erosion through the preparation and implementation of an erosion and sediment control plan. In addition, any activities proposing to change the existing grade within the floodway and flood hazard area as defined by the NJ Flood Hazard Area Control Act must obtain a permit from NJDEP and demonstrate that the action will not induce flooding to other properties. The Recommended Plan will provide a cumulative benefit of regional flood risk management within the Peckman River Basin when combined with changes in topography related to other past, current, and future flood storm risk management projects.

6.3 Water Resources

The Recommended Plan, current, and future actions as listed in Table 27 through Table 29 will be required to protect water quality in and adjacent to water bodies through the implementation through the acquisition of water quality certifications, wetland permits that include mitigation requirements for water resource impacts, State Pollution Discharge Elimination Systems permits and implementation of erosion and sediment control best management practices (BMPs). Therefore, the Recommended Plan will not contribute to adverse cumulative impacts to water resources.

In general, the flood risk management measures, stormwater management, habitat mitigation and ecosystem restoration actions when combined with each other could result in minor improvements in water quality and aquatic habitat. Flood risk management measures contribute to water quality and aquatic habitat improvements by reducing the amount of manmade debris and pollutants introduced into waterways during flood events. Stormwater management measures reduce the amount of urban runoff that typically has high levels of nutrients and other pollutants that contribute to water quality and habitat degradation, entering waterways.

The conversion of the approximately 0.48 acres of forested wetlands and loss of 0.85 acres of streambank vegetation will contribute to cumulative losses of wetland/open water values and functions within the watershed. However, these impact will be minimized through compensatory mitigation.

6.4 Vegetation

The Recommended Plan will result in short-term minor and long-term moderate adverse impacts to upland and wetland vegetation within the project area. Short-term impacts include removal of vegetation within construction workspaces. Vegetation will be reestablished within these areas after construction to minimize short term cumulative adverse impacts. The proposed mitigation discussed in previous sections of the report will minimize the Recommended Plan's contribution to significant adverse cumulative impacts to vegetation.

In addition to the proposed action, any current or future actions taken by others that require a Flood Hazard permit and disturb riparian vegetation is subject to the riparian mitigation requirements. Depending on the type of mitigation selected, this could lead to an increase in higher value riparian habitat for fish and wildlife, which will minimize cumulative impacts.

6.5 Fish & Wildlife

The Recommended Plan is expected to have minor cumulative impacts to fish and wildlife resources. The proposed riparian, wetland and riverine mitigation discussed in previous sections of the report will minimize significant adverse cumulative impacts. In addition, actions taken by others that affect aquatic, wetland and riparian habitat are subject to permit mitigation requirements. Any mitigation actions taken by others in conjunction with any ecosystem restoration projects could improve fish and wildlife habitat throughout the watershed.

The Recommended Plan will not have significant adverse cumulative impacts to state and/or Federal endangered, threatened, and special concern species that may occur in the project area.

6.6 Cultural Resources

There will not be a significant cumulative adverse effect on historic properties. The location of the project would not have an adverse effect on the identified eligible and listed properties. Any work requiring state funds that have the potential to impact listed properties would require coordination with the NJHPO. While the project area is sensitive for archaeological resources, the potential to identify intact sites is low throughout much of the project area.

6.7 Hazardous, Toxic & Radioactive Waste

The Recommended Plan will not contribute to the release and/or exposure of HTRW substances. All state and Federally-permitted actions, including the Recommended Plan, must implement measures such as erosion and sediment BMPs and/or an environmental protection plan to manage the risk of improper release, exposure and disposal of HTRW substances.

6.8 Socioeconomics & Environmental Justice

In general, the objective of the Recommended Plan and other flood risk management measures implemented within the Peckman River watershed is to provide long term risk management to decrease loss of life and property/infrastructure damages resulting from flood events.

The Recommended Plan will have no adverse cumulative impacts on the existing demographics, economy, housing and Environmental Justice communities in the geographical region analyzed for cumulative impacts. Increasing flood risk management will reduce damage to property and infrastructure within the project area; thus implementation of the Recommended Plan is expected to benefit the local economy and housing in the long term.

All of the actions considered could produce positive cumulative socioeconomic impacts within the watershed by reducing flooding, which is disruptive to socioeconomic conditions.

6.9 Aesthetics & Scenic Resources

Based on the location of the Recommended Plan and other actions listed in Table 27 through Table 29, it is not anticipated that there will be significant, cumulative long-term impacts to aesthetic and scenic resources. Most impacts will be short-term effects resulting from construction activities. The timing of the implementation of the Recommended Plan and any other actions is such that it is not anticipated that construction noted actions will be concurrent.

6.10 Recreation

The Recommended Plan will result in short term park closures and other construction related disruptions to recreation, but these impacts will have negligible cumulative impacts.

6.11 Transportation

The Recommended Plan will not have any adverse cumulative impacts on transportation. Positive cumulative impacts resulting from the combination of the Recommended Plan and with past, actively occurring or future flood risk management actions will be the reduction in road closures and damage to transportation infrastructure in some locations of the project area due to flooding within the Peckman River watershed.

6.12 Air Quality

The Recommended Plan will not have any adverse cumulative impacts on air quality. Air emissions related to land-based construction activities are a short-term and local impact accounted for in New Jersey's State Implementation Plan (SIP). There are no operable parts of the completed project that will result in air emissions.

There will be no ongoing sources of greenhouse gas emissions resulting from the Recommended Plan once the project is completed. All construction activities combined will generate 7,744 tons of CO_2, which will be below the CEQ threshold. These effects will be negligible.

6.13 Noise

The Recommended Plan will introduce short-term increases in the noise environment from construction. These changes will have a negligible cumulative effect. There will be no adverse long term cumulative impacts on the existing environment once construction is completed.

Chapter 7: Coordination & Compliance with Environmental Requirements*

A NEPA Scoping Meeting focused on the NED plan and the alternative that had been identified at the time as a LPP was held on November 29, 2017. The NEPA Scoping Meeting initiated a 30-day public comment period that was closed on December 29, 2017. A NEPA Scoping Document was prepared and distributed to the NJDEP Office of Permit Coordination and Environmental Review, USGS, USFWS, USEPA, and interested parties. The NJDEP Office of Permit Coordination and Environmental Review is responsible for coordinating the review of Federal NEPA documents, with other NJDEP Divisions such as Green Acres, Fish and Wildlife, Land Use Regulation, Air Quality, Water Resources Management, and the Historic Preservation Office (NJHPO).

No comments were received from the public. Comments were received from USEPA, NJDEP Office of Permit Coordination and Environmental Review, and the NJHPO regarding the study (Refer to Appendix A-7). A NEPA Scoping Meeting was also held in 2004 when the study was initiated. Throughout the feasibility study, the District met with staff from the NJDEP Bureau of Flood Control and Dam Safety, the Division of Land Use Regulation and the Green Acres Program, and study stakeholders.

Coordination with the USFWS has occurred throughout the life of the study. A Planning Aid Letter was developed for the initial array of alternatives in 2005. The USFWS submitted a draft FWCAR to the District July 2014 outlining concerns and recommendations related to the preliminary alternatives. The 2018 DIFR/EA was used as the main coordination vehicle for the USFWS to update the draft FWCAR. The final FWCAR was submitted to the District on October 20, 2018. Based on coordination with the USFWS, the District has provided a copy of the October 2019 Revised DIFR/EA for their review and comment.

Informal consultation under Section 7 of the Endangered Species Act of 1973 was completed via the FWCA. All relevant correspondence related to the FWCAR and Section 7 consultation is included in Appendix A-4.

The District has coordinated the results of the 2013 archaeological and architectural survey and the Recommended Plan with the NJHPO, Native American Tribes, and other interested parties (Appendix A.5). The NJHPO, Tribes, and interested parties have reviewed the Programmatic Agreement regarding the additional activities to be completed as part of project and all parties have concurred with the language in the document.

The Notice of Availability for the 2018 DIFR/EA underwent a 30-day public and agency comment period that closed June 5, 2018 (Appendix A.13). The Notice of Availability was posted on the study webpage located on the District website and sent to federal, state, local agencies, non-profit organizations and interested parties identified in the Distribution List located in Appendix A-11.

No comments from the public were received. Comments were received from EPA in June 15, 2018 and from the NJDEP Office of Permit Coordination and Review on June 5, 2018. A matrix of their comments and the District's responses as well as the Notice of Availability are located in Appendix A-13.

The October 2019 Revised DIFR/EA underwent a 30-day public and agency comment period that closed on November 8, 2019. The Notice of Availability was posted on the study webpage located on the District website and sent to federal, state, local agencies, non-profit organizations and interested parties identified in the Distribution List located in Appendix A-11.

Comments were received from the NJDEP, Township of Little Falls, and a member of the public. The Notice of Availability and summary of the comments and the District's responses are located in Appendix A-13.

Letters of support were received from Congressional Representatives Pascrell and Sherrill, and Senator Corrado, In addition, both the Town of Little Falls and Borough of Woodland Park passed resolutions supporting the Recommended Plan. The letters and resolutions of support are included in Appendix F.

A Conditional Water Quality Certification was received from the NJDEP of December 5, 2019. The Conditional WQC is located in Appendix A-7.

The status of compliance with Federal laws and Executive Orders is presented in Table 30. The status of compliance with state laws is presented in Table 31.

Table 30. Compliance with Federal laws and Executive Orders.

Legislative Title U.S. Code/Other		Compliance
Clean Air Act	42 U.S.C. §7401-7671g	An air quality analysis was completed for the project. Based upon the completed analysis, the emissions from the project are considered to have an insignificant impact on the regional air quality, and according to 40 CFR 93.153 (f) and (g) the proposed project is presumed to conform to the SIP. A Record of Non-Applicability is located in Appendix A-6.
Clean Water Act	33 U.S.C. §1251 et seq.	A 404(b)(1) Evaluation is located in Appendix A-3. The State of New Jersey assumed 404 authority in 1993 and is the responsible administering authority. USACE will submit a Freshwater Wetlands Individual Permit NJDEP to fulfill the requirements of Section 404 of this act prior to initiating construction. A conditional Water Quality Certification was obtained from NJDEP on December 5, 2019 and is located in Appendix A-7
Endangered Species Act of 1973	16 U.S.C. §1531 et seq.	The District completed informal consultation with the U.S. Fish and Wildlife Service. As the project may contain habitat supportive of Indiana bat and northern long-eared bat, a tree clearing restriction from 1 April – 30 September will be implemented during construction.
Fish and Wildlife Coordination Act (FWCA)	16 U.S.C. §661 et seq.	USACE completed coordination with the U.S. Fish and Wildlife Service. A FWCA report prepared in October 2018 is included in Appendix A-4.
National Environmental Policy Act of 1969	42 U.S.C. §4321-4347	The signing of the Finding of No Significant Impact fulfills requirements of this act.
National Historic Preservation Act of 1966	16 U.S.C. §470 et seq.	USACE has continued to coordinate with the NJ Historic Preservation Office to fulfill requirements of this act. Correspondence indicating SHPO concurrence to date is located in Appendix A.5 as well as a Programmatic Agreement (Appendix A-5).
Executive Order 11990, Protection of Wetlands	May 24, 1977	Circulation of the draft version of this report for public and agency review fulfills the requirements of this order.
Executive Order 11988 Floodplain Management	May 24, 1977	The proposed action is within the floodplain. However the project is designed to reduce damages to existing infrastructure located landward of the proposed project. The circulation of this report for public review satisfies the public coordination requirement under this EO.
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks	April 21, 1997	Implementation of this project will reduce environmental health risks. Circulation of the draft version of this report for public and agency review fulfills the requirements of this order.
Executive Order 13112 Invasive Species	February 3, 1999	BMPs to prevent spread, proper disposal of invasive species during construction, replanting with native vegetation monitoring and adaptive management such as invasive species management until mitigation is determined to be successful.

Table 31. Compliance with state laws.

Legislative Title and code/date		Compliance
NJDEP Rules and Regulations – Flood Hazard Area	N.J.A.C. 7:13 (N.J.S.A 58:16A)	The District is in continued coordination with NJDEP. Permits will be obtained during the preconstruction, engineering and design phase.
NJDEP Rules and Regulations – Freshwater Wetland Rules	N.J.A.C. 7:7A (N.J.S.A. 13:9B)	The State of New Jersey assumed 404 authority in 1993 and is the responsible administering authority. The District is in continued coordination with NJDEP. Although permits will be obtained during the PED phase, a conditional water quality certification has been obtained and is included in Appendix A-7.
New Jersey Erosion and Sediment Control Act	N.J.A.C. 2:90-1.1 (N.J.S.A. 4:24-39)	An erosion and sediment control plan will be developed and submitted to the Hudson, Essex, Passaic Soil Conservation District for approval prior to construction.
New Jersey Pollution Discharge Elimination System Permit (NJPDES)	N.J.A.C. 7:14A (N.J.S.A. 58:10A-58:12A-1)	The NJPDES permit will be applied for by the construction contractor once the E&S Plan is approved by the Hudson, Essex, Passaic Soil Conservation District.

Chapter 8: Plan Implementation

The implementation process would carry a plan that is recommended through the PED phase of a project, including development of plans and specifications, and construction. Funding by the Federal government to support these activities would have to meet USACE Civil Works budgeting criteria.

8.1 Consistency with Laws & Policies

This report has been prepared in accordance with relevant laws and USACE policy. Specifically, this section of the report addresses:

- the specific requirements necessary to demonstrate that the project is technically feasible, economically justified and environmentally acceptable
- the costs and cost-sharing to support a PPA

Economics Justification and Environmental Compliance. This report demonstrates that the Recommended Plan is technically feasible. It also identifies the Recommended Plan at this point in the study to have benefits greater than costs. This report has been prepared to meet the requirements of NEPA and demonstrate that the Recommended Plan is compliant with environmental laws, regulations, and policies and has effectively addressed any environmental concerns of resource and regulatory agencies.

8.2 Cost Sharing & Non-Federal Sponsor Responsibilities

In accordance with the cost share provisions in Section 103 of the WRDA of 1986, as amended (33 U.S.C. 2213), project design and implementation are cost shared 65 percent Federal and 35 percent non-Federal. The estimated Total Project Cost is $172,701,000, cost-shared $112,256,000 Federal and $60,445,000 non-Federal (Table 32).

Table 32. Cost apportionment table (FY 20 P.L.).

Cost Category	Federal Share	Non-Federal Share	Total
Total Project Cost	$114,775,000	$61,802,000	$176,577,000
Initial Project Costs	$95,011,000	$51,160,000	$146,170,000
Real Estate Costs[1]	$0	$5,255,000	$5,255,000
Cash Contribution	$95,011,000	$45,905,000	$49,106,000

[1] LERRDs are a non-Federal sponsor responsibility creditable towards the 35 percent non-Federal cost share.

Operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) requirements are considered in the economic analysis for the project. The non-Federal sponsor is responsible for 100 percent of annual OMRR&R requirements, estimated at $575,000 per year. The Federal government is responsible for preparing and providing an OMRR&R manual to the sponsor.

8.3 Institutional & Local Cooperation Requirements

The non-Federal Sponsor supports the Recommended Plan described in this report and intend to execute a PPA for the project once it is authorized and Federal funding is appropriated.

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

1. In coordination with the Federal government, who shall provide 65 percent of the initial project cost,
   a. Provide 35 percent of the total nonstructural flood damage reductions costs and a minimum of 35 percent, but not to exceed 50 percent, of the total structural flood damage reduction costs and, as further specified below:

i. Provide, during design, 35 percent of design costs allocated to nonstructural flood damage reduction and 35 percent of design costs allocated to structural flood damage reduction in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
ii. Pay, during construction, a contribution of funds equal to five percent of total structural flood damage reduction costs;
iii. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material as determined by the Federal government to be required or to be necessary for the construction, operation, and maintenance of the project;
iv. Pay, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total nonstructural flood damage reduction costs and at least 35 percent of total structural flood damage reduction costs;

b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;
c. Inform affected interests, at least annually, of the extent of risk management afforded by the structural flood damage reduction features;
d. Participate in and comply with applicable floodplain management and flood insurance programs;
e. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12);
f. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with performance levels provided by the flood damage reduction features;
g. Operate, maintain, repair, rehabilitate, and replace the project at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal government;
h. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;
i. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;
j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;
k. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal government determines to be necessary for the construction or operation and maintenance of the project;

l. Assume, as between the Federal government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way required for construction, operation, maintenance, repair, rehabilitation, or replacement of the project;
m. Agree, as between the Federal government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;
n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 1986, Public Law 99-662, as amended, (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;
o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4601- 4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;
p. Comply with all applicable Federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c); and
q. Not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal sponsor's obligations for the project unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project.

8.4 Real Estate Requirements

USACE projects require that the non-Federal sponsor provide lands, easements, rights-of-way and relocations, and disposal/borrow areas (LERRDs) for a project. Currently, the Recommended Plan will require the non-Federal sponsor to acquire temporary and permanent easements for construction. The project would impact up to 29 parcels (17 privately-owned and 12 publicly-owned). The project would necessitate the acquisition of 5.84 acres of property. Permanent easements totaling 11.35 acres, and 6.20 acres of temporary easements would also be required. In some instances, more than one estate may be required to be obtained over the lands of the same owner. Required Lands, Easements, and Rights-of-Way total 23.39 acres. Details are provided in the Appendix E.

The sponsor possesses sufficient general and legal acquisition authority to acquire all the real estate required for the project. They maintain the professional capability for land acquisitions and can reasonably obtain contract services, if needed. The sponsor has successfully completed real estate acquisition for similar cost-shared USACE projects at Elberon to Loch Arbor, Newark (Minish), Greenbrook, and Port Monmouth, New Jersey, among others. The sponsor is aware of Public Law 91-646 requirements as well as the requirement to document all LERRD expenses for the claim of credit. It is unlikely for the sponsor to require the assistance from USACE for real estate acquisition.

The NED plan requires temporary easements. Since the project is currently at a feasibility-level design, the size of the real estate interests required are preliminary estimates only based on available Geographic Information System (GIS) data. The precise size and location of the required real estate interests will be identified during the PED phase when Plans and Specifications, and detailed drawings are prepared. As a result, the require acreage are subject to change with project refinements.

Once the real estate requirements are finalized during PED, prior to real estate acquisition, the sponsor is advised to obtain property line surveys with a corresponding legal description for each different estate acquired for the project to mitigate against potential boundary disputes. The sponsor is also advised to obtain title insurance after signature of the PPA on all acquired property to protect against "defects" in title and to identify potential encumbrances.

8.5 Design & Construction Considerations

In order for PED and construction to be initiated, USACE must sign a PPA with a non-Federal sponsor to cost share PED and construction. This project would require congressional authorization for PED and implementation. Implementation would then occur, provided that sufficient funds are appropriated to design and construct the project.

Implementation Schedule. The schedule for plan implementation was developed for planning and cost estimating purposes (Table 33). The schedule assumes that the project will be authorized and funded for construction by the Congress in a Water Resources Development Act or similar legislation (expected 2020). All dates are dependent upon this authorization. Dates for design and construction are also dependent upon appropriation of Federal and non-Federal funding. See Appendix D for a detailed proposed construction schedule.

Table 33. Recommended Plan implementation schedule.

Chief of Engineering Report Approval	April 2020
Pre-Construction Engineering & Design (PED)	
Design start	September 2020
Design end	September 2022
Real estate acquisition start	September 2022
Real estate acquisition end	September 2024
Construction	
Construction start	October 2024
Construction complete	June 2027

Construction years are assumed for the economics evaluation in this study, but are subject to future project approval and funding requirements.

8.6 Views of the Non-Federal Sponsor & Other Agencies

NJDEP, as the non-Federal sponsor, has indicated its support of Alternative 10b-40 as the Recommended Plan in a letter dated December 2, 2019. The agency has also documented in a December 6, 2019 memorandum that it has the financial capability to act as the non-Federal cost-share sponsor for project implementation (Appendix F). In addition, the Township of Little Falls and the Borough of Woodland Park have expressed their support for Alternative 10b-40 as the Recommended Plan (Appendix F).

8.7 Implementation Authority

Implementation of the Recommended Plan would be made through an individual authorization of the project and in response to a Congressional Resolution from the House Committee on Public Works and Transportation, the Senate Committee on the Environment and Public Works, or a Public Law. After authorization, USACE would jointly implement the project with a non-Federal sponsor. This approach requires that Congress provide USACE authority and funds to construct the project. PED is the first phase of construction. After a feasibility study is completed, part of the PED phase can be completed while waiting for authority to construct. USACE would execute a PPA with the non-Federal sponsor to design and construction the project. Based on non-Federal sponsor support of the Recommended Plan it is anticipated that NJDEP would serve as the non-Federal sponsor during PED and construction.

Chapter 9: Public Coordination & Views

A public notice announcing the availability of the Revised DIFR/EA for public review was placed on the USACE New York District website on October 9, 2018. Public and agency comments received are included in Appendix A-13.

Chapter 10: Recommendations

In making the following recommendations, I have given consideration to all significant aspects in the overall public interest, including environmental, social and economic effects, engineering feasibility and compatibility of the project with the policies, desires, and capabilities of the State of New Jersey and other non-Federal interests.

I recommend that the selected plan for flood risk management in the Peckman River Basin, New Jersey, as fully detailed in this final integrated feasibility report and environmental assessment, be authorized for construction as a Federal project, subject to such modifications as may be prescribed by the Chief of Engineers. The Recommended Plan includes a combination of a diversion culvert connecting the Peckman and Passaic Rivers; associated weirs; levees and floodwalls; channel modifications; and nonstructural measures within the ten percent floodplain upstream of Route 46. The plan is designed to manage flood risk up to the two percent flood event.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of highest review levels within the Executive Branch. Consequently, the recommendations may be modified by the Chief of Engineers before they are transmitted to the Congress as proposals for authorization and implementing funding. However, prior to transmittal to Congress, the partner, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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Thomas D. Asbery
Colonel, U.S. Army
District Engineer

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Figure 3: Welcome sign to Little Falls. Image from: http://www.njmls.com/NJ/PASSAIC/LITTLE%20FALLS-community-information. Accessed April 3, 2018.

Figure 4: Overview of Woodland Park. Screen capture from: https://www.youtube.com/watch?v=06G42rtB7Ok. Accessed April 3, 2018.

Figure 5: Peckman River. Image from: https://en.wikipedia.org/wiki/West_Essex_Trail. Accessed on April 3, 2018.

Figure 6: Passaic River at the Hillery Street Bridge. Image from: https://www.flickr.com/photos/jag9889/3488975447/. Accessed on April 3, 2018.

Figure 16. High flows & water levels due to Tropical Storm Floyd at a bridge abutment along the Peckman River (Little Falls Historical Society September 1999). Source: Little Falls Historical Society. Accessed on April 3, 2018.

Figure 17: Two men use yellow trash bags to wade through flood waters after Hurricane Irene in Little Falls. Image from: http://newyork.cbslocal.com/2011/09/08/as-flood-damage-mounts-weary-nj-residents-seek-aid-answers/. Accessed on April 3, 2018.

Figure 26. Flash flooding in the Peckman River during Hurricane Floyd near Little Falls, NJ (1999). Source: Little Falls Historical Society. Accessed on April 3, 2018.

Figure 27: Two people wade across a flooded street in Singac. Image from: https://www.vosizneias.com/78309/2011/03/12/new-jersey-east-coast-keeping-close-eye-on-swollen-waterways/. Accessed April 3, 2018.

Figure 29. Example of an elevated house. Image from: http://keenbug.blogspot.com/2014/06/tall-houses-of-keansburg-union-beach.html. Accessed March 30, 2018.

Figure 39. Flooding in Little Fall in April 2011. Image from: http://newyork.cbslocal.com/2011/04/22/fema-denies-new-jersey-request-for-flood-aid/. Accessed April 4, 2018.

Figure 41. Flood damage in Little Falls after Irene. Image from: http://newyork.cbslocal.com/2011/09/08/as-flood-damage-mounts-weary-nj-residents-seek-aid-answers/. Accessed April, 4, 2018.

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