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Shrewsbury River Basin, Sea Bright, New Jersey Coastal Storm Risk Management Feasibility Study

Draft Final Integrated Feasibility Report & Environmental Assessment

August 2018

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

Sea Bright, New Jersey after Hurricane Sandy, November 2012.

The recommendations included in this report are *draft* and subject to final agency approvals. They are being made available to the public for consideration. The final version of this report will be posted on the project website once it is approved: http://www.nan.usace.army.mil/shrewsbury.

Shrewsbury River Basin, Sea Bright, New Jersey
Coastal Storm Risk Management Feasibility Study

This report was prepared by the
New York District, North Atlantic Division of the
U.S. Army Corps of Engineers
in partnership with the
New Jersey Department of Environmental Protection

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Pertinent Data

Description

The recommended plan includes the elevation of up to 18 structures, and use of a temporary flood barrier around 2 structures to manage the risk of damages caused by coastal storms in Sea Bright, New Jersey. Plan details will be finalized during Pre-construction Engineering and Design (PED).

Location

The Borough of Sea Bright is located in Monmouth County, New Jersey. It sits between the Atlantic Ocean to the east, and the tidally-influenced Shrewsbury and Navesink Rivers to the west.

Plan Features

Up to 18 structures will be elevated to a height of approximately 5 to 7 feet above ground elevation so that their main floor elevations reach +11.2 feet North American Vertical Datum of 1988 (NAVD88). The current main floor elevations of the structures vary from +4.3 feet NAVD88 to +5.8 feet NAVD88. The base flood elevations (BFE) for the structures currently range from +7 feet NAVD88 to +8 feet NAVD88. Each structure will be elevated more than two feet above the BFE, which is the local minimum building standard for construction in a floodplain. The plan also includes a temporary flood barrier to be deployed around two attached structures prior to storms. The top of the temporary flood barrier will measure approximately 7 feet above ground elevation, to an elevation of +11.2 feet NAVD88. The temporary flood barrier will be deconstructed after use and stored between storms. Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) of the temporary flood barrier and its associated costs are the responsibility of the non-Federal sponsor. Design heights for structure elevations and the temporary flood barrier will be refined during PED.

Economics

Costs and benefits are presented at the Fiscal Year (FY) 2018 price level (P.L.) and, where appropriate, are annualized at 2.75 percent over a 50-year period of analysis (2020 – 2070) for the intermediate rate of relative sea level change (RSLC).

Costs (FY18 P.L.)

Total Project Cost	$8,452,000[1]
Initial Project Cost	$8,110,000[2]
Average Annual Cost	$305,000
OMRR&R	$2,000
Total Annual Cost	$307,000

Benefits (FY18 P.L.)

Average Annual Benefits	$335,000
Average Annual Net Benefits	$28,000
Benefit-to-Cost Ratio	1.1

Real Estate Requirements

The project will require temporary work easements for up to 0.8 acres, and temporary relocation of residents and businesses while the elevation of structures is underway. No permanent acquisitions are needed.

Cost Apportionment (FY 18 P.L.)

Project construction will be cost-shared at 65 percent Federal/35 percent non-Federal expense. Because construction will not significantly impact environmental and historic resources, compensatory mitigation is not anticipated.

Cost Category	Federal Share	Non-Federal Share	Total
Total Project Cost	$5,494,000	$2,958,000	$8,452,000
Initial Project Cost	$5,272,000	$2,839,000	$8,110,000
Real Estate Credit	-	$529,000	$529,000
Cash Contribution	$5,272,000	$2,310,000	$7,910,000
Total	$5,272,000	$2,839,000	$8,110,000

[1] The Total Project Cost is the basis for the Project Partnership Agreement, and is based upon the midpoint of construction (October 2019). [2] Includes interest during construction.

Executive Summary

The U.S. Army Corps of Engineers (USACE), North Atlantic Division, New York District has partnered with the New Jersey Department of Environmental Protection (NJDEP) to undertake the Shrewsbury River Basin, Sea Bright, New Jersey coastal storm risk management feasibility study. This final integrated feasibility report and environmental assessment presents the results of the study's evaluation of various alternatives intended to manage the risk of damages caused by coastal storms. Benefits, costs, and impacts caused by implementation of the recommended plan are 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 (CEQ) Rules and Regulations for Implementing NEPA (Title 40, Code of Federal Regulations [CFR], Sections 1500-1508), the USACE's Procedures for Implementing NEPA (Engineer Regulation [ER] 200-2-2), and other applicable Federal and state environmental laws.

The people, economy, and culture of the Borough of Sea Bright, New Jersey are at increasing risk of flood damage caused by coastal storms such as nor'easters, tropical storms, and hurricanes. This is due to its geography, topography, and the anticipated effects of relative sea level rise. The relatively low land is frequently inundated by back bay flooding from the Shrewsbury River. Frequent overtopping of the relatively low river-fronting bulkheads occurs during spring tide events and minor coastal storms. Major storms such as hurricanes occur less frequently but may cause widespread flooding throughout the Borough, as was seen during Hurricane Sandy in 2012. The project purpose is to manage the risk of flooding caused by storm surge. USACE considered a range of nonstructural and structural measures that could potentially reduce flood damages in downtown Sea Bright, the Borough's most densely populated area. Through an iterative plan formulation process, potential coastal storm risk management measures were identified, evaluated, and compared. The recommended plan will provide coastal storm risk management and address damages from coastal storm flooding in downtown Sea Bright.

The recommended plan consists of elevating up to 18 structures so that their main floor elevations are at an elevation of +11.2 feet NAVD88, and the use of a temporary flood barrier around two attached structures. The structures' main floor elevations would be elevated to a design elevation that includes the one percent flood elevation as calculated by USACE for the year 2020, the effects of predicted future relative sea level change, and the effects of waves. The proposed project is part of a comprehensive plan to reduce flood risk to life and property in Sea Bright. It complements other ongoing efforts in the Borough to manage flood risk, the most significant of which is the elevation of many homes and other structures above the height of the one percent floodplain. There would be no significant detrimental impacts to the environment due to implementation of the recommended plan.

The estimated total first cost for project implementation is $8,110,000 (FY18 PL), to be cost shared 65 percent Federal expense and 35 percent non-Federal expense. The Total Project Cost is $8,452,000. The recommended plan would provide $28,000 in average annual net benefits. The benefit-to-cost ratio of is 1.1.

The non-Federal study sponsor, the NJDEP, has indicated its support for the recommended plan and is willing to enter into a Project Partnership Agreement (PPA) with the Federal Government for the implementation of the recommended plan.

Finding of No Significant Impact (FONSI)

The U.S. Army Corps of Engineers, New York District, in partnership with the New Jersey Department of Environmental Protection (NJDEP), proposes to implement the Shrewsbury River Basin, New Jersey Coastal Storm Risk Management Project within the Borough of Sea Bright, Monmouth County, New Jersey. The project involves elevating up to 18 structures to a height of approximately 5 to 7 feet above ground elevation so that their main floor elevations reach +11.2 feet North American Vertical Datum of 1988 (NAVD88). A temporary flood barrier will be deployed around two attached structures prior to storms. The top of the temporary barrier will measure approximately seven feet above ground elevation (+11.2 feet NAVD88). The temporary barrier will be deconstructed after each use and stored between storms. Design heights for structure elevations and the temporary flood barrier will be refined during PED.

The proposed project will manage coastal storm risk and address damages from coastal storm flooding in downtown Sea Bright. Federal Interest is warranted in the development of this plan, which is supported by the non-Federal sponsor, the NJDEP. No major, permanent impacts to the human environment are anticipated as a result of implementation of the plan. No wetlands would be affected nor will any other habitat be destroyed, since building elevation and use of a temporary flood barrier would be placed on developed property. Flow modification would be limited to developed areas with no changes to wetland hydrology. Since levees, floodwalls, or other structures would not be built, impacts to aquatic, wetland and upland habitat would be eliminated. For the same reasons, and because no historic buildings are included in the plan, there would be no impact to historic and cultural properties. Any other impacts, including the environmental impacts associated with building elevation, would be minor and temporary (e.g., temporary relocation of residents during construction).

Detrimental cumulative impacts to the environment are not expected as a result of implementation of the proposed action. There would be no increase in footprint size of the elevated structures, and therefore does not change floodplain characteristics. Use of a temporary flood barrier would also not change floodplain characteristics. Since Hurricane Sandy, many homeowners have elevated or are in the process of elevating their homes. In addition, New York District projects currently in study or construction phase on the Atlantic Coast of New Jersey in the Sandy Hook Peninsula area may reduce storm risk if and when constructed. These actions may mitigate the effects of flood damages. The minimal scale of the proposed project would not contribute any additional or cumulative negative impacts to the coastal landscape. All Federal, state, and local laws and regulations would be followed during construction, including those applicable to transport of debris, proper disposal of materials, and environmental protection of the project area during the entire construction period.

Based on my review and evaluation of the environmental effects as presented in the environmental assessment, I have determined that the proposed project is not a major Federal action significantly affecting the quality of the human environment. I have reviewed the proposed action in terms of overall public interest and found that the proposed action does not warrant the preparation of an Environmental Impact Statement.

_____

Thomas D. Asbery
Colonel, U. S. Army
Commander

_____

Date

Shrewsbury River Basin, Sea Bright, New Jersey
Coastal Storm Risk Management Feasibility Study
Final Integrated Feasibility Report & Environmental Assessment

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Acronyms

ACM: asbestos-containing materials
APE: Area of Potential Effect
CAFRA: Coastal Area Facility Review Act
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CO: carbon monoxide
CEQ: Council on Environmental Quality
CFR: Code of Federal Regulations
EO: Executive Order
ER: Engineer Regulation
FCSA: Feasibility Cost Sharing Agreement
FEMA: Federal Emergency Management Agency
FWCA: Fish and Wildlife Service Coordination
FY: Fiscal Year
HTRW: hazardous, toxic, and radioactive waste
HMA: Hazard Mitigation Assistance
LBP: lead-based paint
Ldn: day-night noise level
MFE: main floor elevation
NAAQS: National Ambient Air Quality Standards
NACCS: North Atlantic Coast Comprehensive Study
NACP: Northern Atlantic Coastal Plain
NAVD88: North American Vertical Datum of 1988
NED: National economic development
NEPA: National Environmental Policy Act of 1969
NHPA: National Historic Preservation Act of 1966, as amended
NJDEP: New Jersey Department of Environmental Protection
NJNG: New Jersey Natural Gas
NNBF: natural and nature-based features
NOAA: National Oceanic and Atmospheric Administration
NOx: nitrogen oxides
NRHP: National Register of Historic Places
OMRR&R: Operation, Maintenance, Repair, Replacement, and Rehabilitation
P&G: Principles and Guidelines
P.L.: Price Level
P.L.: Public Law
PED: Preconstruction Engineering and Design
PPA: Project Partnership Agreement
RONA: Record of Non-Applicability
RSLC: relative sea level change
SO2: sulfur oxides
TRWRA: Two Rivers Water Reclamation Authority
TSP: tentatively selected plan
VOC: volatiles organic compounds
VLM: vertical land movement
WRDA: Water Resources Development Act
U.S.C.: U.S. Code
USACE: U.S. Army Corps of Engineers
USEPA: United States Environmental Protection Agency
USFWS: U.S. Fish and Wildlife Service
USHUD: U.S. Department of Housing and Urban Development

Chapter 1: Introduction

1.1 Study Purpose & Scope

The U.S. Army Corps of Engineers (USACE), North Atlantic Division, New York District has prepared this final integrated feasibility report and environmental assessment for the Shrewsbury River Basin, Sea Bright, New Jersey, coastal storm risk management feasibility study ("Shrewsbury study," or "study"). It includes input from the non-Federal sponsor, local governments, natural resource agencies, non-governmental organizations, and the public. The purpose of the study is to investigate potential coastal storm risk management solutions for the Borough of Sea Bright, Monmouth County, New Jersey. A recommendation for Federal participation in a risk management project that is technically sound, economically justified, and environmentally acceptable is presented in this report.

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, this report: (1) summarizes the current and potential water resource problems, needs, and opportunities for coastal storm risk management; (2) presents the results of the plan formulation for water resource management solutions; (3) identifies specific details of the recommended plan, including risks and uncertainties; and (4) details the extent of Federal Interest and local support for the plan.

1.2 Study Authority

The study was authorized by a resolution of the U.S. House of Representatives dated May 7, 1997:

> *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 Shore of New Jersey from Sandy Hook to Barnegat Inlet, published as House Document 332, 85th Congress, 2nd Session, the Report of Limited Reconnaissance Study on the entire Shore of New Jersey, dated September 1990, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, in the interest of water resources development, environmental restoration, and other allied purposes.*

The resolution was passed in response to frequent flooding from coastal storms such as nor'easters, tropical storms, and hurricanes that affected communities along the New Jersey shore. In response to the authority, USACE completed a reconnaissance report in July 2000 (USACE 2000). The report recommended further Federal investigation into the feasibility of reducing coastal flood risks along the Shrewsbury River at Sea Bright, and the feasibility of aquatic habitat restoration within the region.

A Feasibility Cost Sharing Agreement (FCSA) for a feasibility study was executed between the USACE and the New Jersey Department of Environmental Protection (NJDEP), the non-Federal study sponsor, in August 2001. The study was underway when Hurricane Sandy severely impacted the region in October 2012. In response to the devastation laid forth by the storm, the U.S. Congress passed and the President signed into law the Disaster Relief Appropriations Act of 2013 (Public Law [P.L.] 113-2). The legislation provided supplemental appropriations to address damages caused by Hurricane Sandy and

to reduce future flood risk in ways that will support the long-term sustainability of the coastal ecosystem and communities, and reduce the economic costs and risks associated with large-scale floods and storms. It allocated $5,350,000,000 to USACE to address areas impacted by Hurricane Sandy. USACE received $1,000,000 of these funds to complete the study to investigate potential solutions to reduce damages from coastal storms in Sea Bright. A FCSA amendment to complete the study at 100 percent federal cost, pursuant to P.L. 113-2, was executed with NJDEP on August 5, 2013.

1.3 Study Scope & History

The reconnaissance study initially focused on potential basin-wide solutions to back bay flooding due to coastal storms from the Shrewsbury River. It was undertaken to identify potential locations for Federal participation in coastal storm risk management projects within the entire Shrewsbury River Basin watershed. There are sixteen New Jersey municipalities that lie wholly within the watershed: Colts Neck, Eatontown, Fair Haven, Holmdel, Little Silver, Long Branch, Marlboro, Middletown, Monmouth Beach, Oceanport, Red Bank, Rumson, Sea Bright, Shrewsbury, Tinton Falls, and West Long Branch (Figure 1). The July 2000 reconnaissance report recommended investigation into potential coastal storm risk management solutions in only Sea Bright and Monmouth Beach, and three ecosystem restoration projects within the basin. After a more refined investigation and coordination with locals, it was determined that a project at Monmouth Beach was infeasible. NJDEP requested that a feasibility study focus only on the potential coastal storm risk management opportunities in downtown Sea Bright. This study focuses on the investigation into the feasibility of such a risk management project.

The feasibility study was initiated in 2001. In early 2012, USACE had identified a potential project that included the elevation of 33 structures in Sea Bright. Hurricane Sandy made landfall in October of that year, completely flooding the Borough and underscoring the need for USACE participation in a risk management project. Because the storm caused significant changes to the region, updated engineering and economic data were collected, and new engineering analyses were performed. USACE investigated a wide range of risk management measures, from structure elevations to a storm surge barrier in Sandy Hook Bay. The results of these post-Hurricane Sandy engineering and economic analyses, and a potential plan of action, are detailed in this report.

1.4 Study Area

The study area is the area within which significant project impacts may occur. As described in Section 1.3, it was determined during the 2000 reconnaissance study that limited opportunities for a coastal storm risk management project exist throughout most of the Shrewsbury River Basin. Specifically, downtown Sea Bright was highlighted in the reconnaissance report as one of the areas most vulnerable to coastal storm flooding in the basin. As discussed in Chapter 3, a variety of alternatives were initially formulated to reduce the risk of coastal storm flooding – including a “regional” plan that would potentially affect a large part of the Shrewsbury River Basin. Because only plans with “localized” impacts were carried forward for detailed analysis, existing, future with, and future without-project conditions described in this report are specific to downtown Sea Bright and not the larger Shrewsbury River Basin. The study area, and the discussion in this report about potential impacts and benefits of a coastal storm risk management project focus on the potential implementation of such a project in downtown Sea Bright (Figure 2).

The downtown area is roughly in the geographic center of the Sea Bright, which occupies a thin strip of coastal spit south of Sandy Hook with the Atlantic Ocean to the east and the Shrewsbury and Navesink Rivers to the west (Figure 3). The modern community of Sea Bright dates to the 1840s, when the area was used for fishing and water sports. Hotels, seasonal cottages, and recreational development soon followed, and Sea Bright was formally incorporated in 1889. Over time, the community became year-round as supported by a downtown with stores, restaurants, and other office-based businesses located

on Ocean Avenue south of the Rumson Bridge (County Route 520). Most land in Sea Bright is occupied by residential development (75 percent of landcover), which is mostly single-family dwellings, though a number of multi-unit residential and low-rise developments can be found. Private residences, and a number of marine-related businesses including marinas, seafood restaurants, boat suppliers and repairers, and small-scale fishing businesses line the Shrewsbury River waterfront. Sea Bright is also home to a number of private and public beach clubs along the oceanfront.

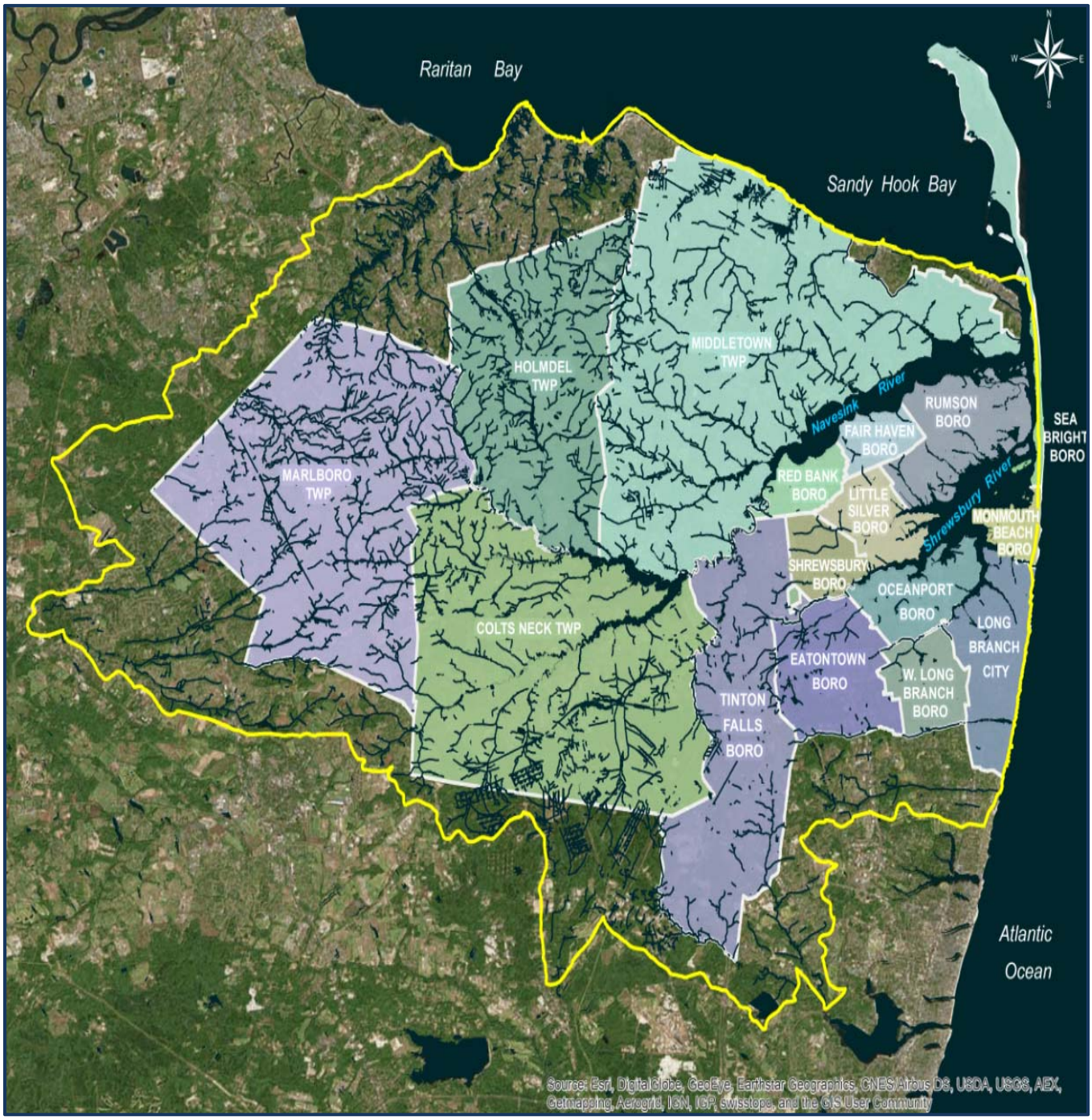


Figure 1: Shrewsbury River Basin, New Jersey.

Figure 2: The study area: downtown Sea Bright.

Figure 3: Borough of Sea Bright, New Jersey.

The study area consists of the Sea Bright commercial district and approximately a third of the Borough's households. It extends from the Shrewsbury River east to the Atlantic Ocean, and the Rumson Bridge (County Route 520) south to Sandpiper Lane. Businesses line Ocean Avenue, with many apartments located on the second story of the mixed-use buildings (Figure 4). Single- and multi-family residences are primarily located along streets off Ocean Avenue (Figure 5).

Figure 4: Downtown Sea Bright streetscape, Ocean Avenue looking south, 2015.

Downtown Sea Bright is also part of the study area for the New York-New Jersey Harbor and Tributaries coastal storm risk management study, which is currently underway. The study will investigate ways to reduce coastal storm risk in Sea Bright and other coastal communities within the New York City metropolitan area.

1.5 Need for Action*

The residents and businesses in Sea Bright have sustained repeated flood damage from coastal storms such as nor'easters, tropical storms, and hurricanes since the Borough's settlement in the early 1840s. The community is vulnerable to coastal storm flooding due to its geography and topography. The Borough is located on a coastal spit between the tidally-influenced Shrewsbury and Navesink Rivers to the west, and Atlantic Ocean to the east (see Figure 3). Most of the Borough is located within areas designated as high risk by the Federal Emergency Management Agency (FEMA) (one percent floodplain, AE zone). The relatively low-lying land is subject to frequent coastal storm flooding from the Atlantic Ocean and, more severely, back bay flooding from the Shrewsbury River, as detailed in Section 2.2 below.

1.6 Prior Studies & Reports

Data from prior reports were used to support the analyses and recommendations presented in this report. This includes analysis and reports completed in support of this study. They include:

- North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk (USACE 2015)
- Draft Preliminary Alternatives Analysis Report, "Shrewsbury River Basin, New Jersey, Flood Risk Management Study Preliminary Alternatives Analysis Report" (USACE 2011)
- USACE Engineer Research & Development Center Coastal Hydraulics Laboratory Letter Report, "Shrewsbury River Flood Control Modeling" (USACE 2006)
- "Shrewsbury River Basin, New Jersey, Reconnaissance Study for Flood Control & Ecosystem Restoration, Section 905(b) (WRDA 86) Preliminary Analysis" (USACE 2000)
- General Design Memorandum, "Atlantic Coast of New Jersey from Sandy Hook to Barnegat Inlet Beach Erosion Control Project" (USACE 1989)

Figure 5: Typical residential streetscape, Center Street looking west to the Shrewsbury River, 2011.

Chapter 2: Existing Conditions*

Existing conditions of the affected environment serve as the basis for the characterization of problem identification and projection of future without-project conditions. The historic and existing conditions, and a forecast of the "future without-project" conditions provide the basis for plan formulation. The future without-project condition is the No Action Alternative. Existing conditions are described here for the environmental setting, the built environment, and the human environment. This description of the affected environment is in accordance with the requirements of National Environmental Policy Act of 1969 (NEPA), and serves as the baseline for Chapter 5 of this report.

2.1 Topography

Sea Bright is characterized by extremely low-lying terrain. The majority of the area west of Ocean Avenue is at or below +4 feet North American Vertical Datum of 1988 (NAVD88). The riverfront is stabilized by a relatively low bulkhead at a height of approximately +5 feet NAVD88 for most of its extent. There is a slight rise east to Ocean Avenue to an elevation generally between +4 feet and +6 feet NAVD88. East of Ocean Avenue towards the Atlantic Ocean, the elevations rise again. Landward of the beach and dune, elevations generally vary between +6 feet NAVD88 to +12 feet NAVD88, and generally average +10 feet NAVD88. The USACE Sandy Hook to Manasquan project is located along the Atlantic Ocean shoreline. The beach conditions vary, but are generally at an elevation of +10 feet NAVD88. The beach is backed by a seawall through a portion of the study area, with varying heights up to elevation +16 feet NAVD88. The seawall has a gap approximately a third of a mile long near the Chapel Beach Club and public parking lot. A local project to join the disconnected parts of the seawall is currently under construction by the NJDEP with scheduled completion in the summer of 2018.

2.2 Flooding in Sea Bright

Living with water is integral to the culture of Sea Bright. The Atlantic Ocean and Shrewsbury River provide many opportunities for recreation, but also pose the potential for flood risk. Most of the community is within the one percent floodplain of the Shrewsbury River. The Shrewsbury River Basin receives about 45 inches of precipitation per year. The mean tidal range on the riverside at Sea Bright is 3.15 feet, and 5.08 feet on the oceanside. Depending on tidal action, runoff and tidal flow from the river can produce significant currents through the narrows at Sea Bright. Flooding is most severe during coastal storms such as nor'easters, tropical storms, and hurricanes.

Frequent overtopping of the relatively low river-fronting bulkheads occurs during spring tide events and coastal storms such as nor'easters, tropical storms, and hurricanes. Tidal surge is pushed from Sandy Hook Bay into the Shrewsbury River, and ultimately into surrounding communities. During and after tidal flood events, streets are typically flooded with up to 2 feet of water for hours or days (Figure 6). Large nor'easters have resulted in street, vehicle, and structure flooding, with the most severe flood damages in areas adjacent to or near the Shrewsbury River. Sea Bright is sometimes also flooded when storm surge from the Atlantic Ocean overtops the ocean-fronting beach and seawall. Hurricane Sandy, the most recent major hurricane to impact Sea Bright, made landfall south of the Borough in October 2012, and inundated the entire Borough with storm surge via back bay flooding from the Shrewbury River and overtopping of the ocean-fronting beach.

Figure 6: Typical street flooding due to a nor'easter, March 2013.

2.2.1 Describing Storms and Flood Levels

Floods are often defined according to their likelihood of occurring in any given year at a specific location. The most commonly used definition is the "100-year flood" or "100-year storm." This refers to a flood level or peak that has a one in 100 chance, or one percent chance of being equaled or exceeded in any year (i.e., one percent "annual exceedance probability"). Therefore, the 100-year flood is also referred to as the "one percent flood," or as having a "recurrence interval" or "return period" of 100 years. In this report, "one percent flood" is used to describe this type of event.

A common misinterpretation is that a one percent flood is likely to occur only once in a 100-year period, when in fact, a second one percent flood could occur a year or even a week after the first one. The term only means that that the average interval between floods greater than the 100-year flood over a very long period (say 1,000 years) will be 100 years. However, the actual interval between floods greater than this magnitude will vary considerably.

In addition, the probability of a certain flood occurring will increase for a longer period of time. For example, over the life of an average 30-year mortgage, a home located within the one percent flood zone has a 26 percent chance of being flooded at least once. Even more significantly, a house in a 10 percent flood zone is almost certain to be flooded at least once (96 percent chance) for the same 30-year mortgage. The probability (P) that one or more of a certain-size flood occurring during any period will exceed a given flood threshold can be estimated as:

$$P = 1 - \left[1 - \frac{1}{T}\right]^n$$

where T is the return period of a given flood (e.g., 100 years, 50 years, 25 years) and n is the number of years in the period. The probability of flooding by various return period floods in any given year and over the life of a 30-year mortgage is summarized in Table 1.

Table 1: Examples of flooding by various return periods.

Return Period (years)	Chance of flooding in any given year	Percent chance of flooding during 30-year mortgage
10	10 in 100 (10%)	96%
50	2 in 100 (2%)	46%
100	1 in 100 (1%)	26%
500	0.2 in 100 (0.2%)	6%

Because of the potential confusion, recent USACE guidance recommends use of the annual exceedance probability terminology instead of the recurrence interval or return period terminology. For example, the "one percent annual exceedance probability flood" or "one percent chance exceedance flood" is a flood event that has a one percent chance of occurring any given year. The terms may be shortened to "one percent flood," as opposed to oft-referenced but confusing "100-year flood." This report uses the short form "one percent flood."

2.3 Water Surface Elevations

Stage-frequency curves for the study area were acquired from the USACE North Atlantic Coast Comprehensive Study (NACCS) (USACE 2015). The stage frequency curves for a range of return periods, from the 100 percent flood to the 0.2 percent flood, are presented in Table 2.

Table 2: Stage-frequency data for Sea Bright, NJ.

Annual Chance of Exceedance (%) "percent flood"	Water Surface Elevation (+feet NAVD88) (based on still water level*)
1 year (100%)	2.0
2 year (50%)	2.6
5 year (20%)	3.6
10 year (10%)	4.5
20 year (5%)	5.5
25 year (4%)	6.0
50 year (2%)	7.0
100 year (1%)	8.2
200 year (0.5%)	9.4
500 year (0.2%)	12.7

* mean water surface elevations were adjusted to include RSLC from 1992-2020

All water level data stated in this report uses data from the NACCS unless stated otherwise

2.4 Existing Water Resource Projects

There are a number of Federal, local, and private water resource projects in the study area that are in place to reduce the risk of flooding to homes and businesses (Figure 7). They include:

- Borough of Sea Bright's ocean-facing seawall, including an extension currently under construction
- Riverfront bulkheads built and maintained by homeowners on their private property
- Riverfront bulkheads built and maintained by the Borough of Sea Bright on municipally-owned property
- Stormwater outfalls maintained by the Borough of Sea Bright
- USACE Atlantic Coast of New Jersey, Sandy Hook to Barnegat Inlet Beach Erosion Control Project (Section 1 – Sea Bright to Ocean Township, New Jersey) – coastal storm risk management erosion control project

The following projects that were built and are maintained for navigation purposes are also located in the study area:

- Shrewsbury & Navesink Rivers Federal (USACE) navigation projects
- Shrewsbury & Navesink Rivers state navigation projects

The ocean-facing seawall was originally built to protect a railroad that traveled through Sea Bright. The stone structure is now currently maintained by the Borough of Sea Bright as a public flood risk management project (Figure 8). It spans most of the study area, and is continuous but for a one-third mile gap near the Chapel Beach Club; the seawall is currently being extended in this area, and is assumed in place for the future with- and without-project conditions. Bulkheads that line the Shrewsbury River are mostly privately built and maintained, and are of various elevations and condition (Figure 9). Most are at or below an elevation of +6 feet NAVD88. The Borough built and maintains bulkheads on municiptally-owned land located at the end of public streets. These bulkheads were reinforced and elevated to +7 feet NAVD88 after Hurricane Sandy.

Flapgates have been installed in Sea Bright to promote one-way flow through the stormwater outfalls. Flapgates are water control structures that allow water to pass one way, generally away from streets and homes. These flapgates have proved to be largely ineffective. Significant quantities of water leak through the flapgates and water seeps through privately-owned bulkheads, which are porous due to poor design and/or maintenance. In several locations, the Borough has installed manual check valves to seal the outfalls during abnormally high tides (i.e., spring tides or coastal storms). The check valves have proved to be more effective. The valves are operated by the Borough Department of Public Works in cooperation with the Borough Police Department, which operates the community flood warning system. However, local residents sometimes open/close the valves independently and irregularly in response to tidal conditions. Although there are operational problems with the valves, the main problem of recurrent flooding appears to be leakage through and over the bulkheads along the river.

2.5 Socioeconomics

Until the late 19th century, the area now occupied by Sea Bright consisted mainly of undeveloped dunes and a small fishing community known as Nauvoo. Nauvoo changed its name to Sea Bright in 1870, and began importing soil from nearby Rumson and Long Branch on which to build summer houses. From then on the area developed principally as a beachside resort community, with a now-defunct railroad along what is now Ocean Avenue that made Sea Bright easily accessible for residents of New York City. The widespread use and ownership of motor vehicles after World War II ensured that the area would continue to derive much income from tourism and vacationers. Available data suggests that while the populations of the Nation, the State of New Jersey, and Monmouth County have grown over recent decades and will continue to grow for the foreseeable future, the population of Sea Bright has experienced slower overall growth in recent decades and has reached a more or less stable level.

Figure 7: Existing and planned water resource projects. Approximate location of seawall currently under construction shown as dashed line. Study area shown in yellow.

Figure 8: Sea Bright's seawall, 2015.

Figure 9: Typical bulkheads on the Shrewsbury River, 2006.

Population densities for the State of New Jersey and for Monmouth County are 1,218 persons per square mile and 1,337 persons per square mile, respectively (U.S. Census 2010). Because of the physical constraints of the Atlantic Ocean and the Shrewsbury River, Sea Bright is more densely populated, with 1,412 persons per square mile. According to the 2010 U.S. Census, incomes and the value of owner-occupied housing units in Sea Bright is generally significantly higher than those in the rest of Monmouth County and the State of New Jersey. Household income and home values in the downtown area are generally less than those in other parts of the Borough. It is assumed that the majority of the working population is employed at locations outside Sea Bright. The 2010 census data records that 86.1 percent of the employed population commute to work by car, and 7.2 percent by public transportation. The mean travel time to work is 33.6 minutes. Downtown Sea Bright is the business and cultural center of the Borough. Many important businesses are located on Ocean Avenue. They include marinas, retail shops and restaurants that are important to the regional economy. Seasonal rentals and tourists contribute a lot to the economy of the seaside town. Borough Hall, a fire department, and police headquarters are also located on Ocean Avenue. The temporary location of the J.W. Ross Cultural Arts Center and Library is inside the United Methodist Church on Ocean Avenue and River Street; the buiding that housed the library and cultural center was destroyed during Hurricane Sandy. A weekly seasonal farmers market is held in the municipal parking lot adjacent to the public beach during growing season.

2.6 Environmental Justice

Environmental justice is 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. USACE used 2009 – 2013 American Community Survey data from the U.S. Census to help understand community demographics, and determine if communities at risk would be negatively or disproportionately impacted by a proposed project. Sea Bright has noticeably fewer individuals living below the poverty line (5.5 percent) than the state (10.4 percent) or county (7.0 percent) overall. Based on the data, there are no significant minority populations and/or low-income populations in the study area (Table 3).

Table 3: Select demographics (ACS, 2009 – 2013).

	Sea Bright	Monmouth County	State of New Jersey
Median household income	$83,000	$85,000	$72,000
% families below poverty line	3.7%	5.1%	7.9%
% individuals below poverty line	5.5%	7.0%	10.4%
% minority* population	8.1%	17.2%	31.4%

* defined as black or Hispanic or Latino; African-American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; Other, or two or more races. Data from the 2010 U.S. Census.

2.7 Critical Infrastructure

Critical infrastructure is defined as the infrastructure that is essential for the functioning of a society and economy. The Nation's critical infrastructure provides the essential services that underpin American society and serve as the backbone of our Nation's economy, security, and health. Most commonly associated with the term are facilities for security services (police, military); electricity generation, transmission and distribution; telecommunications; water supply (drinking water, waste water/sewage); heating (natural gas, fuel oil, district heating); public health (hospitals, ambulances); and transportation systems (evacuation routes, railway networks, airports, harbors). Critical infrastructure in the study area includes an evacuation route, fire department, police department, and Borough Hall (Figure 10).

Ocean Avenue is a state highway (NJ-36) that serves as the only designated evacuation route for Sea Bright, and serves as an evacuation route for Monmouth Beach and other nearby communities. It spans north-south through the Borough, traveling south to neighboring Monmouth Beach. It links in the north to the Highlands Bridge that connects the Borough to Highlands, New Jersey. The road also connects to the Rumson Bridge (County Route 520) to the west. Prior to storms, residents from Sea Bright and neighboring communities use the road to evacuate inland to temporary shelters, hotels, and other places of safety. Though on relatively high ground, the road is sometimes inundated by storm surge, as was the case during Hurricane Sandy. Surge waters usually bring with it debris and sand, blocking access to and travel within the Borough. Hurricane Sandy covered Ocean Avenue with a few feet of sand, the removal mission for which took days and prevented residents' repopulation and recovery after the storm. The Borough of Sea Bright police department, fire department, and Borough Hall are all located along Ocean Avenue. The police force's 20 officers serve to protect life and property during emergency and non-emergency events. The fire department, Sea Bright Fire & Rescue, is a volunteer organization operating out of one firehouse, which houses a truck and engine. The fire department also has access to boats and a wave runner. Borough Hall is home to the Borough of Sea Bright Office of Emergency Management, which coordinates emergency mitigation and response efforts prior to, during, and after emergency events. Police officers, volunteer firefighters, and other local emergency responders contribute greatly to emergency mitigation and response. They respond to emergency calls, assist with mandatory evacuations, clear roads, and generally enhance safety in the community (Figure 11).

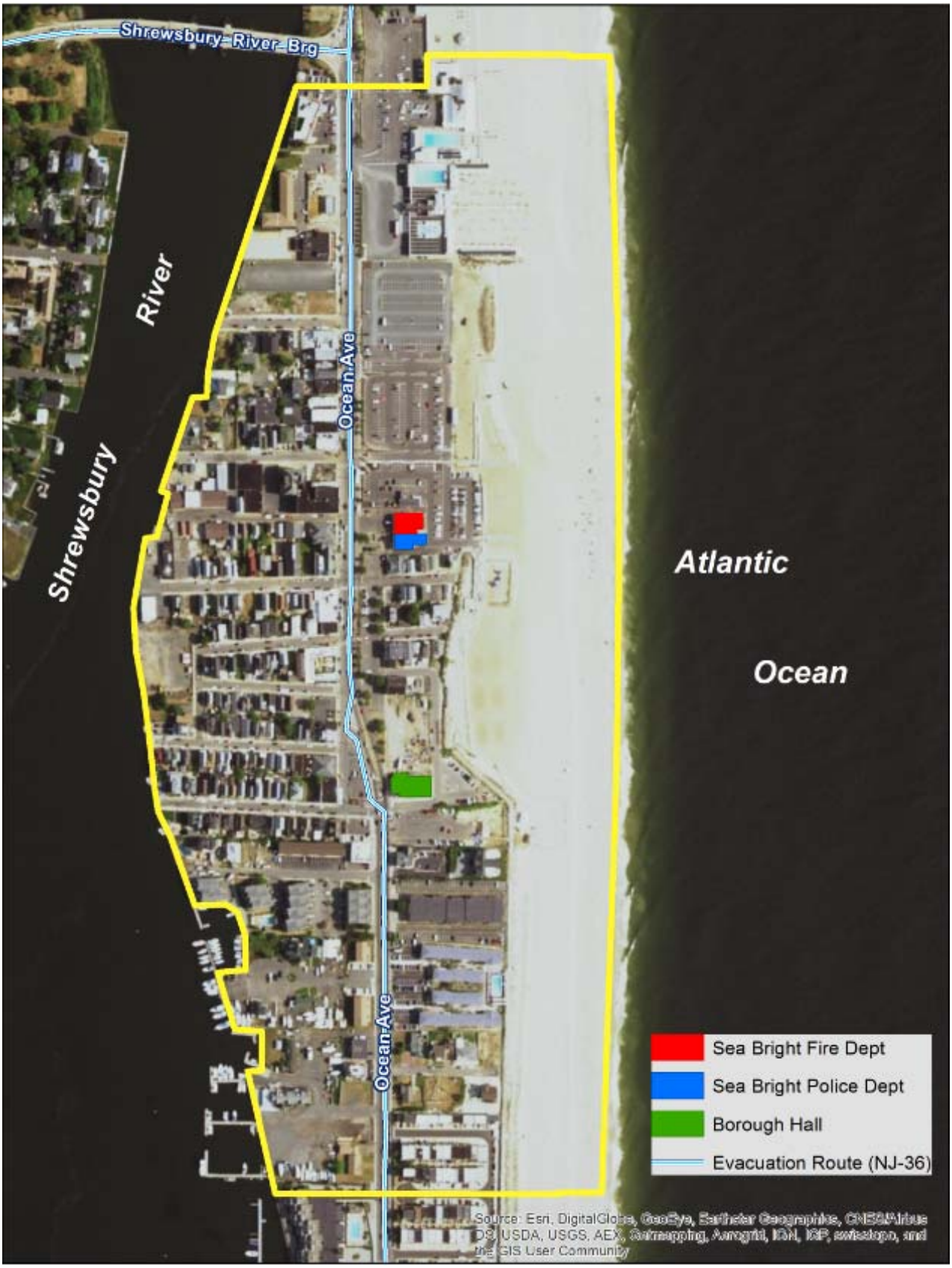


Figure 10: Critical infrastructure in Sea Bright. Study area outlined in yellow.

These facilities were flooding by Hurricane Sandy. A new complex that will house the borough's government offices, police station, and fire station is currently in final design. The complex will be built above the base flood elevation (BFE)[1], and as such be less susceptible to flooding than the previous facilities.

Figure 11: Firefighters clean the Sea Bright fire station after Hurricane Sandy, 2012.

2.8 Water Resources

2.8.1 Groundwater

The study area is located directly above the Northern Atlantic Coastal Plain (NACP) aquifer system, which is a Nationally-designated Sole Source Aquifer (USEPA 1988). This aquifer system is a complex, multi-layered system underlain by semi-consolidated to unconsolidated sediments that consist of silt, clay, and sand, with some gravel and lignite (Trapp and Horn 1997). Sole Source Aquifer designation is one tool to protect drinking water supplies in areas with few or no alternative sources to the ground water resource, and where if contamination occurred, using an alternative source would be extremely expensive. The designation protects an area's ground water resource by requiring EPA to review all proposed projects within the designated area that will receive federal financial assistance.

[1] Base flood elevation: the computed elevation to which floodwater is anticipated to rise during the base flood. The base flood is colloquially called the "one percent flood" or "100 year flood."

The New Jersey Coastal Plain Aquifer System is the local component of the NACP in the study area and covers about 4,200 square miles. More than half of the land area is below an altitude of fifty feet above sea level. The area is largely surrounded by salty or brackish water and is bounded by the Delaware River on the west, Delaware Bay on the south, the Atlantic Ocean on the east, and Raritan Bay on the north. The New Jersey Coastal Plain Aquifer discharges to the surface through streams, springs, and evapotranspiration. Many streams ultimately flow into bays or directly into the ocean. Development of ground water as a water supply source constitutes another discharge component which today accounts for a significant portion of discharge from the overall system. In certain areas (e.g., along the Delaware River) heavy pumping has caused a reversal in the normal discharge from the aquifer (Raritan-Magothy) such that the surface stream (Delaware River) now recharges the aquifer. This phenomenon implies that, in addition to the New Jersey Coastal Plain Area, the Delaware River Basin within Delaware, New Jersey, Pennsylvania and New York must be regarded as a stream flow source zone (an upstream headwaters area which drains into a recharge zone), which flows into the Coastal Plain Area (USEPA 1988).

The primary source of groundwater extraction in the study area is from the Potomac-Raritan-Magothy aquifer. The source of recharge for this aquifer is through precipitation and infiltration (Trapp and Horn 1997). Groundwater quality of the Potomac-Raritan-Magothy aquifer is generally good, with a median chloride concentration of 11.6 milligram/liter (mg/L), soft groundwater (0-60 mg/L as calcium carbonate), iron concentrations routinely exceeding the National drinking-water standard of 300 microgram/liter (µg/L), and nitrate plus nitrite levels being consistently 0.11 mg/L or less (Moody et al. 1988). The predominant ions in most New Jersey groundwater are calcium, magnesium, and bicarbonate (Moody et al. 1988).

2.8.2 Surface Water

The key surface water feature in the study area is the Shrewsbury River. The Shrewsbury River is a wide tidal river surrounded by mostly residential development and separated from the Atlantic Ocean by developed barrier beaches. A few dredged material and salt marsh islands exist at the confluence of the river. The Shrewsbury River forms the entire western boundary of the study area. There are no open creeks or streams in downtown Sea Bright that flow into the Shrewsbury River. The river is classified by NJDEP as “SE1(C1),” which indicates salt water estuarine category 1 waters. The Shrewsbury River is the main source of back bay flooding in the study area.

2.9 Vegetation

2.9.1 Uplands

The study area is almost fully developed with closely spaced homes and businesses. There are no significant vegetation communities. Upland plants are those typical in urban settings and include ornamental shrubs, grasses, and trees adjacent to houses.

2.9.2 Wetlands

The study area is almost fully developed with closely spaced homes and businesses. There are no significant wetland vegetation communities in the study area. Bulkheads are present on the shoreline adjacent to the Shrewsbury River below the high tide zone, resulting in total loss of fringing wetlands and mud flats in the Shrewsbury River.

2.10 Fish & Wildlife to include Coastal Barrier Resources Act

2.10.1 Amphibians & Reptiles

The study area has minimal and poor to no habitat for amphibians and reptiles. Amphibians possibly residing within the area include Northern Spring Peeper (*Pseudacris crucifer crucifer*) and American Bullfrog (*Rana catesbeiana*). Reptiles possibly occurring include Diamondback Terrapin (*Malaclemys terrapin*), Common Snapping Turtle (*Chelydra serpentina*), and Eastern Box Turtle (*Terrapene carolina carolina*).

2.10.2 Birds

The North American Breeding Bird Survey conducts a survey route in nearby Keyport, New Jersey. Species observed in the Keyport route would likely be observed in and around Sea Bright. Bird species observed were typical of an urban setting. These species include Herring Gull (*Larus argentatus*), Double-crested Cormorant (*Phalacrocorax auritus*), Canada Goose (*Branta canadensis*), Killdeer (*Charadrius vociferous*), Rock Pigeon (*Columba livia*), Mourning Dove (*Zenaida macroura*), Turkey Vulture (*Cathartes aura*), Hairy Woodpecker (*Picoides villosus*), Downy Woodpecker (*Picoides pubescens*), Blue Jay (*Cyanocitta cristata*), American Crow (*Corvus brachyrhynchos*), European Starling (*Sturnus vulgaris*), Brown-headed Cowbird (*Molothrus ater*), Red-winged Blackbird (*Agelaius phoeniceus*), Common Grackle (*Quiscalus quiscula*), House Finch (*Carpodacus mexicanus*), Song Sparrow (*Melospiza melodia*), Eastern Towhee (Pipilo erythrophthalmus), Northern Cardinal (*Cardinalis cardinalis*), House Sparrow (*Passer domesticus*), Northern Mockingbird (*Mimus polyglottos*), Gray Catbird (*Dumetella carolinensis*), American Robin (*Turdus migratorius*), Mallard (*Anas platyrhynchos*), Great Blue Heron (*Ardea herodias*), and Red-tailed Hawk (*Buteo jamaicensis*) (USGS 2013). The study area is surrounded by estuarine and coastal habitat extensively used by migratory birds, waterfowl, wading and shore birds for their lifecycle needs, however the existing habitats of the proposed project sites are limited. Food sources mostly include garden flowers, feeders and scavenged waste.

2.10.3 Mammals

Mammals within the study area are presumed to be those typically found in urban settings. These species include opossum (*Didelphis virginiana*), raccoon (Procyon lotor), muskrat (*Ondatra zibethica*), gray squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), Norway rat (*Rattus norvegicus*) and skunk (*Conepauts mesoleucus*).

2.10.4 Finfish, Shellfish, and Benthic Resources

As downtown Sea Bright is entirely terrestrial, there are no existing fish, shellfish, or benthic habitat or resources in the study area.

2.10.5 Coastal Barrier Resources Act (CBRA)

In the early 1980s, Congress recognized that certain actions and programs of the Federal government have historically subsidized and encouraged development on coastal barriers, resulting in the loss of natural resources; threats to human life, health, and property; and the expenditure of millions of tax dollars each year. To remove the federal incentive to develop these areas, the Coastal Barrier Resources Act (CBRA) of 1982 and subsequent amendments designated relatively undeveloped coastal barriers along the Atlantic, Gulf of Mexico, Great Lakes, U.S. Virgin Islands, and Puerto Rico coasts and made these areas ineligible for most new federal expenditures and financial assistance.

CBRA encourages the conservation of hurricane prone, biologically rich coastal barriers by restricting federal expenditures that encourage development, such as federal flood insurance. Areas within the CBRS can be developed provided that private developers or other non-federal parties bear the full cost.

According to the USF&WS Coastal Barrier Resources System Mapper, Coastal Barrier Resouces Unit NJ-04A (Navesink/Shrewsbury Complex) is near to downtown Sea Bright on the northwest and southwest, but does not affect the study area. No components of the proposed plan are within or abut upon this Unit.

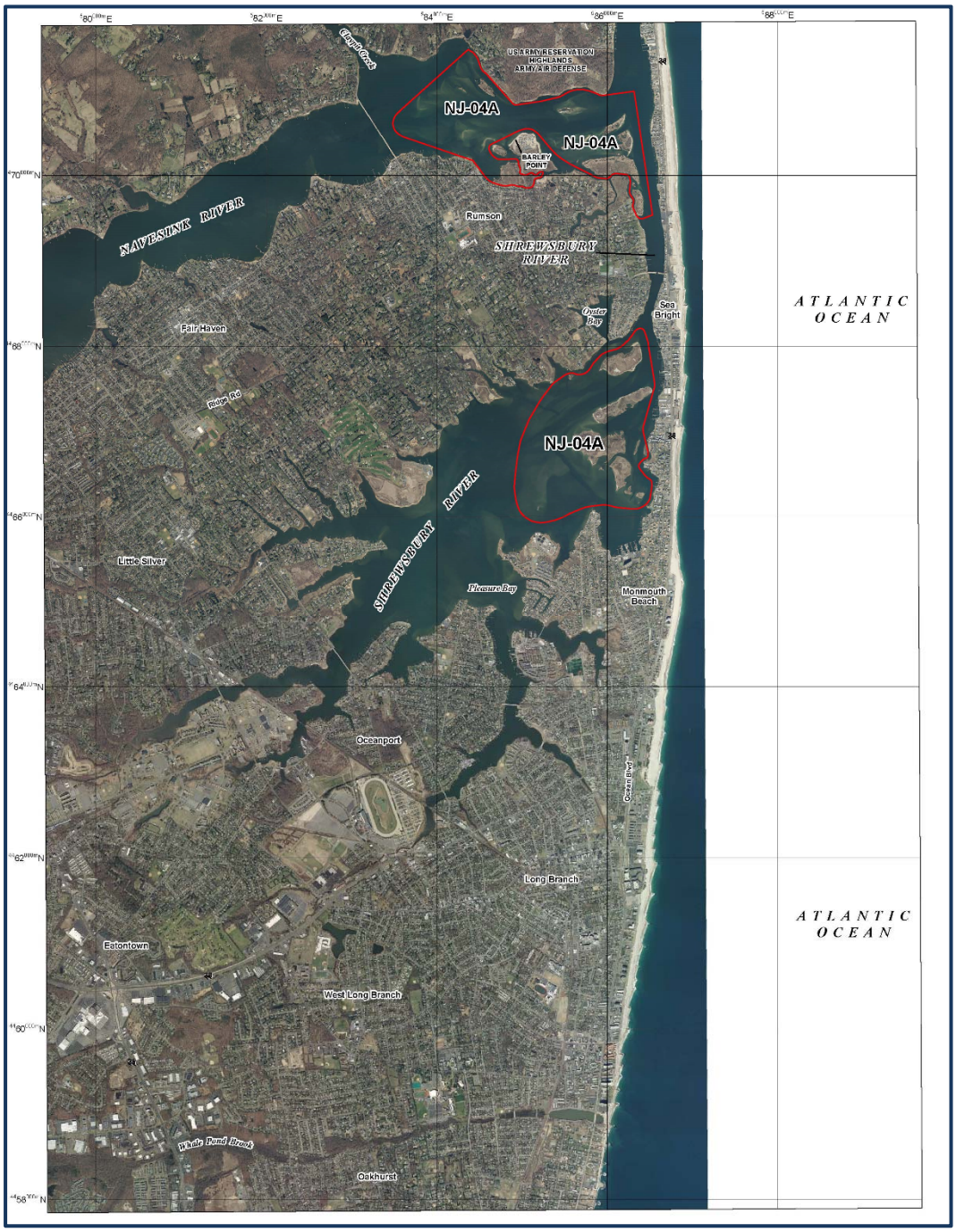


Figure 12: Coastal Barrier Resources System map. System unit boundaries in red.

2.11 Threatened and Endangered Species

2.11.1 Federal Threatened & Endangered Species

The U.S. Fish and Wildlife Service (USFWS) lists the Federally-threatened Piping Plover (*Charadrius melodus*), Red Knot (*Calidris canutus rufa*), seabeach amaranth (*Amaranthus pumilus*), and Northern long-eared Bat (*Myotis septentrionalis*) as potentially occurring in the study area. However, there is no designated critical habitat for any of the listed species in the study area of downtown Sea Bright, and the USFWS has no records of any of the listed species occurring there. ESA concurrence was received March 8, 2017 (Appendix E).

Piping Plover

Plovers have been seen on several Monmouth County Ocean beachs. In 2017 a significant number of Piping Plovers nested and raised young on the Atlantic Ocean beach about 1.5 miles north of downtown Sea Bright as well as at Port Monmouth Beach about 1.5 miles to the south. Other occurrences of the Piping Plover nesting are Seven Presidents Park to the south (approximately three miles) and Sandy Hook National Seashore to the north (between four and seven miles). These plover use special symbolically-fenced areas and are extensively monitored by USFWS, NJDEP and USACE. A review of the USFWS Information for Planning and Conservation website shows that the threatened Piping Plover is present within a 3.5 mile radius of the study area (USFWS 2016). USACE has conducted Piping Plover monitoring along the New Jersey shore since the 1990s. While there has been Piping Plover activity on the beaches outside the study area, there has been no evidence of Piping Plover activity within it. Coordination with the USFWS pursuant to Section 7 of the Endangered Species Act has been initiated and documented. ESA concurrence was received March 8, 2017 (see Appendix E).

Red Knot

Small numbers of red knots may occur in New Jersey year-round, while large numbers of birds rely on New Jersey's coastal stopover habitats during the spring (mid-May through early June) and fall (late-July through November) migration periods. Smaller numbers of knots may spend all or part of the winter in New Jersey. A review of the USFWS Information for Planning and Conservation website shows that the threatened Red Knot is present within a 3.5 mile radius of the study area (USFWS 2016). While there has been Red Knot activity on the beaches outside the study area, there has been no evidence of Red Knot activity within it. Coordination with the USFWS pursuant to Section 7 of the Endangered Species Act has been initiated and documented. ESA concurrence was received March 8, 2017 (see Appendix E).

Seabeach Amaranth

There is a known occurrence of the Federally-listed threatened plant seabeach amaranth within 3.5 miles of the project area. However, there is no seabeach amaranth habitat within the study area of downtown Sea Bright. USACE has conducted seabeach amaranth monitoring along the New Jersey shore in the past number of years. While there has been seabeach amaranth identified outside the study area, there has been no evidence of seabeach amaranth activity within it.

Northern Long-Eared Bat

The Northern long-eared bat is a Federally-listed threatened species that inhabits specific habitat within this area of New Jersey. There are no known roosting trees or hibernacula of Northern long-eared bat

in or nearby the study area. Although there are no elements of preferred bat habitat, such as dense forests or known hibernacula in the study area, the Northern long-eared bat is may nest in houses, and especially attics or eaves. Final ESA coordination with the USFWS occurred on March 8, 2017 (see Appendix E).

2.11.2 New Jersey State Threatened and Endangered Species

The NJDEP Division of Fish and Wildlife manages the state's lists of threatened and endangered species. A review was conducted of the agency's online database that maps threatened and endangered species habitat within the study area (NJDEP 2018). There are no known state-listed threatened or endangered species in in the study area. Transient bald eagles (*Haliaeetus leucocephalus*) or peregrine falcons (*Falco peregrinus*), both listed as endangered in New Jersey, may pass through the study area. However, none are expected to breed or roost in it. The osprey, listed as threatened by the State of New Jersey, may use the adjacent Shrewsbury and Navesink River estuaries for feeding and nesting activities, thereby flying over or passing through the project area. However, there are no osprey or osprey nests within the study area.

2.12 Essential Fish Habitat

Essential Fish Habitat is designated for the waters surrounding the study area. NOAA informed USACE that since all our proposed actions are on dry land, no futher coordination is necessary.

2.13 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 a proposed project. For this study, the APE boundaries are contiguous with the study area. Present statutes and regulations governing the identification, protection and preservation of these resources include the National Historic Preservation Act of 1966 (NHPA), as amended; NEPA; Executive Order 11593; and the regulations implementing Section 106 of the NHPA (36 Code of Federal Regulations [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).

As established by 36 CFR Part 60, a historic property (generally a property over 50 years of age) is eligible for listing in the National Register if it possesses "integrity of location, design, setting, materials, workmanship, feeling, and association," and it meets at least one of four criteria:

- It is associated with events that have made a significant contribution to the broad patterns of our history; or
- It is associated with the lives of persons significant in our past; or
- It embodies the distinctive characteristics of a type, period, or method of construction, or it represents the work of a master, or it possesses high artistic values, or it represents a significant and distinguishable entity whose components may lack distinction; or
- It has yielded, or may be likely to yield information important in prehistory or history.

The identification of historic properties is coordinated with the New Jersey Historic Preservation Office (NJHPO). The Advisory Council on Historic Preservation, Native American Tribes, other interested parties and the public are given opportunities to participate in the process. NJHPO has determined that the New Jersey barrier islands have a low potential for archaeological resources (Personal Communication, West-Rosenthal, June 2015). In addition, NJHPO has determined since Hurricane Sandy and the associated demolition and rebuilding, none of the structures in the APE are eligible for the NRHP as an historic district or as individual structures (Appendix E).

2.14 New Jersey Coastal Zone

Pursuant to the Coastal Zone Management Act of 1972 and the Coastal Zone Reauthorization Act Amendments of 1990, the State of New Jersey has defined its coastal zone boundaries and developed policies to be utilized to evaluate and issue permits for activities located within the designated coastal zone, as set forth in New Jersey's Rules on Coastal Zone Management (NJAC 7:7, NJAC 7:7E). The NJDEP administers the coastal permit program through the Coastal Area Facility Review Act (CAFRA, New Jersey State Act 13:19-1 et seq.), the Wetlands Act of 1970 (NJSA 13:9A-1 et seq.), and the Waterfront Development Law (NJSA 12:5-3). Each of these acts provides a slightly different definition of the coastal zone; therefore, the designated coastal zone consists of the cumulative total of these three definitions.

The coastal zone boundary defined by CAFRA includes the study area. The Waterfront Development Law defines the coastal zone as any tidal waterway within the coastal area as defined by CAFRA, up to and including the high water line. Based on these definitions, the entire study area is located within the designated coastal zone.

2.15 Hazardous, Toxic, and Radioactive Waste

Hazarous, toxic, and radioactive waste (HTRW) are materials that may pose a risk to human health due to their harmful attributes. There are no known facilities that handle or produce hazardous or radioactive materials in the study area. It is assumed that the most common hazards that may be found in and around homes include lead-based paint (LBP), asbestos-containing materials (ACM), mold, dust, and heating oil contamination. Common hazards in and around commercial buildings and facilities may include LBP, ACM, mold, dust, heating oil contamination, and fuel contamination.

2.16 Air Quality

The Clean Air Act requires the United States Environmental Protection Agency (USEPA) to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants. These commonly found air pollutants (also known as criteria pollutants) are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide (CO), sulfur oxides (SO2), nitrogen oxides (NOx), and lead. The USEPA calls these pollutants criteria air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. Limits based on human health are called primary standards. The USEPA also can establish a second set of limits intended to prevent environmental and property damage, which are referred to as secondary standards. In every case except for SO2, the secondary standards established by the USEPA for the criteria pollutants are identical in level and form to their respective primary standards.

When a NAAQS is established or revised, the USEPA goes through a formal process to designate all areas of the country as either in attainment or in nonattainment. The Federal Clean Air Act further classifies ozone, carbon monoxide, and some particulate matter nonattainment areas based on the magnitude of an area's problem. Nonattainment classifications may be used to specify what air pollution reduction measures an area must adopt, and when the area must reach attainment. The technical details underlying these classifications are discussed in 40 CFR 81.

States with areas designated as nonattainment for any criteria pollutant must develop plans that show how they will bring those areas into attainment of the standard by their designated attainment dates. Once an area meets its attainment date, it can be re-designated to attainment, but states must submit maintenance plans for these areas to the USEPA to insure continued attainment of the areas over a period of 10 years. These re-designated areas are referred to as maintenance areas. Currently,

Monmouth County is located within the NY-NJ-LI-CT nonattainment area for the 8-hour ozone NAAQS and within the NY-NJ-LI-CT maintenance area for PM2.5, and the Freehold, NJ maintenance area for CO.

2.17 Aesthetics and Scenic Resources

The aesthetics and scenic resources of Sea Bright are related to its proximity to the Atlantic Ocean on the east and the Shrewsbury River on the west. The Borough is regionally known as a shorefront destination with a public beach and picturesque downtown (Figure 12).

2.18 Recreation

Sea Bright is a popular New Jersey shore community visited by many in the region, mostly in the summer months. The public beach fronting the Atlantic Ocean is the focal point of many recreational activities. The Borough has a number of private and public beach clubs along the oceanfront, including seven private beach clubs, more than any other New Jersey community. As well as private residences, the Shrewsbury River shoreline is the location for a number of marine-related businesses including marinas, seafood restaurants, boat suppliers and repairers, and small-scale fishing businesses. Sea Bright lies along Ocean Avenue (New Jersey State Route 36), a busy through route that connects the Garden State Parkway with various communities along the south shore of Raritan Bay and Sandy Hook Bay before following the shoreline south into Long Branch, then turning east and terminating at the Garden State Parkway in Eatontown. Public transportation in the study area is provided by New Jersey Transit, with local bus services connecting the shoreline communities with larger population centers. The nearest passenger rail station is in the City of Long Branch, approximately four miles south of Sea Bright, with direct services provided by New Jersey Transit to Newark, Hoboken, and New York City.

2.19 Noise

Noise is defined as unwanted sound. The day-night noise level (Ldn) is widely used to describe noise levels in any given community (USEPA 1978). 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 study area is vehicular traffic on Ocean Avenue (NJ-36), local roadways, and local construction projects that may be underway. Although noise level measurements have not been obtained in the study area, they can be approximated based on existing land uses. The typical Ldn in residential areas ranges from 39 to 59 dBA (USEPA 1978). It is assumed that the existing sound levels in the study area are roughly within this range. The Code of the Borough of Sea Bright, Chapter 144-7 Section B(3) prohibits noise disturbance due to construction and demolition activities (except emergency work) between the hours of 6:00 pm to 7:00 am on weekdays and 6:00 pm to 9:00 am on Saturdays, Sundays, and Federal holidays.

2.20 Infrastructure

2.20.1 Public Utilities & Services

New Jersey Natural Gas (NJNG) is the principal subsidiary of New Jersey Resources and provides natural gas to the project area. NJNG is one of the fastest-growing local distribution companies in the United States, serving more than 450,000 customers in New Jersey's Monmouth, Ocean, Middlesex and Morris Counties. There are many natural gas lines located below-ground in the study area. Jersey Central Power & Light/First Energy supplies electricity to nearly one million commercial and residential customers in New Jersey. Its parent company, GPU Incorporated, is one of the largest investor-owned electric utilities. GPU Energy also provides a variety of services, free of charge, to assist companies

with relocation and expansion. Services include a computerized listing of available commercial and industrial sites, community profiles and statistics, and data on government regulations and financing options. Along with technical assistance, GPU Energy can calculate potential power needs, and suggest programs for optimum efficiency and reduced power costs. The company provides electric to all residences and businesses in Sea Bright.

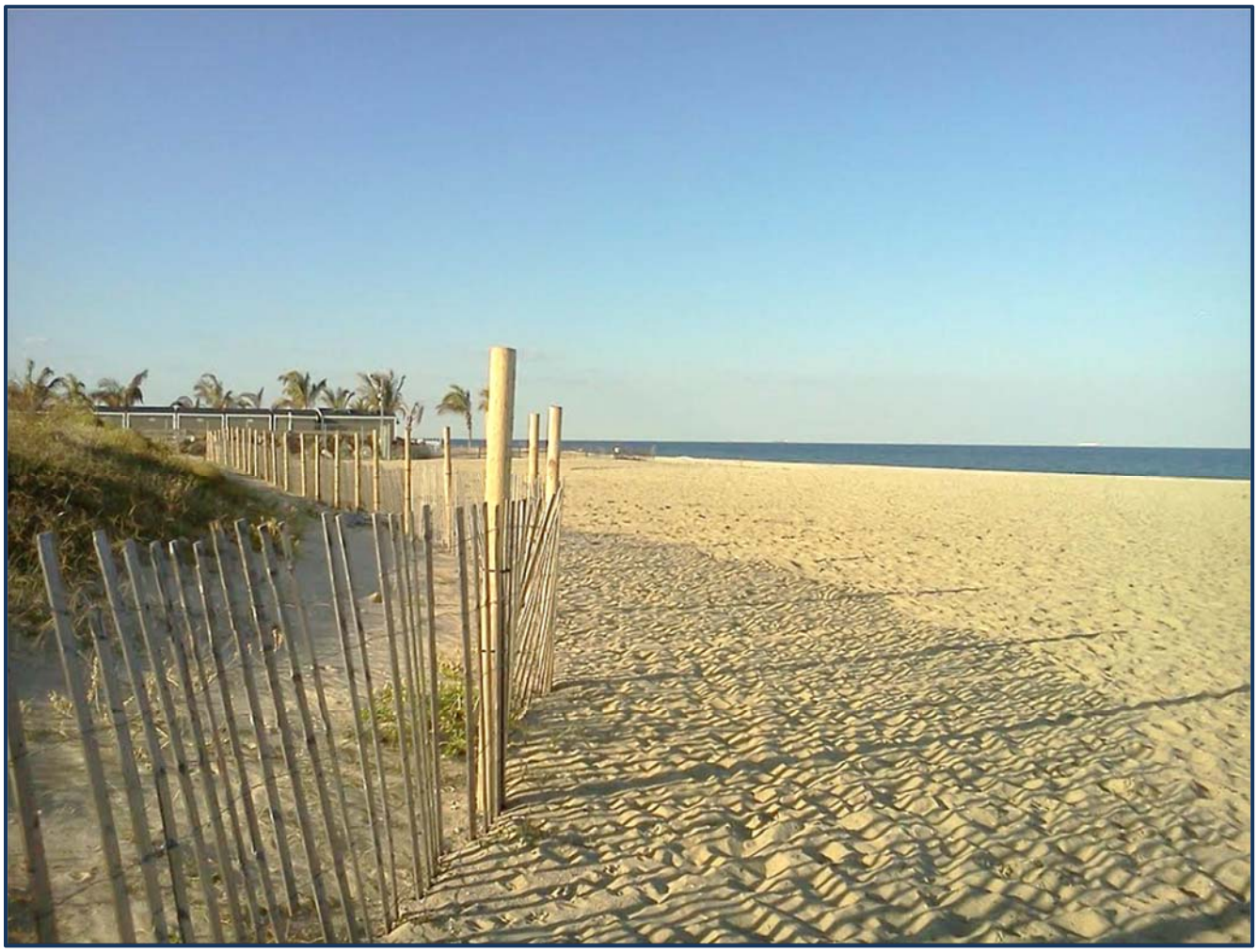


Figure 13: Sea Bright is a popular Jersey shore community, 2015.

Public water service is provided by New Jersey-American Water, a subsidiary of American Water Works. The service area extends through 120 square miles of Monmouth County, including numerous residential and commercial centers and tourism destinations. The majority of the County's water is provided from surface sources and processed at two large facilities: the Swimming River Reservoir and Treatment Plant in Colts Neck, and the Jumping Brook Treatment Plant in Neptune. The service provides water to all residences and businesses in Sea Bright. In 1965, six municipalities - Monmouth Beach, West Long Branch, Oceanport, Fair Haven, Little Silver and Shrewsbury - joined to create a regional sewerage authority to service communities with their wastewater disposal and water reclamation. As a result, the Northeast Monmouth County Regional Sewerage Authority was formed. Because its service area borders the Navesink and Shrewsbury Rivers, the Authority, in November 2001, adopted the new name Two Rivers Water Reclamation Authority (TRWRA). The TRWRA treatment plant is not located in the study area. It is located to the south in Monmouth Beach. It is a secondary type treatment plant. The sludge is thickened, and trucked offsite for incineration. The effluent is discharged into the Atlantic through an offshore outfall at Monmouth Beach.

2.20.2 Storm Water

The Borough of Sea Bright adopted the applicable design and performance standards for storm water management measures as outlined in NJAC 7:8-5 to reduce the negative impact of storm water runoff on water quality and quantity, and loss of groundwater recharge in receiving water bodies. The Borough of Sea Bright Storm Water Management Plan (adopted August 17, 2007) and Ordinance Nos. 15-2007 & 18-2010 (Storm Water Surface Run Off & Requiring Retrofitting of Existing Storm Drains) documents the strategy for the Borough of Sea Bright to address stormwater related impacts. There are many stormwater outfalls in the study area, as detailed in Section 2.4.

2.21 Land Use and Zoning

Sea Bright is almost entirely developed: very little undeveloped land remains, and the likelihood of significant intense redevelopment is low. Most land in Sea Bright is occupied by residential development, which is mostly single-family dwellings, but the Borough also contains a number of multi-unit residential and low-rise developments. The small downtown commercial area is dominated by stores, restaurants, and other office-based businesses. There is no heavy industrial development in Sea Bright, and only very minor light industrial development. Land use is approximately 75 percent residential, with another 22 percent commercial and office-based businesses.

The Borough of Sea Bright building codes require that, in areas of special flood hazard, residential construction be built to a minimum of two feet above the BFE. Many homes in the study area were built at- or near-grade prior to enactment of the current building codes. Because of this, many homes were severely damaged by Hurricane Sandy (Figure 13). Many residents have chosen to rebuild or elevate their homes above the BFE to reduce the risk of flood damage. Post-Hurricane Sandy amendments to the building codes allows for total height of structures not to exceed in 38 feet above ground elevation in most cases.

Figure 14: Hurricane Sandy water mark in Sea Bright, 2012.

Chapter 3: Plan Formulation

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. This chapter presents a summary of problems and opportunities; inventory and forecast; and plan formulation, evaluation, comparison, and selection. As decribed in Chapters 3, 4, and 7, the plan formulation process is consistent with and complements the NACCS flood risk management framework, USACE Environmental Operating Principles, and U.S. Army Corps of Engineers post-Hurricane Katrina 12 Actions for Change.

3.1 Problems & Opportunities

Problem Statement: The people, infrastructure, and property of downtown Sea Bright experience significant damages due to back bay flooding from the Shrewsbury River due to coastal storms such as nor'easters, tropical storms, and hurricanes.

Opportunities: There is an opportunity to manage the risk of coastal storm damage in downtown Sea Bright. Doing so may reduce damages to property and infrastructure, and contribute to community resilience.

As discussed in Section 2.2, an understanding of the Shrewsbury River Basin watershed and Sea Bright's geography is integral to understanding the study area's problems. The low lying Borough is frequently inundated by spring tide events and coastal storms, most significantly from the Shrewsbury River. Flooding from the Atlantic Ocean occurs less frequently, typically only during large nor'easters, tropical storms, and hurricanes. This is because the beach fronting the ocean, generally at an elevation of +10 feet NAVD88, is higher than that of areas fronting the Shrewsbury River. In addition, the beach is backed by a seawall that varies in height up to +16 feet NAVD88. An extension of the seawall, which will further reduce risk, is currently underway by the non-Federal sponsor, the NJDEP. Note that reducing flood risk from the more frequent and severe back bay flooding, not flooding from the ocean, is the focus of this study. Over $81,000,000 in National Flood Insurance Program claims have been dispersed since the program's inception in 1978. Historically, a nor'easter in March 1984 caused up to three feet of inundation in areas along the Shrewsbury River. The Halloween 1991 nor'easter, known locally as "the Perfect Storm," caused major flooding from the Shrewsbury River and overtopping of the Atlantic Ocean seawall, forcing 200 people to evacuate. Most recently, Hurricane Irene in August 2011 caused major beach erosion and flooding in Sea Bright and other communities in Monmouth County. Hurricane Sandy in 2012 caused very heavy damage throughout the Borough (Figure 14 through Figure 17). It was reported by many residents that "the river met the sea" when storm surge from Hurricane Sandy flooded Sea Bright. The widespread damage Sea Bright sustained during the storm underscored the need for action. Many residents have elevated or demolished their homes in response to frequent flood damage from the multiple storms that have plaged the area (Figure 18). The availability of post-Hurricane Sandy grant funding accelerated this trend. The Borough granted permits for at least 54 structures in the study area to be elevated, and 35 structures to be demolished after Hurricane Sandy. It is expected that structures will be rebuilt to at least 2 feet above the BFE, which is the minimum building standard set by the Borough of Sea Bright. Despite recurring flood damage, many homes remain at or near grade. Local initiatives will help mitigate the risk of coastal storm damage. The Borough has received a number of Federal and state grants to mitigate future flood risk.

Its post-Hurricane Sandy work to elevate publicly -maintained bulkheads along the river to an elevation of +7 NAVD88 may help localized but not widespread flooding. The extension of the seawall currently under construction, as well as periodic nourishment of the beach, will reduce the risk of coastal storm flooding from the Atlantic Ocean. Even with these efforts, there remains an opportunity in downtown Sea Bright to manage the risk of coastal storm surge flooding to residents, infrastructure, and property.

Figure 15: Flooding from the Shrewsbury River during Hurricane Sandy, 2012. Photo taken from the Rumson Bridge (County Route 520) looking south. The Shrewsbury River is on the right.

Figure 16: Flooding from the Shrewsbury River during Hurricane Sandy, 2012. Photo taken from Ocean Avenue looking west down Church Street, looking at the Shrewsbury River. The Shrewsbury River is in the background.

Figure 17: Sea Bright Mayor Dina Long walks along Ocean Avenue past a destroyed house that fronted the Shrewsbury River, 2012.

Figure 18: Clean up on Ocean Avenue after Hurricane Sandy, 2012.

Figure 19: Many homes have been elevated after Hurricane Sandy, 2014.

3.2 Future Without-Project Conditions

Sea Bright will continue to be subject to coastal storm flooding from the Shrewsbury River. It will continue to experience road flooding during spring tides and structural damages during storms as water from the Shrewsbury River comes through and over bulkheads, threatening the safety of residents and resilience of the cultural economy (Figure 19). The Borough will continue to flood, with homes and businesses sustaining damages. Average annual damages in the future without-project condition from 2020 to 2070 were calculated at $1,590,000 (FY18 P.L.).

Many homeowners received Federal and state grants after Hurricane Sandy to elevate their homes. It is assumed that most homeowners who will pursue these grants and/or have completed elevation of their homes with Federal and state funding have done so already. Funding for post-Hurricane Sandy mitigation grants available to property owners from FEMA and other agencies has for the most part been dispersed.

Relative Sea Level Change

Engineer Regulation (ER) 1100-2-8162 “Incorporating Sea Level Change in Civil Works Programs” requires that future sea level change projections be incorporated into the planning, engineering design,

construction and operation of all civil works projects. Relative sea level change (RSLC) considers the effects of (1) the eustatic, or global, average of the annual increase in water surface elevation due to the global warming trend, and (2) the "regional" rate of vertical land movement (VLM) that can result from localized geological processes, including the shifting of tectonic plates, the rebounding of the Earth's crust in locations previously covered by glaciers, the compaction of sedimentary strata and the withdrawal of subsurface fluids. Regional movement varies by location, and is specific to a point on the Earth. Figure 20 shows the low, intermediate, and high estimates for sea level change based on the Sandy Hook tide gage through the 50-year period of analysis (2020-2070). The Shrewsbury River area is experiencing relative sea level change.

Figure 20: Former New Jersey Governor Chris Christie, Former Housing and Urban Development Secretary Shaun Donovan, and Sea Bright Mayor Dina Long walk along closed businesses on Ocean Avenue, 2013.

The high and intermediate rates of RSLC are based on findings by the National Research Council (NRC 1987) and the Intergovernmental Panel for Climate Change (IPCC 2007), and are calculated by USACE using Engineer Technical Letter 1100-2-1 Procedures to Evaulate Sea Level Change: Impacts, Responses, and Adaptation. The low or "historic" rate of future RSLC is determined by projecting the historic rate of sea level risk directly from gage data gathered in the vicinity of the study area. Tide conditions at Sandy Hook (National Oceanic and Atmospheric Administration [NOAA] Station #8531680) best represent the conditions experienced in Sea Bright. A 75-year record (1932 to 2006) of tide data gathered at Sandy Hook, New Jersey indicates a mean sea level trend (eustatic sea level rise + the local rate of VLM) of 0.014 feet per year (published rate at the National Oceanic and Atmospheric Administration [NOAA] Sandy Hook gage). As calculated using the methodology detailed in ER 1100-2-8162 and ETL 1100-2-1, the region is projected to experience up to 2.61 feet of relative sea level rise through 2070. For comparison, Key West, Florida is projected to experience up to 1.96 feet; Norfolk, Virginia up to 2.95 feet; Galveston, Texas (Pier 21) up to 3.01 feet; and Grand Isle, Louisiana up to 3.48 feet during the same timeframe (all NOAA gages at stated locations). Relative sea level rise further increases flooding issues.

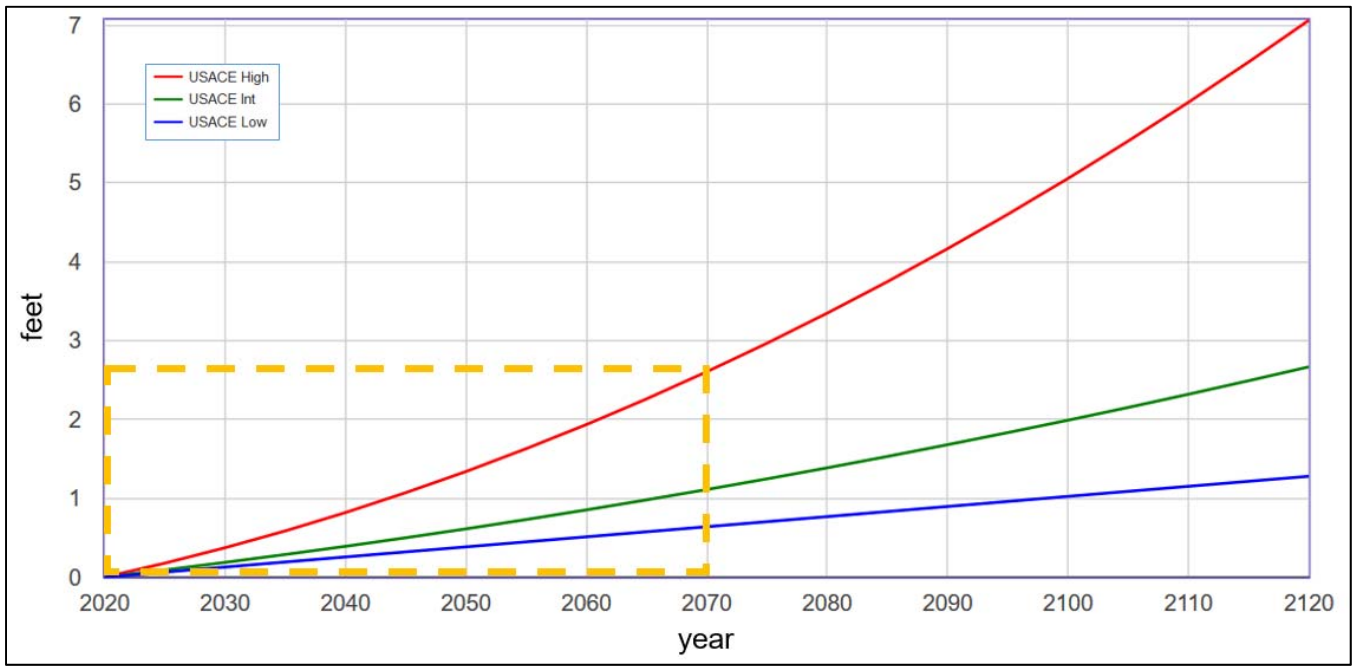


Figure 21: Relative sea level change projections at the Sandy Hook, New Jersey gage. Calculations based on those set forth in ER 1100-2-8162. The economic period of analysis (2020 – 2070) is shown in the orange box.

Figure 21 shows that the study area is projected to experience approximately 0.64 feet of sea level rise under the USACE "low" scenario, 1.11 feet of sea level rise under the "intermediate" scenario, and 2.61 feet of sea level rise under the "high scenario" from 2020 through 2070. The study area is projected to experience approximately 1.28 feet of sea level rise under the USACE "low" scenario, 2.67 feet of sea level rise under the "intermediate" scenario, and 7.06 feet of sea level rise under the "high scenario" from 2020 through 2120.

3.3 Planning Goal & Objectives

A study goal based on problems and opportunities was developed to help create and evaluate alternative plans. It is the overarching intent of the project, and is based on the problems and opportunities detailed in Section 3.1. The period of analysis for this study is 2020 to 2070.

Study Goal: Manage the risk of coastal storm surge flooding to residents, infrastructure, and property due to back bay inundation from the Shrewsbury River in downtown Sea Bright (Figure 21).

Plans are formulated to achieve planning objectives. Planning objectives and constraints are inexorably linked to problems and opportunities. A planning objective states the intended purposes of the planning process. It is a statement of what solutions should try to achieve. Objectives provide a clear statement of the study purpose. In support of the goal, the planning objectives are to:

- Manage the risk of damages from back bay flooding from the Shrewsbury River in downtown Sea Bright through 2070.
- Support community resilience and cohesion in Sea Bright through 2070 by reducing economic losses from flooding and maintaining the community and economic base.

Figure 22: Sea Bright post office after Hurricane Sandy, 2012.

3.4 Planning Constraints & 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. Constraints specific to the study include:

- Physical constraints: The project cannot greatly impact existing infrastructure and homes. In many areas, there is little room to implement large-scale risk management measures.
- Navigation: The project cannot impact the Federal Shrewsbury River navigation project.

Considerations: Those issues or matters that should be taken into account during the planning process, but do not necessarily limit the extent of the process as do constraints are labeled considerations. Two considerations were taken into account during plan formulation:

- FEMA sometimes updates BFEs for communities based on new technical information. 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.
- NJDEP and the Borough of Sea Bright have expressed their concerns about the impact of a structural solution, specifically the raising of existing bulkheads, on the community. Their concern is two-fold:

- Borough residents generally do not want to lose their view of the river through elevation of the existing bulkhead. Specifically, the community does not want to elevate the bulkheads higher than +7 feet NAVD88. The Borough has passed an ordinance restricting the raising of bulkheads above +7 feet NAVD88.
- The residual risks of flooding associated with a bulkhead at elevation less than or equal to +7 feet NAVD88 are significant. The elevation corresponds roughly to that of a 50 to 20 percent flood event, including wave set up. USACE has concerns about the residual risk of flooding associated with a bulkhead elevation less than or equal to this height. Residual risk is the flood risk that remains after all efforts to reduce the risk are completed. It is the exposure to loss remaining after other known risks have been countered, factored in or eliminated. A bulkhead at or below +7 feet NAVD88 would be frequently overtopped, even by certain spring tide or relatively small coastal storms. It would provide no meaningful flood risk reduction for larger flood events.

3.5 Key Uncertainties

The following two key uncertainties informed plan formulation.

Relative Sea Level Change: Research by climate scientists predict continued or accelerated climate change for the 21st century and possibly beyond, which would cause a continued or accelerated rise in global mean sea level. The USACE has developed projections related to probable relative sea level change in the study area (Ficure 20). The use of multiple RSLC scenarios as opposed to individual scenario probabilities underscores the uncertainty in how local relative sea levels will actually play out into the future. The use of the "curves" in Figure 20 is mathematically smooth, but it is unlikely that actual variations will have that attribute. The USACE "historic" or "low" projection of RSLC was used during the initial plan formulation, screening, and selection. An analysis of future project performance under all RSLC scenarios pursuant to ER 1100-2-8162 was performed during plan optimization, as detailed in Section 4.5.

Plan Participation Rate: Participation in USACE nonstructural projects is voluntary for property owners. It is assumed that participation in a nonstructural project would be popular with many property owners in Sea Bright. Many homeowners in Sea Bright and other communities affected by Hurricane Sandy have or are in the process of elevating their homes. Based on coordination with non-Federal and local interests, and current rebuilding strategies, an at- or near-100 percent participation rate is likely.

3.6 Management Measures

Measures were developed to address problems and to capitalize upon opportunities. They were derived from a variety of sources including prior studies, the public scoping process, and the team. The following measures were considered:

- Nonstructural Measures
- Floodwalls
- Bulkheads
- Levees
- Beach and Dune Fill
- Storm Surge Barrier
- Pumps
- Road Raising

3.6.1 Nonstructural Measures

A combination of nonstructural flood risk management features, including dry floodproofing, wet floodproofing, structure elevation, rebuilding, acquisition, evacuation plans, and floodplain management/ zoning changes/enforcement were considered. The Borough of Sea Bright is encouraging residents to elevate their homes. Because of this and the availability of post-disaster

grants to do so, many houses in this area have been elevated post-Hurricane Sandy. Various nonstructural techniques were considered as elements of a comprehensive solution.

Buy-outs: Permanent evacuation of areas subject to erosion and/or storm inundation involves the acquisition of the impacted land and its structures either by purchase or by exercising the powers of eminent domain. Following this action, all development in these areas is either demolished or relocated. Before Hurricane Sandy, the cost of this plan including land and relocation was deemed to be prohibitively expensive and was dropped from consideration as a comprehensive solution. However, more limited buy-outs (to be investigated on an individual structure basis) may be a viable means of enhancing or supplementing the coastal storm risk management provided by other features, especially considering the change of home prices in affected areas post-Hurricane Sandy.

Zoning: 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.

Building Retrofit: Building retrofit is a body of techniques for preventing flood damages by making adjustments to both structures and their contents. Such adjustments can be applied by an individual or as part of a collective action. Retrofits involve keeping water out (dry flood proofing) as well as reducing the effects of water entry (wet flood proofing). Flood proofing techniques can also include elevating structures above the design flood level. Retrofitting techniques can be undertaken when structures are under construction, during remodeling or expansion activities, or during a structure retrofit. While flood proofing measures can work to reduce damages to structures and their contents, residents must still be evacuated during flood conditions to ensure their safety.

Elevation (Raising) of Frequently Flooded Structures: This technique lifts an existing structure. Elevation can be performed using fill material, or on extended foundation walls, or on piers, post, piles, and columns, or some combination thereof.

Rebuilding: Demolishing and rebuilding of structures was not considred a feasible alternative due to windfall benefits, which states land enhancement benefits of “unconscionable magnitude” to a few benificiaries are subject to special cost sharing (ER 1105-2-100 Planning Guidance Notebook). Because of this the measure was excluded from consideration.

3.6.2 Structural Measures

Bulkheads: Riverside bulkhead generally consist of cantilevered steel sheet pile extending below the river mud line, and may be installed as close as possible on the water side of existing bulkheads.

Floodwalls: River-fronting or inland floodwalls (tie backs) may consist of cantilevered steel sheet pile to required embedment depth below grade. The inland floodwalls could generally tie off the alignment into high ground or an elevated road at the inland design still water elevation.

Levees: Levees generally consist of a trapezoidal shaped mound of earth with 1 vertical:3 horizontal vegetated side slopes. Levee sections could be utilized in lieu of the inland floodwalls or landward of the existing shorefront bulkhead or beachfront.

Raised Roads: Road raising (elevation) is an alternative that can be used to facilitate tie-backs of alignment to high ground. Road raising is preferable to closure gates, which cause traffic interruption during storms when the gates would be closed.

Beach and Dune Fill: This measure includes the construction of beaches and dunes fronting the Shrewsbury River. Because of the topography of the study area, and existing development in the study area, beach and dune fill would have to extend entirely into the river to avoid significant adverse impacts to property use. Beach and dune fill requires approximately 250 feet of footprint extending out from the existing bulkhead, which would entirely block the 200-foot wide river flow and the Shrewsbury River navigation project.

Storm Surge Barrier: A storm surge barrier could be constructed within the river to serve as a flood risk management structure. A barrier could be constructed near the mouth of the Shrewsbury River from Highlands, New Jersey, extending to Sandy Hook.

Pumps: Pumps would remove water from downtown Sea Bright. Water would likely be pumped into the Shrewsbury River. They would be complimentary to other project features.

Temporary Flood Barriers: Temporary flood barriers are intended to reduce the frequency of flooding to one or a group of structures on a small-scale basis. They are deployed prior to a storm.

3.6.3 Natural and Nature-Based Features

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

3.7 Plan Formulation Strategy

The general plan formulation strategy was 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). The P&G is the 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

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, but the minimization of flooding or flood damage will greatly improve the 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 structural 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 surge inundation. Detailed analysis of the alignment features could indicate that variations or uncertainty in some design conditions, such as storm surge elevation and 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 and Combination 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 objectives?
2. Does the measure avoid constraints?

Measures eliminated from further consideration are shaded (Table 4).

Table 4: Screening of measures.

Measure	Does the measure…			
	Objective 1: Manage the risk of damages	Objective 2: Support community resilience and cohesion	Constraint 1: Avoid physical constraints	Constraint 2: Avoid impacts to navigation
Nonstructural Measures	Yes	Yes	Yes	Yes
Floodwalls	Yes	Yes	Yes	Yes
Levees	Yes	Yes	No	Yes
Road Raising*	Yes	Yes	No	Yes
Beach and Dune Fill	Yes	No	No	No
Storm Surge Barrier**	Yes	Yes	Yes	Yes
Pumps	Yes	Yes	Yes	Yes
Temporary Flood Barriers*	Yes	Yes	Yes	Yes
Natural and Nature-Based Features	Yes	No	No	No

* screened as a stand-alone measure
** determined to not be cost effective during preliminary plan formulation.

Nonstructural Measures: Nonstructural measures are those that reduce human exposure or vulnerability to a flood hazard without altering the nature or extent of that hazard. Nonstructural measures were carried forward for further consideration. It should be noted that additional nonstructural measures would not reduce the problems of street flooding, including auto damage, lost income, and adverse effects on businesses located on Ocean Avenue.

Floodwalls: Based upon an assessment of site conditions, floodwalls are well suited to address the flooding problem. They were considered for further alternative development.

Levees: Levees were dropped from further consideration because of the significantly large footprint requirements (50-foot width) with associated prohibitively significant property use reduction and real estate impacts.

Road Raising: This measure 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 alternative development as part of a plan with floodwalls.

Beach and Dune Fill: Beach and dune fill were dropped from further consideration. The measure is not consistent with current riverfront geomorphology and land use. Construction and maintenance of a beach and/or dune would require major re-engineering of the landscape, which would greatly impact existing infrastructure and homes (Constraint #1). In addition, placement of sand and maintenance of a beach and/or dune would have a prohibitive impact on the adjacent river flow and the Shrewsbury Federal navigation project (Constraint #2).

Storm Surge Barrier: This measure could prevent storm surge from traveling up the Shrewsbury River. A likely location for such structures could be near the mouth of the Shrewsbury River near Highlands, New Jersey. The non-Federal sponsor requested consideration of this measure.

Temporary Flood Barriers: Based upon an assessment of site conditions, temporary flood barriers could be well suited to prevent storm damage to homes and businesses. Because they would be redundant features when used in concert with another structural measure, they were considered individually during a last-added analysis, as described later in this chapter.

NNBFs: Based on current USACE research, these measures could provide only limited storm risk management; risk management benefits are not quantifiable based upon current USACE research and guidance. In addition, there is limited space available to meaningfully construct NNBFs in the study area. Typically, NNBFs are constructed along or in waterbodies. Construction and maintenance of NNBFs along the Shrewsbury River could require major re-engineering of the shorefront, which would impact existing land uses (i.e., river-fronting homes and infrastructure) (Constraint #1). Construction of NNBFs within the river channel would likely imact river flow and the Shrewsbury Federal navigation project (Constraint #2). Because of these reasons, NNBFs were dropped from further consideration.

3.9 Initial Array of Alternative Plans

The initial array of alternative plans includes the following:

- No Action Alternative
- Nonstructural Alternatives
- Floodwall Alternatives
- Storm Surge Barrier Alternative

No Action Alternative

If USACE takes no action, downtown Sea Bright would continue to experience back bay flooding from the Shrewsbury River during coastal storms. Substantially damaged structures would be elevated beyond the BFE after storms, as required by local flood risk management ordinances. This plan fails to meet the USACE study objectives or needs for the majority of the study area. It will, however, provide the baseline against which project benefits are measured. Expected average annual damages for the No Action alternative from 2020 to 2070 are in the amount of $1,590,000 (FY18 P.L.).

The No Action Alternative assumes that:

- Construction of the ocean-fronting seawall is complete
- Planned renourishment of the USACE Atlantic Coast of New Jersey, Sandy Hook to Barnegat Inlet Beach Erosion Control Project (Section 1 – Sea Bright to Ocean Township, New Jersey) – coastal storm risk management erosion control project will be implemented in the future
- River-fronting, municipally-maintained bulkheads are reinforced and elevated to +7 feet NAVD88
- All new development will be built above the BFE

Nonstructural Alternatives

The nonstructural alternatives consist of implementing one or more of the following measures:

- Wet floodproofing
- Dry floodproofing
- Elevation
- Acquisition
- Evacuation Plans
- Floodplain management/ zoning changes/ enforcement

Different nonstructural scenarios were developed, each affecting a greater number of structures. A 2014 structure inventory identified 238 structures, 234 (98 percent) of which are located in the footprint of the one percent floodplain. The Borough of Sea Bright issued permits after Hurricane Sandy through August 2016 for the elevation of at least 54 and demolition of 35 of these structures; the remaining 162 structures were considered during formulation and analysis. The main floor elevation (MFE), or the elevation of the lowest habitable floor, was estimated for these structures using information from the structure inventory. Light Detection and Ranging (LIDAR) data were used to determine ground elevations in the study area. The height of structures above ground elevation was determined during field surveys using an estimation based on the number of steps to main floors. Of the 162 structures, 112 had MFEs at or below the one percent flood water surface elevation (Table 5).

Three alternatives were formulated by grouping structures by MFEs. The groupings that were used were structures with a MFE less than or equal to the 10 percent, 4 percent, and 1 percent still water surface elevations. The nonstructural alternatives are:

- Nonstructural Alternative 1: structures with a MFE less than or equal +4.5 feet NAVD88 (the 10 percent flood water surface elevation)
- Nonstructural Alternative 2: structures with a MFE less than or equal to +6.0 feet NAVD88 (the 4 percent flood water surface elevation)
- Nonstructural Alternative 3: structures with a MFE less than or equal to +8.2 feet NAVD88 (the one percent flood water surface elevation)

Structures would be elevated in order for their MFE to be at a height of +11.2 feet NAVD88. This height takes into consideration: 1) the one percent flood still water level in year 2020 calculated by USACE (+8.2 feet NAVD88), 2) anticipated intermediate rate of sea level change over 50 years, and 3) the typical contribution of wave effects caused by coastal storms. The BFEs for affected structures range from +7 feet NAVD88 to +8 feet NAVD88. The final height of all of the structures would be more than three feet above the BFE.

An engineering tool, based on a matrix developed by the USACE National Nonstructural Floodproofing Committee, identified the most appropriate treatment for each structure (Appendix A, Figures A6 and A7). It has been used for other USACE feasibility studies with nonstructural components, most recently by USACE for the Leonardo, New Jersey coastal storm risk management feasibility study. The tool identified elevations and temporary flood barriers as the most appropriate treatments in the study area, given the amount of inundation and structure types involved (Appendix A). Table 5 shows a breakdown by structure type (residential and commercial/nonresidential) for each of the nonstructural alternatives.

Table 5: Detailed breakdown of potential structures included in nonstructural alternatives.

	Elevations		Temporary Flood Barrier*		Total # Structures
	Residential	Commercial/ Non-residential	Residential	Commercial/ Non-residential	
Structures at/below 10 percent WSEL (+4.5 feet NAVD88)	1	0	1	7	**9**
Structures at/below 4 percent WSEL (+6.0 feet NAVD88)	33	0	2	30	**66**
Structures at/below 1 percent WSEL (+8.2 feet NAVD88)	66	3	5	38	**112**

* maximum number of structures behind temporary flood barrier, as explained in detail later in this section
WSEL = water surface elevation

To identify the most efficient and cost effective nonstructural plan, structure elevations and temporary flood barriers were considered separately during initial plan formulation, as described in Section 3.10. Groupings of structure elevations were compared and used for the initial screening (Table 6). The number of structures varies for Alternative NS 2 due to one structure that was initially identified as within a temporary flood barrier, due to its location adjacent to other structures within the proposed barrier. Finally, temporary flood barriers that were economically justified on their own, or incrementally justified, were added to the plan later in the planning process during a last-add analysis.

Table 6: Groupings of structure elevations by alternative.

Nonstructural Alternatives	Description	Features
Alternative NS 1 Structures at/below 10 percent WSEL (+4.5 feet NAVD88)	Elevations only for structures with a MFE at or below the 10 percent WSEL of +4.5 feet NAVD88	one structure elevation
Alternative NS 2 Structures at/below 4 percent WSEL (+6.0 feet NAVD88)	Elevations only for structures with a MFE at or below the four percent WSEL of +6.0 feet NAVD88	34 structure elevations*
Alternative NS 3 Structures at/below 1 percent WSEL (+8.2 feet NAVD88)	Elevations only for structures with a MFE at or below the one percent WSEL +8.2 feet NAVD88	69 structure elevations

* one structure that was originally included within a temporary flood barrier is included in this plan / WSEL = water surface elevation

Floodwall Alternative

This alternative would reduce risk to the most vulnerable and frequently flooded parts of the downtown area. The alignment would span from the Rumson Bridge (County Route 520) to just south of Osborne Street, about a half mile (Figure 22). It would tie into relatively higher elevation at Ocean Avenue to the east. The floodwalls would likely look similar to existing bulkheads that front the Shrewsbury River (Figure 23).

Because of physical (space) constraints, there is only one possibility for the floodwall alignment along the riverfront. Various crest heights along this alignment were considered (Table 7). The crest elevations of the tieback components were controlled by the need to prevent induced flooding and by site conditions at the southern end of the project, where the raised road dimensions are restricted by the topography, the proximity of existing structures, and drainage issues. Pumps were considered in combination with floodwalls, but were found to be less cost effective than the raised floodwall by itself.

Table 7: Floodwall dimensions considered.

	Floodwall Crest Elevation (+ft NAVD88)	Percent Flood Event (based on still water level*)
Alternative F1	7.0	2%
Alternative F2	8.5	1%
Alternative F3	9.5	0.5%
Alternative F4	11.5	0.3%

* The still water level doesn't include a potential increase in water level during storms due to wave effects. The floodwall may be overtopped at a water surface elevation less than crest elevation because of the effects of wave overtopping.

Figure 23: Floodwall alternative alignment.

Figure 24: Typical bulkhead along the Shrewsbury River in Sea Bright, 2014. **A floodwall would be visually similar to it, but would be higher in elevation.**

Storm Surge Barrier Alternative

The alternative would provide a comprehensive solution to flooding in the Shrewsbury River Basin. It would reduce the risk of storm surge coming from the Shrewsbury River. It would include a surge barrier extending across Sandy Hook Bay at the mouth of the Shrewsbury River. The structure would likely tie into raised ground or a raised road. Closure gates would be constructed to allow for navigation on the Shrewsbury River (Figure 24).

The total breakwater alignment is approximately 4,500 feet, crossing a broad shoal area on the Sandy Hook side. At the location of the existing navigation channel approximately 500 feet from a state-owned bulkhead located on Marine Place in Highlands, a 200-foot wide navigation sector gate will be installed to allow for a 100-foot clear opening for navigation transit when the gate is in the open position. Prior to potential major storms, the sector gate will be closed during a period of lower tide, sealing the inner basin, providing additional runoff storage leeward of the barrier.

Mean bay-bottom elevation along the breakwater alignment is roughly –4 feet NAVD88 or less, except across the navigation channel where it is an average of –19 to –21 feet NAVD88. The crest of the breakwater will be set at elevation +12.4 feet NAVD88. The crest elevation was selected to limit the effect of storm waves, reduce overtopping damage to the leeward side of the breakwater, and avoid water buildup from overtopping wave effects. There is insufficient storage leeward of the breakwater to store storm water runoff buildup to below elevation +5 feet NAVD88 with the sector gate closed,

therefore a pump station will be required. Based on gross approximations, a 4,000 cubic feet per second pump station would be necessary to prevent residual damages from the closed gate.

It should be noted that the USFWS indicated during preliminary coordination that it does not support the storm surge barrier alternative, per its Fish and Wildlife Service Coordination Act (FWCA) preliminary comment letter dated July 2, 2002. In the letter, the USFWS recommended against the construction of any new hard structures where none currently exist. The USFWS strongly advocated for nonstructural alternatives. In a final FWCA coordination letter dated March 8, 2017, USFWS again stated its support for a nonstructural plan in Sea Bright (Appendix E).

Figure 25: Storm surge barrier alternative.

3.9.1 Screening of the Initial Array of Alternative Plans

The 1983 Principles and Guidelines (P&G) require that plans are formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability.

- **Completeness** is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. All structural alternatives had to provide risk management along the entire length of the alignment to be considered complete. Any "holes in the fence" would threaten the success of the entire project. It was acknowledged that a nonstructural alternatives may provide only a small "piece of the puzzle" for risk management in Sea Bright. Because of this, consideration and communication of residual risk is a key component of nonstructural alternatives. All alternatives carried forward for consideration met a minimum standard of providing positive net NED benefits.

- **Effectiveness** is the extent to which the alternative plans alleviates the specified problems and achieves the opportunities. The alternatives all achieve the study opportunity "to manage the risk of coastal storm damage in downtown Sea Bright." Alternatives were judged upon whether or not they make significant contributions to this opportunity; some do so more efficiently than others, as decribed below.

- **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. An early screening of alternatives that had a benefit-to-cost ratio under one were eliminated from consideration, as decribed below.Plans that provide the same level of performance, but at higher cost, were be eliminated from consideration.

- **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 and regulations. One important facet of acceptability is implementability, which is the feasibility of a plan in the technical, environmental, economic, social, and similar senses. Due to their limited impact to the human environment and relative simple scope, nonstructural measures are thought to be generally more implementable. Large-scale structural measures are generally less implementable because they are more challenging to construct and generally have greater impacts to the human environment.

An estimate of average annual costs were considered against the average annual benefits for the alternatives (Table 8). This allowed for an initial screening of alternatives. The average annual costs include interest during construction. Interest accumulated during construction is the cost of the funds used to finance the construction. It is calculated using Institute for Water Resources Planning Suite software.

This initial screening showed that of the alternatives, Alternative NS 2 and Alternative NS 3 provide positive net benefits and passed the efficiency criteria. As such, they were the only alternatives carried forward for consideration. Both alternatives meet the remaining P&G criteria of completeness, efficiency, and acceptability. Because Alternative NS 2 provides a greater net benefits of the two plans, it was identified as the TSP. The plan includes the elevation of 34 structures with a MFE at or below the 4 percent WSEL of +6.0 feet NAVD88. Refined costs and benefits were developed for Alternative NS 2, as presented in Chapter 4.

Table 8: Economic performance of the initial array of alternatives (FY16 P.L.).[2]

	First Cost	Average Annual Cost	Average Annual Benefit	Net Benefits	BCR
Alternative NS 1 Structures at/below 10 percent WSEL	$283,000	$11,000	$7,000	-$5,000	0.63
Alternative NS 2 Structures at/below 4 percent WSEL	$7,891,000	$314,000	$395,000	$81,000	1.3
Alternative NS 3 Structures at/below 1 percent WSEL	$14,641,000	$583,000	$583,000	$1,000	1.00
Alternative F 1 +7.0-foot NAVD88 floodwall	$10,203,000	$737,000	$479,000	-$258,000	0.65
Alternative F 2 +8.5-foot NAVD88 floodwall	$10,605,000	$764,000	$508,000	-$257,000	0.66
Alternative F 3 +9.5-foot NAVD88 floodwall	$10,832,000	$780,000	$562,000	-$218,000	0.72
Alternative F 4 +11.5-foot floodwall	$11,897,000	$854,000	$587,000	-$267,000	0.69
Storm Surge Barrier	$374,579,000	$19,538,000	$14,200,000	-$5,338,000	0.73

BCR: benefit-to-cost ratio / WSEL: water surface elevation / Average annual costs include interest during construction / Discount rate of 3.125 percent from 2020 through 2070

3.10 Consideration of Temporary Flood Barriers in the Plan

Temporary flood barriers were individually considered in a last-added analysis to reduce residual risk. Many different designs were considered. Considering current land uses, temporary barriers (vs. permanent barriers) are the most appropriate for the study area (Figure 25). Permanent flood barriers would impede the operation of businesses and potentially impact Ocean Avenue, a major evacuation route. For consistency with the proposed height of structure elevations, the flood barriers were designed to a height of +11.2 feet NAVD88. Detailed design will be developed prior to construction, in coordination with the NJDEP and Borough of Sea Bright. Costs and benefits were calculated for individual temporary flood barriers identified in Table 5 above, and were compared (Table 9). Of the temporary flood barriers in Alternative NS 2, one had positive average annual net benefits of $42,000. Temporary flood barrier #10 is located around two attached structures, and would be up to seven feet tall. It was added to Alternative NS 2. Refined costs and benefits were developed for Temporary lood Barrier #10, as presented in Chapter 4.

[2] The comparison of alternatives was performed using FY16 price levels and discount rate and that the final costs and benefits of the recommended alternative will be updated to FY18 price levels and discount rate.

Figure 26: Temporary flood barrier concepts. Counter clockwise from top left: Portadam, FloodBreak, AquaFence, and a rapid deployment floodwall.

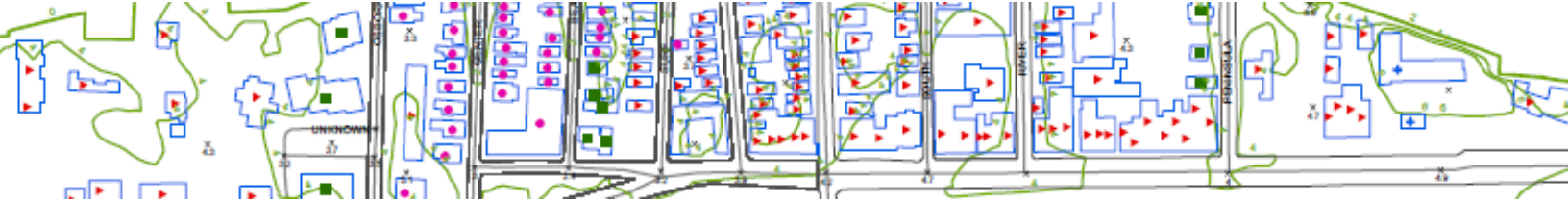
Table 9: Economic performance of temporary flood barriers (FY16 P.L.).

Barrier ID	First Cost	Annual Cost*	Annual Benefits	Average Annual Net Benefits	BCR
#1	$5,660,000	$232,000	$172,000	-$60,000	0.74
#2	$2,840,000	$116,000	$48,000	-$68,000	0.41
#3	$3,856,000	$158,000	$40,000	-$118,000	0.25
#4	$5,981,000	$244,000	$73,000	-$172,000	0.30
#5	$1,843,000	$79,000	$32,000	-$47,000	0.41
#6	$2,026,000	$83,000	$11,000	-$72,000	0.13
#8	$2,927,000	$120,000	$59,000	-$61,000	0.49
#9	$2,880,000	$118,000	$29,000	-$89,000	0.25
#10	$1,958,000	$80,000	$122,000	$42,000	1.5
#11	$3,702,000	$152,000	$60,000	-$92,000	0.39
#18	$2,599,000	$106,000	$10,000	-$96,000	0.09

Average annual costs include interest during construction / discount rate of 3.125 percent from 2020 through 2070 / Discount rate of 3.125 percent from 2020 through 2070

3.11 Optimization of the Tentatively Selected Plan

Since release of the draft version of this report in August 2016, the TSP has been refined based on updated information from the Borough of Sea Bright and site visits. The Borough provided USACE with the most current list of properties that are permitted to be elevated or demolished. Eleven structures included in the TSP were identified as permitted by the Borough for elevation by the property owners, and two were permitted for demolition. These 13 structures were removed from the recommended plan. Recent site visits revealed more information about an additional three structures. These structures were reclassified as nonresidential structures based on current use. Because these three structures are used by businesses that require street level access to operate, they were removed from the plan. Engineering and economic analyses were revised to update costs and benefits associated with removing the 16 structures from the recommended plan. The recommended plan is described in detail in Chapter 4.



Chapter 4: Recommended Plan*

4.1 Plan Components

Alternative NS 2 (elevation of structures with a main floor elevation at or below +6.0 feet NAVD88), including the one temporary flood barrier with positive average annual net benefits has been identified as the recommended plan. Considering refinement of the TSP described in Section 3.11 above, the recommended plan includes the elevation of up to 18 structures and the use of one temporary flood barrier around two adjoining structures (Figure 26). The estimated first cost of the project is $8,110,000, with average annual net benefits of $28,000 (FY18 P.L.). The project is complementary to ongoing Hurricane Sandy recovery efforts, and will not include structures that already have been or will be elevated through other means.

The 18 structures will be elevated to a height of approximately 5 to 7 feet above ground elevation so that their main floor elevations reach +11.2 feet NAVD88. A temporary flood barrier will be deployed around two attached structures prior to storms. The top of the barrier will measure approximately seven feet above ground elevation. It will be deconstructed after use and stored between storms (Table 11). The barrier would be deployed, stored, and maintained by the non-Federal construction sponsor. Design heights for structure elevations and the temporary flood barrier will also be refined during PED.

LIDAR data were used to determine ground elevations in the study area. The height of structures above ground elevation was determined during field surveys using an estimation based on the number of steps to main floors. A detailed survey will be performed during PED to precisely measure pre-construction structure heights.

Construction techniques will vary depending on the structure foundation type. The structures would have their foundations extended into the ground for stability as part of elevation; the space between the elevated structure and ground surface may be partially enclosed or left open. Diagrams illustrating the construction technique for each foundation type can be found in Appendix A.

4.2 Benefits of the Plan

Refined benefit estimates were developed for the recommended plan after the initial screening described in Chapter 3. The benefits of implementing the proposed plan represent flood damages avoided with project implementation. Benefits were calculated as the difference in damages before and after project implementation. Benefits were then amortized over a 50-year period to identify equivalent average annual benefits using FY18 P.L. and an discount rate of 2.75 percent from 2020 through 2070 (Table 10).

Table 10: Costs and benefits of the recommended plan (FY18 P.L.).

Total First Cost	$8,110,000
Average Annual Cost	$307,000
Average Annual Benefits	$335,000
Annual Net Benefit	**$28,000**
Benefit-to-Cost Ratio	**1.1**

Average annual costs include interest during construction / discount rate of 2.75 percent from 2020 through 2070 / Discount rate of 2.75 percent from 2020 through 2070

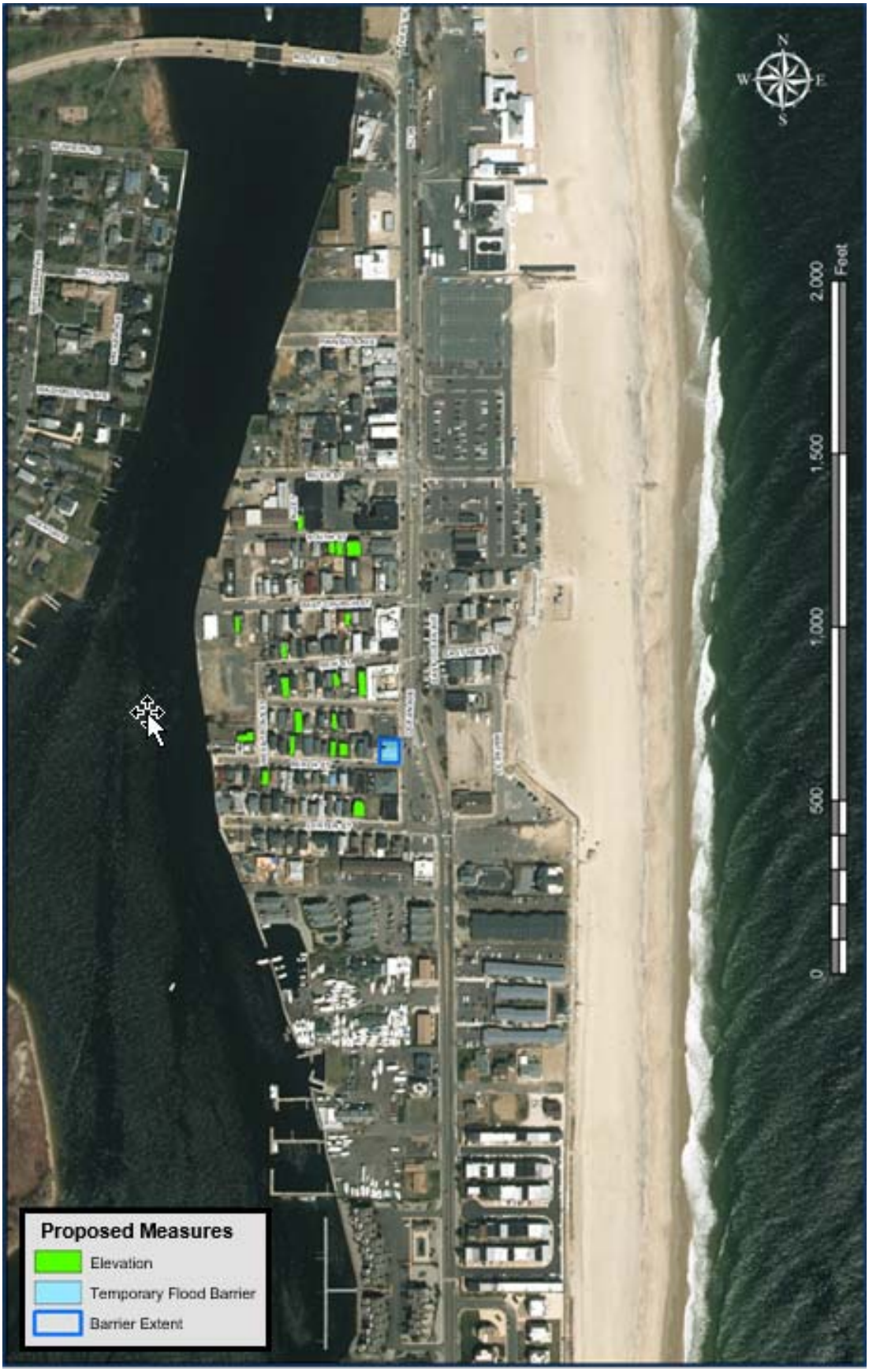


Figure 27: The recommended plan.

Table 11: Components of the recommended plan.

Structure ID	Foundation Type	Main Floor Area (sq ft)	FEMA Zone	Current FEMA Base Flood Elevation (+ft NAVD88)[1]	USACE 1% Water Surface Elevation (+ft NAVD88)	Ground Elevation (+ft NAVD88)	Main Floor Elevation(+ft NAVD88)	Elevate (E) or temporary flood barrier (B)	Increase to Structure Height (ft)	Final Main Floor Elevation of Structure (+ft NAVD88)[2]	Top elevation of temp. flood barrier (+ft NAVD88)
22	Crawl	660	AE	8	8.2	3.8	5.8	E	5.4	11.2	N/A
30	Slab	660	AE	8	8.2	4.0	5.6	E	5.6	11.2	N/A
31	Crawl	740	AE	8	8.2	4.3	5.8	E	5.4	11.2	N/A
32	Slab	1840	AE	8	8.2	4.5	5.5	E	5.7	11.2	N/A
46.01	Crawl	700	AE	8	8.2	3.2	5.6	E	5.6	11.2	N/A
56	Crawl	600	AE	7	8.2	3.9	5.7	E	5.5	11.2	N/A
66	Crawl	650	AE	7	8.2	3.1	5.6	E	5.6	11.2	N/A
70	Slab	1250	AE	7	8.2	3.2	5.0	E	6.2	11.2	N/A
75	Slab	710	AE	7	8.2	3.3	5.3	E	5.9	11.2	N/A
78	Slab	1560	AE	7	8.2	3.8	4.5	E	6.7	11.2	N/A
84	Slab	740	AE	7	8.2	3.9	5.6	E	5.6	11.2	N/A
86	Slab	1350	AE	7	8.2	2.2	5.2	E	6	11.2	N/A
90	Slab	1110	AE	7	8.2	3.1	4.8	E	6.4	11.2	N/A
93	Crawl	1490	AE	7	8.2	2.3	5.2	E	6	11.2	N/A
97	Crawl	760	AE	7	8.2	2.9	5.1	E	6.1	11.2	N/A
98	Slab	980	AE	7	8.2	3.5	5.3	E	5.9	11.2	N/A
101.01	Slab	1420	AE	7	8.2	3.1	4.3	B	N/A	N/A	11.2
101.02	Slab	1160	AE	7	8.2	3.1	4.3	B	N/A	N/A	11.2
106	Crawl	810	AE	7	8.2	2.4	5.3	E	5.9	11.2	N/A
117	Crawl	1510	AE	7	8.2	3.1	4.9	E	6.3	11.2	N/A

[1] Effective base flood elevation based on current preliminary flood insurance rate map.
[2] The Borough of Sea Bright requires that all new construction be at a height at least two feet above the BFE. The final main floor elevation of structures to be elevated will be at a height that meets this requirement.

4.3 Cost Estimates

Refined project costs were developed for the recommended plan after the initial screening described in Chapter 3. The initial project cost is $8,110,000 and the Total Project Cost is $8,492,000 (FY18 P.L.) (Table 12). The Total Project Cost is escalated to the midpoint of construction (October 2019) and serves as the basis of the Project Partnership Agreement. These costs include construction, lands and damages, design, supervision and associated administration costs. The material costs were based on a combination of MII database, RSMeans, quotes, and historical information. Equipment rates were obtained from Region 1, and Davis Bacon Wage Rates for Monmouth County, NJ were utilized for labor costs. The contingencies were developed via an Abbreviated Risk Analysis. A summary of the results of this risk analysis, and more detail on the cost estimate, can be found in Appendix B.

Table 12: Project average annual costs (FY18 P.L.).

Initial Project Cost	$8,4391,000
Annualized Initial Cost*	$305,000
Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Costs	$2,000
Total Annual Cost*	**$307,000**

Average annual costs include interest during construction / discount rate of 2.75 percent from 2020 through 2070

4.4 Operation, Maintenance, Repair, Replacement & Rehabilitation Considerations

OMRR&R are the responsibility of the non-Federal sponsor. There will be no OMRR&R expenses for individual property owners as a result of the proposed elevation of structures. Annual OMRR&R of the temporary flood barrier is estimated to cost $2,000 per year.

4.5 Risk and Uncertainty Analysis

Floodplain Management: The recommended plan does not contribute to risk in an overall sense, as it does not encourage development in the floodplain. In this sense, the plan is compliant with Executive Order (EO) 11988 “Floodplain Management,” which requires Federal agencies to minimize and prevent encouragement of development in the floodplain in their planning and project implementation. It should be noted, however, that Sea Bright is mostly developed and there is generally little room for additional development within the community, regardless of which alternative is under consideration. The residual risk to people and property are discussed in Sections 4.5.1 and 4.5.2.

Relative Sea Level Change: The regional RSLC trend of rising sea level over time may have significant ramifications for Sea Bright. The low-lying community, which is located on a coastal spit between a tidally-influenced river and the Atlantic Ocean, already experiences chronic inundation. The streets are regularly flooded during high tides and minor nor'easters. A rise in relative sea level would likely impact Sea Bright sooner and more severely than neighboring municipalities. For example, Ocean Avenue is currently closed by the Sea Bright Police Department when a few inches of flooding makes the road unsafe to utilize. An increase in relative sea level would likely make flood events more frequent, while at the same time potentially impacting roads in other Monmouth County communities that are located at higher elevations.

It was assumed during plan optimization that the study area will experience 1.11 feet of sea level rise from 2020 through 2070. This potential change in sea level was accounted for when choosing the design heights for structures to be elevated, and the temporary flood barriers.

An analysis was completed of the performance of the recommended plan over time with consideration of projected RSLC. As discussed in Section 3.2 and shown in Figure 20 above, the region is projected to experience up to a 2.61-foot increase in sea level through 2070 under the high scenario. The costs and benefits of the recommended plan were calculated under the three RSLC scenarios for the time period 2020 - 2070 (Table 13).

Table 13: Project performance over time considering RSLC (FY18 P.L.).

RSLC Scenario	Annual Benefits	Average Annual Costs*			Net Benefits	BCR
		Implementation	OMRR&R	Total		
Low	$302,000	$305,000	$2,000	$307,000	-$5,000	0.98
Intermediate	$335,000	$305,000	$2,000	$307,000	$28,000	1.1
High	$527,000	$305,000	$2,000	$307,000	$220,000	1.7

Average annual costs include interest during construction / discount rate of 2.75 percent from 2020 through 2070 / Discount rate of 2.75 percent from 2020 through 2070

The analysis shows that the project generally performs well over time. There is an inverse relationship between the projected rate of RSLC and net benefits accrued over time. That is, the project would provide greater net benefits under the "high" scenario than the "intermediate" scenario, and even greater than under the "low" scenario. There is a risk that the costs of the project will outweigh its benefits through 2070 if relative sea level does not increase as quickly as projected. The opposite is also true – the benefits the project would provide may be greatest if RSLC increases greater than or faster than projected. Because of the great sensitivity of the community to sea level change, the study team feels it is appropriate to consider the intermediate RSLC scenario to best describe potential benefits of the project over time.

Plan Participation Rate: Participation in nonstructural projects is voluntary for property owners. Theoretically, it is possible for the project to have a benefit-to-cost ratio above one for the purposes of authorization, but below one in implementation if some of the property owners elect not to participate. Based on coordination with local interests and the long-term trend to elevate existing structures, an at- or near-100 percent participation is anticipated for this project.

4.5.1 Residual Risk & Damages

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 all efforts to reduce the risk are completed. It is the exposure to loss remaining after other known risks have been countered, factored in, or eliminated.

The proposed project is part of a comprehensive plan to reduce flood risk to life and property in Sea Bright. The plan complements other ongoing efforts in the Borough to reduce flood risk. Most significantly, many residents are elevating their homes above the still water level elevation of the one percent flood. After Hurricane Sandy, the Borough of Sea Bright issued permits for the elevations or demolition of at least 89 structures in the study area. Because of the availability of post-Hurricane Sandy grants and nonprofit volunteer labor, residents continue to elevate their homes to reduce the risk of flood damages. In accordance with local regulations, new construction is built to an elevation at least two feet above the BFE. Elevated homes are at less risk of damage from nuisance flooding due to high-frequency flood events such as high tides and small nor'easters.

The Borough and NJDEP are very proactive in reducing flood impacts and communicating risk to residents. They continue to reduce risk in the community by leveraging local, state, and Federal investment. NJDEP and FEMA have partnered to build a 3,000-foot ocean-fronting seawall in downtown Sea Bright that will connect with existing seawalls. Completion of the seawall project, which is currently under construction and is scheduled to be complete in the summer of 2018, will reduce the risk of storm surge inundation from the Atlantic Ocean. The Borough has elevated and reinforced river-fronting, municipally-maintained bulkheads after Hurricane Sandy. Future efforts to elevate existing

river-fronting bulkheads along the Shrewsbury River may also reduce the risk of inundation in Sea Bright. A new complex that will house the Borough's government offices, police station, and fire station is currently in final design. The complex will be built above the BFE, and as such be less susceptible to flooding than the previous facilities that were inundated by storm surge during Hurricane Sandy.

Flood damages from coastal storms will not be totally prevented, only reduced. Even with the project in place, the area is likely to experience $1.26 million in Average Annual Damages (AAD). With forecasted intermediate SLC, the without project condition equivalent annual damage is $1,590,000 (FY18 P.L.). With residual damage of $1,260,000, equivalent average annual benefits are $335,000. The project will not eliminate all flood risk to life and property. The fundamental risk associated with the recommended plan is that access routes would still become inaccessible due to flooding from coastal storms since the plan only involves the elevation of structures, stranding individuals who choose not to evacuate when directed to prior to coastal storms. Residual damages can occur from very high storm surge, rainfall events, and hurricane winds and windblown debris. The proposed project will provide net benefits of $28,000 annually (FY18 P.L.). With plan implementation, there will still be public and private properties that are vulnerable to coastal storm damages. Post-disaster assistance and aid for owners of these other properties may come from other Federal agencies, such as FEMA and the U.S. Department of Housing and Urban Development (USHUD), or from programs run by the State of New Jersey.

4.5.2 Risk to Life Safety

Sea Bright and other coastal communities have always existed with the threat of coastal storms. 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 incidents of major coastal storm flooding, people are given sufficient warning to evacuate prior to storms. Before severe storms, the Borough of Sea Bright aids residents in evacuating out of harm's way by implementing its robust evacuation plan. Ocean Avenue, the major or only emergency evacuation route for Sea Bright, Monmouth Beach, and other coastal communities, is cleared of sand and debris prior to and following storms in order to allow residents, emergency responders, and recovery workers to exit and enter the area. 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 coastal 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.

4.6 Economic, Environmental, and Other Social Effects

The 1983 Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (USWRC 1983) presents four accounts to facilitate evaluation and display of effects of alternative plans:

- NED – changes in the economic value of the National output of goods and services
- Environmental Quality (EQ) – non-monetary effects on significant natural and cultural resources
- Regional Economic Development (RED) – changes in the distribution of regional economic activity that result from each alternative plan
- Other Social Effects (OSE) – effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts

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 structure elevations or temporary flood barrier (+11.2 feet NAVD88). A small nonstructural project neither contributes to nor detracts from the EQ and RED accounts. As detailed in Chapter 5, there would be minimal environmental impacts due to implementation of the plan. No wetlands will be affected nor will any other habitat be destroyed because the project footprint is limited to structure elevation, which utilizes already developed property and flow modification is limited to the developed areas with no changes to wetland hydrology. . For the same reason, and because no historic buildings are included in the project, there will be no adverse effects to historic properties. Any other impacts, including the environmental impacts associated with building elevation, will 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 might include features such as a sense of common belonging or cultural similarity. There is a shared interest among residents of Sea Bright to reduce coastal flooding, which affects everyone in the Borough. Ocean Avenue is the community's main thoroughfare and only road into and out of the Borough. It and its side streets frequently experience nuisance flooding during high frequency storm events and spring tides. The community's determination to fix its flooding problems was made acutely obvious in the aftermath of Hurricane Sandy. After the storm, many local and national civic groups joined Borough officials to help neighbors, businesses, and essential services return. The expansion of community spaces and events in recent years is indicative of growing cohesion in the community.

In support of its post-Hurricane Sandy recovery, the Borough finalized the Sea Bright 2020 Recovery Plan in December 2013 (Sea Bright 2013). The plan highlights key recovery issues, summarizes recovery projects developed to address those issues, and outlines the community's strategy for moving forward in the aftermath of Hurricane Sandy. The planning process entailed a three month intensive effort on the part of residents, businesses, and local officials. Residents identified at a series of community workshops major recovery issues, and proposed project that may address flood and recovery issues. The resulting project-oriented plan incorporates various approaches and techniques to mitigate against future disasters and carries the support and buy-in of the community. It is being used as a roadmap for the Borough's recovery.

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. 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 structure elevations or temporary flood barrier (+11.2 feet NAVD88). People would not be displaced for months or years because their homes were severely damaged by a storm, as was the situation after Hurricane Sandy. 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 community 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. The Borough of Sea Bright and non-governmental organizations have helped connect residents with sources of disaster assistance after coastal flood events.

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 or 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 1 percent or greater chance of flooding in any given year, i.e., 1 percent flood).

The Proposed Action is within the defined base floodplain.

Step 2: Conduct early public review, including public notice.

USACE has coordinated with the NJDEP, the Borough of Sea Bright, and the public during the course of the study. In accordance with NEPA, a draft version of this report was released to the public for review on August 4, 2016.

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 NACCS flood risk management framework, which is similar in concept to 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 discussed in Chapter 3.

Step 4: Identify impacts of the proposed action.

As detailed in Chapter 5, there would be minimal environmental impacts due to implementation of the plan. The plan will 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 final report presents the findings.

Step 8: Implement the action.

The NJDEP is willing to enter into a Project Partnership Agreement (PPA) with the Federal Government for implementation of the plan.

4.8 Potential Changes to the Recommended Plan

The TSP was refined after release of the draft version of this report in August 2016, in order to incorporate the most up-to-date information about the existing conditions in the study area. Since post-disaster rebuilding is an ongoing process, the number of structures has changed (see Table 11). The ultimate number of structures included in the plan will likely change again as homeowners continue to elevate their homes. Engineering and economic analyses will be revised during PED as appropriate to reflect any revisions to the plan.

Chapter 5: Recommended Plan*

This chapter describes the environmental consequences of implementing the recommended plan and taking no action, as required by NEPA. The No Action alternative consists of USACE not implementing the proposed coastal storm risk management project. The proposed action consists of implementing the recommended plan described in Chapter 4 above. The following resources are not present in the study area, and thus are not included in the discussion of potential environmental impacts:

- Wetlands
- CBRS units
- Threatened and endangered species
- EFH
- Aquatic resources
- Cultural resources
- Low income and minority communities (environmental justice)

5.1 Socioeconomics

No Action: Structures, businesses, and streets would continue to be inundated by storm surge from the Shrewsbury River. There would be a continuation of negative socioeconomic impacts due to flood induced damages, including destruction of property and potential loss of life. Damages to structures with relatively high MFEs would generally be lower than those with lower MFEs. Local building ordinances require that new construction be built at least two feet above the BFE, potentially reducing damages for future construction.

Ocean Avenue and other streets would continue to be inundated by storm surge from the Shrewsbury River. With completion of the Borough's ocean-fronting seawall project, storm surge from the Atlantic Ocean will likely not inundate Ocean Avenue and other streets during storms.

Proposed Action: The economy of Sea Bright may accrue socioeconomic benefits as a result of implementation of the proposed project. Recurrent costs to affected residents of cleaning up and rebuilding after floods would be mitigated, allowing the community to focus on community-building activities rather than on preparing for and recovering from storm surge events. Due to use of a temporary flood barrier around two attached flood-prone structures, less time would be lost for businesses on their ground flood compared to a flood situation without the barrier. Use of the temporary flood barrier would allow businesses and residents who operate or live in the structures to resume normal operations and recovery actions in a shorter period of time following a storm.

Ocean Avenue and other streets would continue to be inundated by storm surge from the Shrewsbury River, though costs and time associated with clean-up and debris removal would be reduced. With completion of the Borough's ocean-fronting seawall project, storm surge from the Atlantic Ocean will likely not inundate Ocean Avenue and other streets during storms.

5.2 Water Resources

5.2.1 Ground Water

No Action: No significant impacts to groundwater resources are expected as a result of the No Action alternative.

Proposed Alternative: No significant impacts to groundwater resources are expected as a result of implementation of the proposed project since construction activities would be limited to the immediate areas of the individual structure foundations. Foundations would not be built any deeper than they are at present, and thus groundwater flow would not be affected.

5.2.2 Surface Water

No Action: No significant impacts to surface water resources are expected as a result of the No Action alternative. There would be a continuation in high water flood events and inundation of low-lying areas.

Proposed Alternative: No significant impacts to surface water resources are expected as a result of implementation of the proposed project.

5.3 Vegetation

5.3.1 Uplands

No Action: No significant impacts to surface upland resources are expected as a result of the No Action alternative.

Proposed Alternative: Implementation of the proposed project would affect existing, largely cultivated vegetation in front and back yards because it would be removed to provide safe access for construction equipment when necessary. However, subsequent post-construction landscaping would mitigate the impact of cultivated vegetation loss.

5.4 Fish and Wildlife

5.4.1 Amphibians and Reptiles

No Action: There is no significant impact expected to amphibian and reptiles, and their habitat from the No Action alternative, as no significant populations are located in the study area.

Proposed Alternative: There are no significant populations of amphibians and reptiles located within the footprint of structures included in the recommended plan. Construction staging areas would be located on streets or parking lots. Since noise and dust generation would be extremely limited in space and time, no significant impacts are anticipated due to the proposed action. Any amphibians and reptiles near the construction activities would be able to relocate. Disturbance leading to movement and relocation would not impose a minor risk of mortality in an urban construction environment. This would be an insignificant adverse impact.

5.4.2 Birds

No Action: There is no significant impact to birds and bird habitat from the No Action alternative.

Proposed Alternative: There would be no significant impacts on birds due to implementation of the proposed project. There are no birds located within the footprint of structures included in the recommended plan. Construction staging areas would be located on streets or parking lots, and since noise and dust generation would be extremely limited in space and time, no significant impacts are anticipated due to the proposed action. Any birds near the construction activities would be able to relocate. Disturbance leading to movement and relocation would not impose a minor risk of mortality in an urban construction environment. This would be an insignificant adverse impact. Some landscape vegetation and possibly trees on the affected properties would be removed or pruned to provide construction access. Depending upon the season, contractors would have to be attentive to nesting birds. This would be a potential minor adverse impact to some birds for the period of construction. However, construction would also involve restorative landscaping that could mitigate potential impacts.

5.4.3 Mammals

No Action: There is no significant impact to mammals and their habitat from the No Action alternative, as no significant populations are located in the study area.

Proposed Alternative: There would be no significant impact on mammals within the project area. There are no mammals located within the footprint of proposed structures. Construction staging areas would be located on streets or parking lots, and since noise and dust generation would be extremely limited in space and time, no significant impacts are anticipated due to the proposed action. Any mammals near the construction activities would be able to relocate.

5.5 New Jersey Coastal Zone

No Action: The No Action alternative would not result in any modification to the New Jersey Coastal Zone.

Proposed Alternative: No significant impacts on the coastal zone are anticipated as a result of implementation of the proposed project. The on-site elevation of structures would be coordinated with the NJDEP to provide ample time to comply with coastal zone regulations. A Federal consistency determination is required since the project area is within the New Jersey coastal zone. New Jersey Department of Environmental Protection, Division of Land Use Regulation issued a Federal Consistency Determination on September, 29 2017. See Appendix E for the New Jersey Coastal Zone Act Consistency Statement.

5.6 Hazardous, Toxic, and Radioactive Waste

No Action: The No Action Alternative would result in recurrent flooding impacts, causing more destruction of low lying residences that may collapse or have to be demolished. This could lead to local exposure to LBP, ACM, mold, and dust. Additionally, there could be fuel tank failures causing local contamination of soil and water.

Proposed Alternative: No significant impact to the environment from hazardous, toxic, and radioactive waste is expected as a result of implementation of the proposed action. All activities are anticipated to occur within the footprint of an existing structure. All structures slated for elevation will be

inspected for any potential environmental issues, e.g., LBP, ACM, and fuel storage tanks. The presence of LBP, ACM and/or fuel storage tanks does not affect structure eligibility. 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 have been determined 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.

5.7 Air Quality

Under the Clean Air Act, the project area is within an ozone non-attainment area and maintenance areas for PM2.5 and CO. As a land-based construction activity using traditional equipment in standard manner such actions as are being proposed for downtown Sea Bright would have already been assessed in developing the State Implementation Plan.

No Action: There would be no impact to air resources from the No Action alternative. As noted in Chapter 2, Sea Bright is located in a non-attainment and maintenance areas, so there are extant air quality issues that will remain with or without the proposed project.

Proposed Alternative: The estimated emissions from the proposed alternative will be approximately 4.3 tons of NOx and one ton or less of VOCs, PM2.5, SO2, and CO. These amounts are far below applicable thresholds of concern under the Clean Air Act, and will be temporary in nature. A General Conformity Compliance was achieved through a Record of Non-Applicability (RONA) (Appendix E). The RONA is supported by emission estimates that have been based on the MII construction analysis of the proposed project to evaluate the applicability of the General Conformity regulations of 40 CFR 93 Subpart B. The proposed action is not considered regionally significant under 40 CFR 93.153(is). Any fugitive dust generated due to construction activities would be contained according to proper standards and procedures.

5.8 Aesthetics and Scenic Resources

No Action: There would be no impact to aesthetics and scenic resources from the No Action alternative.

Proposed Alternative: Because Sea Bright is a closely-spaced, low rise community, implementation of the proposed project may cause disruption of loss of views for some residents. Any visual impacts associated with elevating structures would be minimized through proper design and construction, while conforming to local and state building codes. Some landscape vegetation on the affected properties could be removed or pruned to provide construction access. This is a potential minor adverse impact to viewsheds during construction. However, construction could also involve restorative landscaping that could mitigate the impacts.

It is important to note that many homes have been elevated after the 1992 nor'easter, with many homes elevated since Hurricane Sandy in 2012. It is expected that the trend to elevate homes or rebuild them

to a higher elevation will continue. Thus, changes to aesthetics caused by the project would be similar to changes made through other actions that are likely to continue.

5.9 Recreation

No Action: There would be no impact to recreation resources from the No Action alternative.

Proposed Alternative: There are no identified impacts on recreation, or public access to public and/or recreational areas by the proposed plan. All construction activities would take place within the footprint of an existing structure. Construction staging areas would be located on streets or parking lots. Since noise and dust generation would be extremely limited in space and time, they would have no significant impacts on recreation areas, which would remain available to residents throughout the construction duration.

5.10 Noise

No Action: There would be no change to noise disturbances from existing conditions under the No Action alternative.

Proposed Alternative: There would be no significant impacts from noise disturbances due to the proposed action. Construction activities related to the proposed action would be limited to day time hours, out of the noise disturbance prohibitions required by the Borough of Sea Bright (no noise disturbance between the hours of 6:00 pm to 7:00 am on weekdays and 6:00 pm to 9:00 am on Saturdays, Sundays, and Federal holidays). Noise which is not in violation of the local ordinances might still disturb neighbors who live within earshot. Best management practices for contractors may lessen or abate these occurrences or provide a complaint mechanism to remedy them. Construction noise is a potential minor impact.

5.11 Infrastructure

No Action: Infrastructure such as Ocean Avenue and power lines would continue to be impacted by storm surge from the Shrewsbury River. Their clean-up, removal, and repair would commence after storms that would impact this infrastructure. With completion of the Borough's ocean-fronting seawall project, storm surge from the Atlantic Ocean will likely not inundate Ocean Avenue and other streets during storms.

Proposed Alternative: There would be no significant impact on utility infrastructure as a result of the proposed action. There are potential minor adverse impacts associated with construction traffic, construction induced changes to traffic flow and other inconveniences caused by the construction activities. 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, and should be elevated to a height above the BFE (i.e., above the 1 percent floodplain). Because utilities for buildings would be relocated above the floodplain, they would likely not be impacted by frequent, small storms, allowing for residents and businesses who operate or live in the structures to resume normal operations and recovery actions in a shorter period of time following a storm. The same is true for utilities for those structure that are behind the temporary flood barrier during a storm.

Infrastructure such as Ocean Avenue and power lines would continue to be impacted by storm surge from the Shrewsbury River. Impacts to this infrastructure is similar for the No Action alternative.

5.12 Land Use and Zoning

No Action: There would be no impact to land use and zoning from the No Action alternative. Local building ordinances require that new construction be built at least two feet above the BFE, potentially mitigating damages for future construction.

Proposed Alternative: Land use zoning would remain the same and all parcels would continue to be used as residential properties. There would be no significant impact as a result of implementation of the proposed project on land use. Local building ordinances require that new construction be built at least two feet above the BFE, potentially mitigating damages for future construction.

5.13 Cumulative Impacts*

Cumulative impacts are the effects on the environment that result from the incremental direct and indirect impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from actions that individually are minor, but collectively result in significant actions taking place over time (Section 1508.7 40 CFR Parts 1500-1508). The Council on Environmental Quality's (CEQ) "Considering Cumulative Effects Under the National Environmental Policy Act" (CEQ 1997) provides an 11-step framework for cumulative effects analysis that was utilized to conduct the cumulative impact assessment for this study.

The following describes the cumulative effects or impacts for the No Action and proposed alternatives by describing both the spatial (United States, New Jersey, and study area) and the temporal (past, present and reasonably foreseeable future (50-year period of analysis) actions of other coastal storm risk management projects, and the potential contribution of the proposed action to these impacts.

Federal, state, and local governments, and homeowners are taking action to reduce the risk of flooding in many communities located in floodplains. Federal agencies including USACE and FEMA are working to reduce the risk of flooding and flood damages through different authorities and programs. Specifically, the USACE is involved in the planning and construction of many risk management projects that include the construction of levees, floodwalls, pumps, and other structural measures, as well as nonstructural measures such as structure elevations. FEMA manages the distribution of Hazard Mitigation Assistance (HMA) funds that provide funding for eligible mitigation activities that reduce disaster losses and risk to life and property from future disaster damages. These National initiatives compliment similar risk management projects by state and local governments. In addition, many homeowners who have been recently impacted by flooding are elevating their homes via FEMA HMA grants or private funding. Since Hurricane Sandy, many homeowners have or are in the process of elevating their homes. This action mitigates the effects of flood damages to structures. Elevation of homes is generally encouraged in post-disaster communities such as Sea Bright, as seen throughout the northeast after Hurricane Sandy.

Actions in Sea Bright. The proposed action would complement the following post-Hurricane Sandy rebuilding and recovery activities that could potentially mitigate for flood damages. Major actions include:

- Elevation of many homes above the floodplain via FEMA HMA or private funds (Figure 27)
- Borough of Sea Bright building ordinances requiring that new construction be built at least two feet above the BFE

- Completion of the Borough's ocean-fronting seawall project
- Elevation of existing riverfront bulkheads by homeowners

Important to note is the fact that many residents have elevated or demolished their homes in response to frequent flood damage since the 1992 nor'easter. The availability of post-Hurricane Sandy grant funding has only accelerated this trend. The Borough granted permits for at least 54 structures in the study area to be elevated, and 35 structures in the study area to be demolished after Hurricane Sandy. It is expected that structures will be rebuilt to at least two feet above the BFE, which is the minimum building standard set by the Borough of Sea Bright. The proposed project will accelerate a trend to elevate homes that has progressed after every major flood event in the past 25 years.
Initiatives led by the Borough will help mitigate the risk of coastal storm damage. The Borough has received a number of Federal and state grants to mitigate future flood risk. Its post-Hurricane Sandy work to elevate publically-maintained bulkheads along the river to an elevation of +7 NAVD88 may help localized but not widespread flooding. The extension of the seawall currently under construction, as well as periodic nourishment of the beach, will reduce the risk of coastal storm flooding from the Atlantic Ocean. Even with these efforts, there remains an opportunity in downtown Sea Bright to manage the risk of coastal storm surge flooding to residents, infrastructure, and property.

The Borough of Sea Bright has received and is currently pursuing Federal and state grants, funding from which could be used to construct risk management projects. Though not included in the scope of this analysis, it is nevertheless important to note that these and other projects/actions could impact future conditions in the study area.

Detrimental cumulative impacts to the environment are not expected as a result of implementation of the proposed project. There would be no increase in footprint size of the elevated structures, and therefore it does not change floodplain characteristics. Use of a temporary flood barrier would also not change floodplain characteristics. The proposed project is consistent with post-Hurricane Sandy rebuilding strategy by many homeowners in Sea Bright - that is, the elevation of structures.

USACE Coastal Storm Risk Management Projects. The proposed action is one of many USACE coastal storm risk management projects along the central New Jersey coast. They include the Port Monmouth, Union Beach, Highlands, and Leonardo studies along the Raritan Bayshore. Along the Atlantic Coast are the recently completed Elberon to Loch Arbor (2016), and Port Monmouth (estimated 2018 completion) coastal storm risk management projects. These studies may result in constructed projects that may provide coastal storm risk management benefits to the area's coastal communities.

Construction of these projects may cumulatively add to the reduction of risk from coastal storm flooding along the northern Monmouth County New Jersey coast.

Chapter 6: Summary of Environmental Compliance*

Federal laws and Executive Orders applicable to all USACE recommended plans, their applicability to the proposed project, and, if applicable, their status is presented below:

N/A Non-applicable
C In compliance
P Compliance pending

STATUS	PUBLIC LAW (US CODE)/EXECUTIVE ORDER
N/A	Abandoned Shipwreck Act of 1987 (43 U.S.C. 2101)
N/A	American Indian Religious Freedom Act (42 U.S.C. 1996)
N/A	Agriculture and Food Act (Farmland Protection Policy Act) of 1981 (7 U.S.C. 4201)
N/A	American Folklife Preservation Act of 1976, As Amended (20 U.S.C. 2101)
N/A	Anadromous Fish Conservation Act of 1965, As Amended (16 U.S.C. 757a et seq)
N/A	Antiquities Act of 1906, As Amended (16 U.S.C. 431)
C	Archeological and Historic Preservation Act of 1974, As Amended (16 U.S.C. 469)
N/A	Archeological Resources Protection Act of 1979, As Amended (16 U.S.C. 470)
N/A	Bald Eagle Act of 1972 (16U.S.C. 668)
N/A	Buy American Act (41 U.S.C. 102)
N/A	Civil Rights Act of 1964 (Public Law 88-352) (6 U.S.C. 601)
C	Clean Air Act of 1972, As Amended (42 U.S.C. 7401 et seq)
C	Clean Water Act of 1972, As Amended (33 U.S.C. 1251 et seq)
N/A	Barrier Resources Act of 1982 (16 U.S.C. 3501-3510)
C	Coastal Zone Management Act of 1972, As Amended (16 U.S.C. 1451 et seq)
N/A	CERCLA of 1980 (42 U.S.C. 9601)
N/A	Conservation of Forest Lands Act of 1960 (16 U.S.C. 580 mn)
N/A	Contract Work Hours (40 U.S.C. 327)
N/A	Convict Labor (18 U.S.C. 4082)
N/A	Copeland Anti-Kickback (40 U.S.C. 276c)
N/A	Davis-Bacon Act (40 U.S.C. 276)
N/A	Deepwater Port Act of 1974, As Amended (33 U.S.C. 1501)
N/A	Emergency Flood Control Funds Act of 1955, As Amended (33 U.S.C. 701m)
N/A	Emergency Wetlands Resources Act (16 U.S.C. 3901-3932)
C	Endangered Species Act of 1972 (16 U.S.C. 1531)
C	EO 11988, Floodplain Management
C	EO 11990, Protection of Wetlands
C	EO 12898, Environmental Justice
N/A	Estuary Protection Act of 1968 (16 U.S.C. 1221 et seq)
N/A	Equal Opportunity (42 U.S.C. 2000d)
N/A	Farmland Protection Policy Act (7 U.S.C. 4201 et seq)
N/A	Federal Environmental Pesticide Act of 1972 (7 U.S.C. 136 et seq)
N/A	Federal Water Project Recreation Act of 1965, As Amended (16 U.S.C. 4601)
C	Fish and Wildlife Coordination Act of 1958, As Amended (16 U.S.C. 661)
N/A	Flood Control Act of 1944, As Amended, Section 4 (16 U.S.C. 460b)
N/A	Food Security Act of 1985 (Swampbuster) (16 U.S.C. 3811 et seq)
N/A	Hazardous Substance Response Review Act of 1980, As Amended (26 U.S.C. 4611)
N/A	Historic and Archeological Data Preservation (16 U.S.C. 469)

C	Historic Sites Act of 1935 (16 U.S.C. 461) Note: Superceded by NHPA, Section 106
N/A	Jones Act (46 U.S.C. 292)
N/A	Land and Water Conservation Fund Act of 1965 (16 U.S.C. 4601)
N/A	Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801)
N/A	Marine Mammal Protection Act of 1972, As Amended (16 U.S.C. 1361)
N/A	Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1401)
N/A	Migratory Bird Conservation Act of 1928, As Amended (16 U.S.C. 715)
N/A	Migratory Bird Treaty Act of 1918, As Amended (16 U.S.C. 703)
C	NEPA of 1969, As Amended (42 U.S.C. 4321 et seq)
C	National Historic Preservation Act of 1966, As Amended (16 U.S.C. 470)
C	National Historic Preservation Act Amendments of 1980 (16 U.S.C. 469a)
N/A	Native American Religious Freedom Act of 1978 (42 U.S.C. 1996)
N/A	Native American Graves Protection and Repatriation Act (25 U.S.C. 3001)
N/A	National Trails System Act (16 U.S.C. 1241)
N/A	Noise Control Act of 1972, As Amended (42 U.S.C. 4901 et seq)
N/A	Rehabilitation Act of 1973 (29 U.S.C. 794)
N/A	Reservoir Salvage Act of 1960, As Amended (16 U.S.C. 469)
N/A	Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901-6987)
N/A	River and Harbor Act of 1888, Section 11 (33 U.S.C. 608)
N/A	River and Harbor Act of 1899, Sections 9, 10, 13 (33 U.S.C. 401-413)
N/A	River and Harbor and Flood Control Act of 1962, Section 207 (16 U.S.C. 460)
N/A	River and Harbor and FC Act of 1970, Sects 122, 209 and 216 (33 U.S.C. 426 et seq)
N/A	Safe Drinking Water Act of 1974, As Amended (42 U.S.C. 300f)
N/A	Shipping Act (46 U.S.C. 883)
N/A	Submerged Lands Act of 1953 (43 U.S.C. 1301 et seq)
N/A	Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601)
N/A	Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201-1328)
N/A	Toxic Substances Control Act of 1976 (15 U.S.C. 2601)
N/A	Policy Act of 1970, As Amended (43 U.S.C. 4601)
N/A	Utilization of Small Business (15 U.S.C. 631, 644)
N/A	Wild and Scenic River Act of 1968 (16 U.S.C. 1271 et seq)

Assuming that the proposed project does not expand beyond the scope described in this report, the project is in compliance with NEPA.

Chapter 7: Plan Implementation

As the non-Federal sponsor, the NJDEP must sign a PPA that will carry the project through the Preconstruction Engineering and Design (PED) phase to project construction. A Project Management Plan will be prepared to identify tasks, responsibilities, and financial requirements of the Federal Government and the non-Federal sponsor during PED and construction. A project schedule has been developed based on current assumptions for the detailed design and construction schedules. It will be refined as more data are available in subsequent phases of the project.

Funding by the Federal Government to support these activities would have to meet the requirements of P.L. 113-2) or traditional Civil Works budgeting criteria.

7.1 Consistency with Public Law 113-2

P.L. 113-2 lays out specific requirements necessary to demonstrate that a project is technically feasible, economically justified, and environmentally complaint; specific requirements necessary to demonstrate resiliency, sustainability, and consistency with the NACCS; and the costs and cost-sharing to support a PPA.

Economic Justification. The prior sections of this report demonstrate that the recommended plan is technically feasible. It also identifies that the plan has benefits greater than its costs.

Environmental Compliance. The final Environmental Assessment, which is integrated into 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.

Resilience and Sustainability. The proposed project would contribute to community resilience, as described in Section 4.6.2. Elevation of structures is inherently sustainable, as there is no action required to maintain their new ultimate heights. Deployment of the temporary flood barrier requires little time, effort, and OMRR&R.

Consistency with the NACCS. The NACCS report was released in January 2015 and provides a Risk Management Framework designed to help local communities better understand changing flood risks associated with climate change and to provide tools to help those communities better prepare for future flood risks. In particular, it encourages planning for resilient coastal communities that incorporate, wherever possible, coastal landscape systems that take into account future sea level and climate change scenarios (USACE 2015). The Framework process was used during plan formulation and selection. In addition, the process used to identify the recommended plan included an evaluation of the benefits and costs of an array of alternative solutions both structural and nonstructural, and took into account storm data, climate change, and rising sea levels developed as part of and consistent with the NACCS. The recommended plan is adaptable to changing conditions and provides a solution that can be adapted as warranted by future conditions.

7.2 Institutional Requirements & Local Cooperation

NJDEP has indicated its intent to implement the proposed project through a strong record of involvement and coordination throughout the study. A fully coordinated PPA package will be prepared subsequent to the approval of the feasibility phase to initiate design and construction. It will be based

on the recommendations of the study. NJDEP has agreed to comply with all applicable Federal laws and policies and other requirements that may include, but are not limited to:

a. Provide a minimum of 35 percent of initial project costs assigned to coastal and storm damage reduction, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits, and as further defined below:

   (1) Provide, during design, 35 percent of design costs allocated to coastal and storm damage reduction in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

   (2) Provide all lands, easements, rights-of-way, and perform or assure performance of all relocations, including utility relocations, as determined by the Federal government to be necessary for the initial construction, periodic nourishment or operation and maintenance of the project;

   (3) Provide, during construction, any additional amounts necessary to make its total contribution equal to 35 percent of initial project costs assigned to coastal and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

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 yearly, of the extent of protection afforded by the flood risk management features; participate in and comply with applicable federal floodplain management and flood insurance programs; comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12); and 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 protection levels provided by the flood risk management features;

d. Operate, maintain, repair, replace, and rehabilitate the completed project, or function portion of 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;

e. For so long as the project remains authorized, ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;

f. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

g. At least twice annually and after storms, perform surveillance of the project and provide the results of such surveillance to 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 initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project, 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 3 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 U.S.C. 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 initial construction, periodic nourishment, 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 the initial construction, periodic nourishment, or operation and maintenance 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, replace, and rehabilitate 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 86, 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.

7.3 Real Estate Requirements

The project will require USACE to obtain up to 18 individual Rights of Entry for Construction. The project requires Rights of Entry for Construction affecting a total of 0.43 acres of land (Table 14).

Table 14: Real estate requirements (FY18 P.L.).

Cost Category	Total
Lands and Damages Costs	$441,000
Contingency (20%)	$88,000
Total Lands & Damages*	$529,000

7.4 Relocations

Property owners and occupants of eligible residential structures who willingly participate in the residential elevation program are not considered displaced persons (in accordance with 49 CFR Part 24), and therefore are not entitled to receive relocation assistance benefits. However, displaced tenants of eligible residential structures to be elevated may be eligible for temporary relocation assistance benefits in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970 (49 CFR 24.101[a][2]). Eligible tenants that temporarily relocate would be reimbursed for the cost of temporary alternate housing, meals and incidentals (such as laundry services), and the fees for disconnection and connection of utilities at the temporary residence. Alternate housing could be hotels or apartments, depending upon availability in the community. A case-by-case determination will be made during PED regarding eligibility for relocation assistance.

Comparable Housing Payment: This includes the sum of the amounts by which the cost of a temporary comparable dwelling exceeds the out of pocket cost of the displacement dwelling, per diem and laundry service as temporary accommodations generally do not include required facilities, and the reasonable expenses incidental to the temporary comparable dwelling. Comparable housing payment was determined by assuming a displaced person has owned and occupied his/her dwelling for at least 180 days prior to initiation of negotiations. Currently, by Federal law the sum of total of payments are not to exceed $22,500, unless under housing of last resort. Based on an average New Jersey household size of 2.68 persons from the 2010 United States Census, comparable housing payments are estimated at approximately $21,400 per displaced tenant household.

Moving Expense Payment: The 2012 Fixed Residential Moving Cost Schedule approved by the Federal Highway Administration does not apply to the proposed project as the relocations are temporary, not permanent. An estimated figure of $1,000 is used to account for the displaced persons move into and out of a temporary comparable dwelling. The total estimated relocation assistance benefits paid in support of the proposed plan is approximately $128,000.

7.5 Financial Analysis

NJDEP has indicated its intent to enter into a PPA at the conclusion of the study. The agency supports the recommendations that are included in this report, which included the elevation of up to 18 homes and the use of a temporary flood barrier within the project area. They will continue to provide staffing and support needed to complete this project.

7.6 Preconstruction Engineering and Design

Because the study is included as a project under study as part of the P.L. 113-2 response to Hurricane Sandy, PED could be cost shared under a PPA (which typically only covers construction), if there are sufficient P.L. 113-2 funds to complete initial construction of the project. A separate Design Agreement for PED is not required unless P.L. 113-2 funds are insufficient to complete initial construction of a project.

Given the modest scale of the proposed project and that it is a nonstructural project with no beach element that will require future periodic nourishment, it is anticipated that completion of the study will be followed by PPA execution, once the Assistant Secretary to the Army (Civil Works) (ASA [CW]) provides notification to the Committee on Appropriations of the U.S. House of Representatives and the Senate.

PED costs are estimated at $845,000 (FY18 P.L.), to be cost-shared 65 percent Federal and 35 percent non-Federal.

7.7 Design and Construction Considerations

A construction start date of March 2019 was assumed because of the lack of technical complexity and small scale of the project. The construction schedule also assumes that five homes would be worked on at once by one contractor with multiple crews working five days a week. A single home will take approximately eight weeks to accomplish with one group of five overlapping with the next group by one week (Table 15). Assuming work will not be done the months of December, January, and February because of weather and the potential for disconnected plumbing to freeze and due to the difficulty of masonry to cure, the overall duration will be 16 months with a completion date in June 2020.

Table 15: Construction schedule.

Task	Duration	Start	Finish
Contract Award	1 day	March 1, 2019	March 1, 2019
Notice to Proceed	1 day	March 4, 2019	March 4, 2019
Preconstruction Submittals	60 days	March 5, 2019	May 27, 2019
Group #1	Begin May 28, 2019 Typical 48 days from Preconstruction to Demobilization/ Completion	Various – dependent on weather and other factors	Construction end June 25, 2020
Group #2			
Group #3			
Group #4			
Group #5			
Group #6			
Group #7			

7.8 Cost Sharing and Non-Federal Sponsor Responsibilities

The details behind the total first cost of implementing the recommended plan are shown in Table 16. The Federal share of the project's total first cost is 65 percent of the total. The Federal Government will design the project, prepare detailed plans/specifications and construct the project, exclusive of those items specifically required of non-Federal interests. The non-Federal share of the estimated total first cost of the proposed project is 35 percent of the total. The non-Federal share consists of a number of components including LERRDs (of which the Non-Federal portion is deducted from the Non-Federal cash contribution) and cost-sharing for PED and construction.

The cost of any work requested by homeowners that is outside the scope of this project will be the responsibility of the homeowner, and will be accounted for during design. For example, if a homeowner would like their home elevated an "extra" three feet, the cost of this work beyond the Federal action will be required from the landowner. The procedure for design modifications and payments will be agreed to prior to construction.

Table 16: Project cost (FY18 P.L.).

Cost Category	Federal Share	Non-Federal Share	Total
Total Project Cost*	$5,494,000	$2,958,000	$8,452,000
Initial Project Cost	$5,272,000	$2,839,000	$8,110,000
Real Estate Credit	-	$529,000	$529,000
Cash Contribution	$5,272,000	$2,310,000	$7,910,000
Total	$5,272,000	$2,839,000	$8,110,000

* Average annual costs include interest during construction / discount rate of 2.75 percent from 2020 through 2070

7.9 Views of the Non-Federal Sponsor and Other Agencies

USACE coordinated with a number of Federal and state agencies throughout the planning process (Appendix E and Appendix F). NJDEP has indicated its support of the study and its intent to implement the proposed project. As indicated by ongoing recovery from Hurricane Sandy, many residents of Sea Bright generally support elevating their homes and businesses out of the floodplain. The recommended plan, as one component of reducing flood risk in Sea Bright, complements the recovery efforts currently underway.

7.10 Implementation Authority

In the Disaster Relief Appropriations Act of 2013 (P.L. 113-2), the Congress provided funding and authority for USACE to execute actions related to the consequences of Hurricane Sandy. The Federal share of initial construction of the recommended plan is eligible to be funded using construction funds provided in P.L. 113-2. USACE will address whether P.L. 113-2 construction funds will be used to complete initial construction of the recommended plan at a later date.

If it is determined that P.L. 113-2 funds will not be used for the Federal share of initial construction of the recommended plan, Congressional authorization and appropriations may be required in order to carry out both initial construction and periodic renourishment. Because of the relatively small scope and cost of the project, it is expected that it will be implemented under the authority of Section 103 of the USACE Continuing Authorities Program.

Chapter 8: Coordination, Public Views & Comments*

A public notice announcing the availability of this draft report for public review was placed on the USACE New York District website on August 4, 2016. Public and agency comments received were reviewed, considered, and incorporated into plan optimization. No public comments were received during the 45 day report public review period. Coordination with Federal and state resource agencies is provided in Appendix E and Appendix F.

Chapter 9: 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.

The recommended plan includes the elevation of up to 18 structures, and use of a temporary flood barrier around 2 structures to manage the risk of damages caused by coastal storms in Sea Bright, New Jersey. The plan will provide $335,000 in average annual benefits (Fiscal Year 18 Price Level).

I recommend that the selected plan for coastal storm risk management at Sea Bright, 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. Because of the relatively small scope and cost of the project, I recommend that the plan be implemented under the authority of Section 103 of the USACE Continuing Authorities Program.

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Thomas D. Asbery
Colonel, U.S. Army
District Engineer

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Figure 4: USACE. (2015, October 21.) Downtown Sea Bright streetscape, Ocean Avenue looking south, 2015 [digital image]. On file.

Figure 5: USACE. (2003, December 29.) Typical residential streetscape, Center Street looking west to the Shrewsbury River, 2003 [digital image]. On file.

Figure 6: Associated Press. (2013, March 7.) Carol Marelli walks down her flooded street Thursday, March 7, 2013, in Sea Bright, N.J., after an overnight storm. [digital image]. Retrieved from https://www.vosizneias.com/news/photos/view/728070769

Figure 8a: USACE. (2015, October 21.) Sea Bright's seawall 2015 [digital image]. On file.

Figure 8b: USACE. (2015, October 21.) Sea Bright's seawall 2015 [digital image]. On file.

Figure 9a: USACE. (2006, April 19.) Typical bulkheads on the Shrewsbury River, 2006 [digital image]. On file.

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Figure 11: FEMA. (2012, November 25.) Sea Bright, New Jersey Fire Station Clean Up [digital image]. Retrieved from https://www.fema.gov/media-library/assets/images/67280.

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Figure 23: USACE. (2014, October 31.) Typical bulkhead along the Shrewsbury River in Sea Bright, 2014 [digital image]. On file.

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