ENVIRONMENTAL APPENDIX
CLEAN AIR ACT EVALUATION

NEW JERSEY BACK BAYS
COASTAL STORM RISK MANAGEMENT
FEASIBILITY STUDY

PHILADELPHIA, PENNSYLVANIA

APPENDIX F.8

August 2021

NJBB
NEW JERSEY BACK BAYS STUDY

U.S. Army Corps of Engineers
Philadelphia District

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1.0 INTRODUCTION

The US Army Corps of Engineers (USACE) in partnership with the Non-Federal Sponsor (NFS), the New Jersey Department of Environmental Protection, are conducting the New Jersey Back Bays Draft Integrated Feasibility Study and Tier 1 Environmental Impact Statement (NJBB Study) to determine the feasibility of alternatives that provide coastal storm risk management (CSRM) along the New Jersey coast. In accordance with the Clean Air Act (CAA) in 40 CFR Part 93 Subpart B, federal actions that result in direct and indirect emissions in exceedance of threshold values described in Table 1 are required to perform a General Conformity Determination. The scale of the NJBB Study and potential resulting construction effort would indicate a significant construction related emission output. However, the information required to make a formal emissions estimate is not available at this time. The purpose of this document is to analyze the potential emissions using the currently available information in order to determine if a formal General Conformity Determination is required and what the planning impacts would be. This is a “Tier 1” level evaluation that provides a broader view consistent with a Tier 1 Draft Environmental Impact Statement using available information on plan details and effects on air quality and to identify the potential for the need for General Conformity.

At this time there is insufficient information available to determine if any alternatives or their components are actionable. Additional information or design details may further inform the need for General Conformity following the public and agency review and some actionable items could be identified and evaluated prior to the Final Tier 1 EIS at the conclusion of the Feasibility Study Phase. A “Tier 2” level CAA evaluation would be conducted during the Engineering and Design Phase consistent with a more refined “Tier 2 Environmental Impact Statement” where detailed emissions estimates would be available to determine if General Conformity is required.

2.0 REGULATORY

General Conformity is a Federal Clean Air Act (CAA) requirement that ensures actions taken by federal agencies do not cause or contribute to violations of the National Ambient Air Quality Standards (NAAQS) and will not delay the states timely attainment of the NAAQS. The definition of a Federal action as specified in 40 CFR 93.152 includes "…any activity engaged in by a department, agency, or instrumentality of the Federal government, or any activity that a department, agency or instrumentality of the Federal government supports in any way, provides financial assistance for, licenses, permits, or approves, other than activities related to transportation plans, programs, and projects developed, funded, or approved under title 23 U.S.C. or the Federal Transit Act (49 U.S.C. 1601et seq.)".

The General Conformity Rule (GCR) was established under 176(c)(4) of the CAA and delineates certain requirements for federal agencies to demonstrate conformity of any proposed actions with the State Implementation Plan (SIP) for attainment of the NAAQS.

The GCR establishes *de minimis*, emission levels for a project in tons per year based on the severity of an area's air quality problem. The exceedance of a *de minimis* threshold requires a conformity determination, thresholds can be seen in Table 1. In 1993, the USEPA issued the initial GCR. The GCR was substantially revised in 2010 to improve the process federal entities use to demonstrate that their actions would not contribute to a NAAQS violation. Under the GCR, certain actions are exempted from conformity determinations, while others are presumed to be in conformity if total project emissions are below *de minimis* levels established under 40 CFR Section 93.153. Total project emissions include both direct and indirect emissions that can be controlled by a federal agency. Any new project that may lead to nonconformance or to a violation of the NAAQS requires a conformity analysis before initiating the action. The general conformity requirements apply only to nonattainment and maintenance areas.

Table 1. Significant Action Thresholds in Non-Attainment Areas (NAA's).

Ambient Pollutant	**Non-attainment Status**	**Tons/yr**
Ozone (VOCs or NOx):	Serious NAA's	50
	Severe NAA's	25
	Extreme NAA's	10
	Other ozone NAA's outside an ozone transport region:	100
	Other ozone NAA's inside an ozone transport region:	
	VOC	50
	NOx	100
Carbon monoxide:	All NAA's	100
SO2 or NO2	All NAA's	100
PM–10:	Moderate NAA's	100
	Serious NAA's	70
PM–2.5:	Direct emissions	100

Ambient Pollutant	Non-attainment Status	Tons/yr
	SO_2	100
	NO_x (unless determined not to be a significant precursor)	100
	VOC or ammonia (if determined to be significant precursors)	100
Pb:	All NAA’s	25

Source of table: 40 CFR §93.153 Applicability. (Amended to include $PM_{2.5}$)

3.0 NJBB AIR QUALITY

The U.S. Environmental Protection Agency (EPA) adopts National Ambient Air Quality Standards (NAAQS) for the common air pollutants, and the states have the primary responsibility to attain and maintain those standards. Through the State Implementation Plan (SIP), The New Jersey Department of Environmental Protection – Division of Air Quality manages and monitors air quality in the state. The goal of the State Implementation Plan is to meet and enforce the primary and secondary national ambient air quality standards for pollutants. New Jersey air quality has improved significantly over the last 40 years but exceeds the current standards for ozone (O_3) throughout the state. Fine particles (PM_{10} or $PM_{2.5}$) standards have been attained in NJ since 2012 using the 2006 24-hr fine particulate standard. Additionally, New Jersey has attained the sulfur dioxide (SO_2) (except for a portion of Warren County), lead (Pb), and nitrogen dioxide (NO_2) and carbon monoxide (CO) standards. The New Jersey Division of Air Quality also regulates the emissions of hazardous air pollutants (HAPs) designated by the U.S. EPA.

The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas (NAA's) for each of the National Ambient Air Quality Standards (NAAQS) (Table 1). Areas can also be found to be "unclassifiable" under certain circumstances. The 1990 amendments to the act required that areas be further classified based on the severity of non-attainment. The classifications range from "Marginal" to "Extreme" and are based on "design values". The design value is the value that actually determines whether an area meets the standard. For the 8-hour ozone standard for example, the design value is the average of the four highest daily maximum 8-hour average concentrations recorded each year for three years. For 2016, the design value is 0.070 ppm. The ozone attainment classification with respect to the 8-hour standard is shown in Figure 1. Ground-level ozone is created when

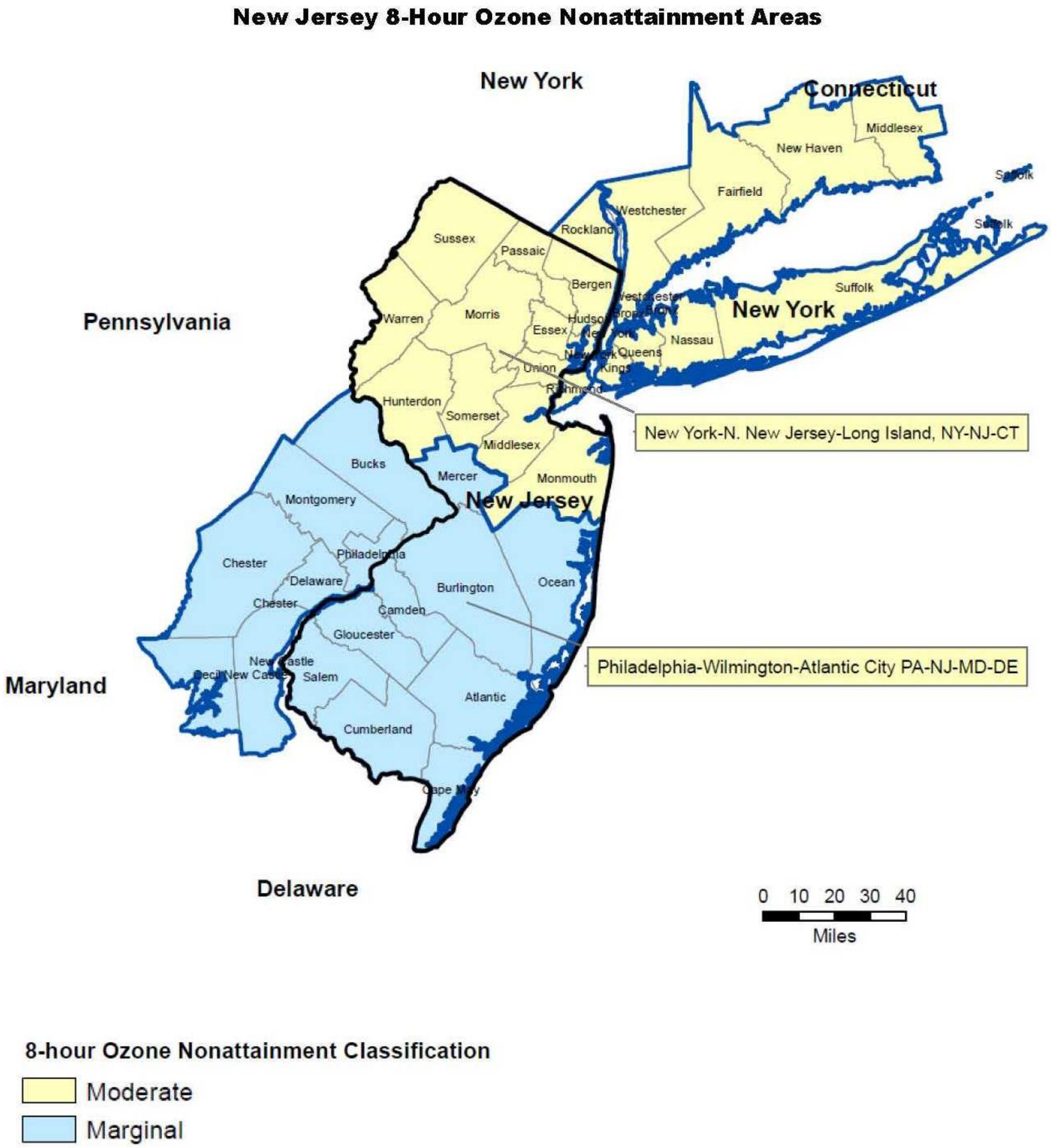


Figure 1. New Jersey Non-Attainment for Ozone (Source: NJDEP, 2017)

nitrogen oxides (NOx) and volatile organic compounds (VOC's) react in the presence of sunlight. NOx is primarily emitted by motor vehicles, power plants, and other sources of combustion. VOC's are emitted from sources such as motor vehicles, chemical plants, factories, consumer and commercial products, and even natural sources such as trees. Ozone and the pollutants that form ozone (precursor pollutants) can also be transported into an area from sources hundreds of miles upwind. The entire state of New Jersey is in non-attainment for ozone and is classified as being either "Moderate" or "Marginal" non-attainment. Within the affected area, marginal classifications have been designated for counties in the Southern New Jersey – Pennsylvania-Delaware-Maryland Area, which include Ocean, Burlington, Atlantic, and Cape May Counties within the NJBB study area. Monmouth County is part of the Northern New Jersey-New York-Connecticut Area that have been reclassified from serious to moderate non-attainment status in 2016 (NJDEP, 2017) (Table 2.).

Table 2. New Jersey Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants

County	NAAQS	Area Name	Non-attainment in Year	Non-Attainment Status	*de minimis* Threshold Trigger Levels (Tons)
Atlantic County	8-Hour Ozone (2008)	Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE	2012-2021	Marginal	NO_x=100 VOC=50
	8-Hour Ozone (2015)		2018-2021	Marginal	NO_x=100 VOC=50
	Carbon Monoxide (1971)	Atlantic City, NJ	1992-1995	Maintenance	CO=100
Burlington County	8-Hour Ozone (2008)	Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE	2012-2021	Marginal	NO_x=100 VOC=50
	8-Hour Ozone (2015)		2018-2021	Marginal	NO_x=100 VOC=50
	Carbon Monoxide (1971)	Burlington, NJ	1992-1995	Maintenance	CO=100
	PM-2.5 (2006)	Philadelphia-Wilmington, PA-NJ-DE	2009-2012	Maintenance	Direct=100 SO2=100

County	NAAQS	Area Name	Non-attainment in Year	Non-Attainment Status	*de minimis* Threshold Trigger Levels (Tons)
					NO_x=100 VOC/NH3 =100
Cape May County	8-Hour Ozone (2008)	Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE	2012-2021	Marginal	NO_x=100 VOC=50
	8-Hour Ozone (2015)		2018-2021	Marginal	NO_x=100 VOC=50
Monmouth County	8-Hour Ozone (2008)	New York-N. New Jersey-Long Island, NY-NJ-CT	2012-2021	Serious	NO_x=50 VOC=50
	8-Hour Ozone (2015)		2018-2021	Moderate	NO_x=100 VOC=50
	Carbon Monoxide (1971)	Freehold, NJ	1992-1995	Maintenance	CO=100
	PM-2.5 (2006)	New York-N. New Jersey-Long Island, NY-NJ-CT	2009-2012	Maintenance	Direct=100 SO2=100 NO_x=100 VOC/NH3 =100
Ocean County	8-Hour Ozone (2008)	Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE	2012-2021	Marginal	NO_x=100 VOC=50
	8-Hour Ozone (2015)	Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE	2018-2021	Marginal	NO_x=100 VOC=50
	Carbon Monoxide (1971)	Toms River, NJ	1992-1995	Maintenance	CO=100

Note: NAAQS that have been revoked are not included in this table.

Source: https://www3.epa.gov/airquality/greenbook/anayo_nj.html

3.1 Greenhouse Gases

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The accumulation of GHGs in the atmosphere can influence the earth's temperature. Predictions of long-term environmental impacts due to global climate change include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems including the potential loss of species, and a significant reduction in winter snow pack. Federal agencies are, on a national scale, addressing emissions of GHGs by reductions mandated in federal laws and EOs, most recently, EO 13423, *Strengthening Federal Environmental Energy, and Transportation Management*. The Council on Environmental Quality (CEQ) has issued final guidance to assist Federal agencies in their consideration of the effects of GHG emissions and climate change when evaluating proposed Federal actions in accordance with the National Environmental Policy Act (NEPA) and the CEQ Regulations Implementing the Procedural Provisions of NEPA (CEQ Regulations) (CEQ, 2016). This guidance recommends that when addressing climate change, agencies should consider: (1) The potential effects of a proposed action on climate change as indicated by assessing GHG emissions (e.g., to include, where applicable, carbon sequestration); and, (2) The effects of climate change on a proposed action and its environmental impacts. The CEQ guidance states: "it is now well established that rising global atmospheric GHG emission concentrations are significantly affecting the Earth's climate." In 1970, the mean level of atmospheric carbon dioxide (CO2) had been measured as increasing to 325 parts per million (ppm) from an average of 280 ppm pre-Industrial levels. Since 1970, the concentration of atmospheric carbon dioxide has increased to approximately 400 ppm (2015 globally averaged value). Since the publication of CEQ's first Annual Report, it has been determined that human activities have caused the carbon dioxide content of the atmosphere of our planet to increase to its highest level in at least 800,000 years (CEQ, 2016).

In the State of New Jersey, the New Jersey Global Warming Response Act of 2007 (GWRA), **N.J.S.A 26:2C-37,** establishes two GHG limits, one for 2020 and another for 2050. The GWRA requires two recommendations reports, one for each limit. The GWRA 2050 target requires New Jersey to reduce GHG emissions by 80 percent from 2006 levels by 2050. This limit is equivalent to 25.4 million metric tons (MMT) CO2 equivalent. The NJDEP has developed four scenarios to identify pathways to meet the GWRA target. In order to approach the 2050 GHG emission limit of 25.4 million metric tons, the following are a must: (a) energy efficiency measures for buildings, industry, and transportation; (b) electrification to avoid combustion wherever it is possible; (c) non-combustion electricity generating technology (e.g., renewables and nuclear); and (d) measures to increase and enhance natural sinks (NJDEP, 2016).

4.0 DESCRIPTION OF THE PREFERRED ALTERNATIVE (PA) (TENTATIVELY SELECTED PLAN-TSP) AND ALTERNATIVES OVERVIEW

4.1 No Action Alternative

The forecast of the future without-project (FWOP) condition reflects the conditions expected during the period of analysis. The future without-project condition provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the without-project condition are essential. Gathering information about historic and existing conditions requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities. Information gathering and forecasts will most likely continue throughout the planning process. The most likely future without project condition is considered to be if no NJBB action is taken, and is characterized by CSRM projects and features, and socio-economic, environmental, and cultural conditions. This condition is considered as the baseline from which future measures will be evaluated with regard to reducing coastal storm risk and promoting resilience. The Future-Without Project Condition serves as the baseline for evaluating the anticipated performance of alternatives. It documents the need for Federal action to address the water resources problem.

A base year of 2030 has been identified as the year when USACE projects associated with the

NJBB CSRM Feasibility Study will be implemented or constructed. Several trends have been identified for the NJBB Region which are projected to continue into the future and will likely affect the future without-project condition for this study. It is anticipated that the study area will continue to experience damages from coastal storms, and that the damages may increase as a result of more intense storm events. These coastal storm events will likely continue to effect areas of low coastal elevations within the study area with pronounced localized effects in some areas.

In the future without project condition, it is anticipated that sea level is increasing throughout the study area that shorelines are changing in response to sea level change, and historic erosion patterns will continue and accelerate. It is anticipated that there will continue to be significant economic assets within the NJBB region, and that population and development will continue to increase. Based on a desktop inventory of structures compiled for the HEC-FDA model, the New Jersey Back Bays study area experiences a total of $1,571,616,000 in FWOP Average Annual Damages (AAD) over a 50-year period of analysis based on the intermediate rate of relative sea level change (RSLC).

The FWOP condition no-action alternative would see no additional federal involvement in storm damage reduction as outlined within this study. Current projects and programs that the USACE conducts in conjunction with other Federal and non-Federal entities would continue and would be constructed by 2030.

The FWOP condition does consider those projects that have been completed (existing), are under construction, or have been authorized for construction and are anticipated to be constructed by 2030. Any proposed projects, which are not yet authorized for construction, are not considered part of the FWOP conditions for analysis.

4.2 Action Area

The action area is defined as all areas that may be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. It encompasses the geographic extent of environmental changes (i.e., the physical, chemical and biotic effects) that will result directly and indirectly from the action and is a subset of the NJBB Study Area.

For the NJBB Study, the action area is all areas directly and indirect affected by the tentatively selected plan (TSP), presented **Error! Reference source not found.**. The TSP includes the following project components:

- Three inlet closures or storm surge barriers (SSB)
    - Manasquan Inlet
    - Barnegat Inlet
    - Great Egg Harbor Inlet
- Two bay closures
    - Absecon Blvd
    - South Ocean City
- Non-structural measures
    - 18,800 structures eligible for elevation and floodproofing

Additionally, the action area considers the effects of the following options, which have not yet been eliminated.

- Non-structural measures only (elevation and floodproofing for 23,152 structures) in the North Region (Alternative 3A; see Figure 3).
- Non-structural measures only alternative (elevation and floodproofing for 10,895 structures) in the Central Region (Alternative 4A; see Figure 4).
- Non-structural measures for (elevation and floodproofing for 1,189 structures) and perimeter plan alternative in the Central Region (Alternative 4D1; see Figure 4).
- Non-structural measures for (elevation and floodproofing for 2,340 structures) and perimeter plan alternative in the Central Region (Alternative 4D2; see Figure 4).
- Non-structural (656 structures) and perimeter plan alternative in the South Region (Alternative 5D2; see Figure 5).

Note that non-structural measures consist of elevating or floodproofing already existing structures in previously developed areas. Therefore, the action area would primarily be defined by the direct and indirect effects of the storm surge barriers, bay closures, and perimeter plans assessed in this BA. Figure 2 and Table 3 lists the actions and locations.

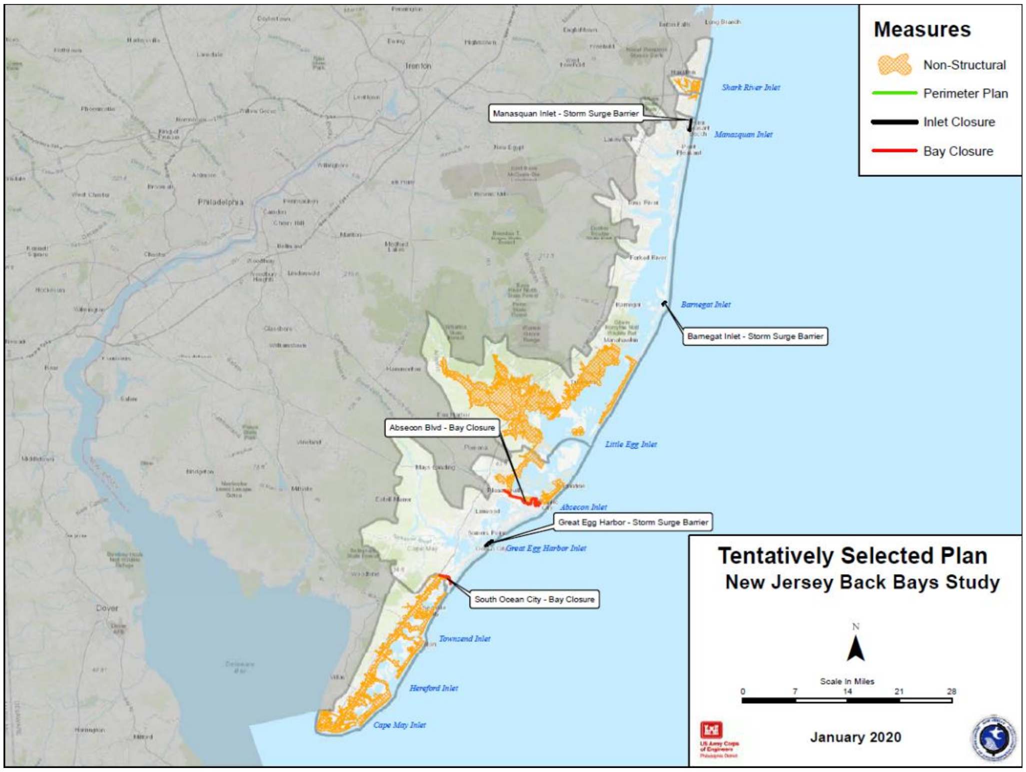


Figure 2. The TSP for the NJBB Study.

Table 3. Tentatively Selected Plan (TSP) and Other Measures

REGION	**ALT**	**NONSTRUCTURAL** Building Raising for structures with first floor w/in 20-yr floodplain	**PERIMETER** Floodwalls, Levees and Miter Gates	**STORM SURGE BARRIER** Inlet Navigable Sector Gates, Auxiliary Lift Gates, Impermeable Barriers, Levees	**BAY CLOSURE** Navigable Sector Gates, Auxiliary Lift Gates, Miter Gates, Sluice Gates, Impermeable Barriers, Levees	**Natural and Nature-Based Features (NNBF)** **Note: The measures presented here are proof of concept measures (see Appendix xx) that have not been modeled for CSRM flood reduction and economic benefits. Further evaluation of these conceptual measures will be conducted in subsequent planning phases.**
SHARK RIVER	**2A* ▲**	**Portions of Belmar, Bradley Beach, Neptune City & Shark River Hills**				• Island Expansion in Shark River • Coastal Lakes Terracing for habitat and to increase flood storage capacity
NORTH **(Manasquan Inlet to Brigantine Inlet)**	**3A†**	Point Pleasant, all communities on LBI, western shore of Barnegat Bay, Mystic Island, and along lower Mullica River Basin				• Horizontal (ecotone) Levee at **Tuckerton Peninsula** along Great Bay Boulevard • Living Breakwaters on southwest side of **Tuckerton Peninsula** • Marsh Augmentation along **Tuckerton Peninsula** • Marsh Island Augmentation and Marsh Island Creation Along **Tuckerton Peninsula** • Beach Haven Surge Filter – island and wetland creation/expansion northeast of **Tuckerton Peninsula** and Great Bay Blvd. • **Barnegat Bay** – reforestation of maritime forests and shrublands in upland locations, • **Barnegat Bay** augmenting existing marshes by mosquito ditch filling and thin-layer placement • **Barnegat Bay** – mudflat expansion • **Barnegat Bay** - SAV bed expansion through “shallowing” and the filling-in of dredge holes.
	3E(2)* ▲	**All communities on southern LBI (Cedar Bonnet Island and south), western shore of Barnegat Bay at Beach Haven West and south, Mystic Island, and along lower Mullica River Basin**		**1. Manasquan Inlet** **2. Barnegat Inlet**		

REGION	ALT	NONSTRUCTURAL	PERIMETER	STORM SURGE BARRIER	BAY CLOSURE	Natural and Nature-Based Features (NNBF)
		Building Raising for structures with first floor w/in 20-yr floodplain	Floodwalls, Levees and Miter Gates	Inlet Navigable Sector Gates, Auxiliary Lift Gates, Impermeable Barriers, Levees	Navigable Sector Gates, Auxiliary Lift Gates, Miter Gates, Sluice Gates, Impermeable Barriers, Levees	**Note: The measures presented here are proof of concept measures (see Appendix xx) that have not been modeled for CSRM flood reduction and economic benefits. Further evaluation of these conceptual measures will be conducted in subsequent planning phases.**
CENTRAL **(Brigantine Inlet to Corson Inlet)**	4A[†]	Brigantine, Absecon, Pleasantville, West A.C., A.C., Ventnor, Margate, Longport, Northfield, Linwood, Estell Manor, Mays Landing, Somers Point, Marmora, Ocean City, Palermo				• Horizontal or ecotone levee(s) • Island Creation/Expansion – Great Bay • Dune Enhancements • Wetland Creation or Restoration Great Bay, Reeds Bay, Absecon Bay, Lakes Bay,Scull Bay, Great Egg Harbor
	4D(1)[▲]	Brigantine, Absecon, Pleasantville, West A.C., Northfield, Linwood, Estell Manor, Mays Landing, Somers Point, Marmora, Palermo	Along South Absecon Inlet and western side of A.C., Ventnor City, Margate City, Longport, & all Ocean City			
	4D(2)[†]	Absecon, Pleasantville, West A.C., Northfield, Linwood, Estell Manor, Mays Landing, Somers Point, Marmora, Palermo	Along Absecon Inlet and western side of Brigantine, A.C., Ventnor, Margate, Longport, & Ocean City			

REGION	ALT	NONSTRUCTURAL Building Raising for structures with first floor w/in 20-yr floodplain	PERIMETER Floodwalls, Levees and Miter Gates	STORM SURGE BARRIER Inlet Navigable Sector Gates, Auxiliary Lift Gates, Impermeable Barriers, Levees	BAY CLOSURE Navigable Sector Gates, Auxiliary Lift Gates, Miter Gates, Sluice Gates, Impermeable Barriers, Levees	Natural and Nature-Based Features (NNBF) **Note: The measures presented here are proof of concept measures (see Appendix xx) that have not been modeled for CSRM flood reduction and economic benefits. Further evaluation of these conceptual measures will be conducted in subsequent planning phases.**
	4G(8)*	**Brigantine, Absecon, Pleasantville, West A.C.,**		**1. Great Egg Harbor Inlet**	**1. Absecon Blvd.** **2. Southern Ocean City (52nd St.)**	
SOUTH **(Corson Inlet to Cape May Inlet)**	**5A*▲**	**All Atlantic Coast and bayside communities from Ludlam Island (Upper Twp.) south to Cape May and W. Cape May**				• No defined NNBF strategies identified at this time
	5D(2)ꜝ	All bayside communities from Ludlam Island (Upper Twp.) south to Cape May and W. Cape May; Strathmere and N. Cape May Inlet along Atlantic Coast.	Western side of Sea Isle City, Seven Mile Island, all Wildwoods, and southern shore along Cape May Harbor in Cape May, and West Cape May			

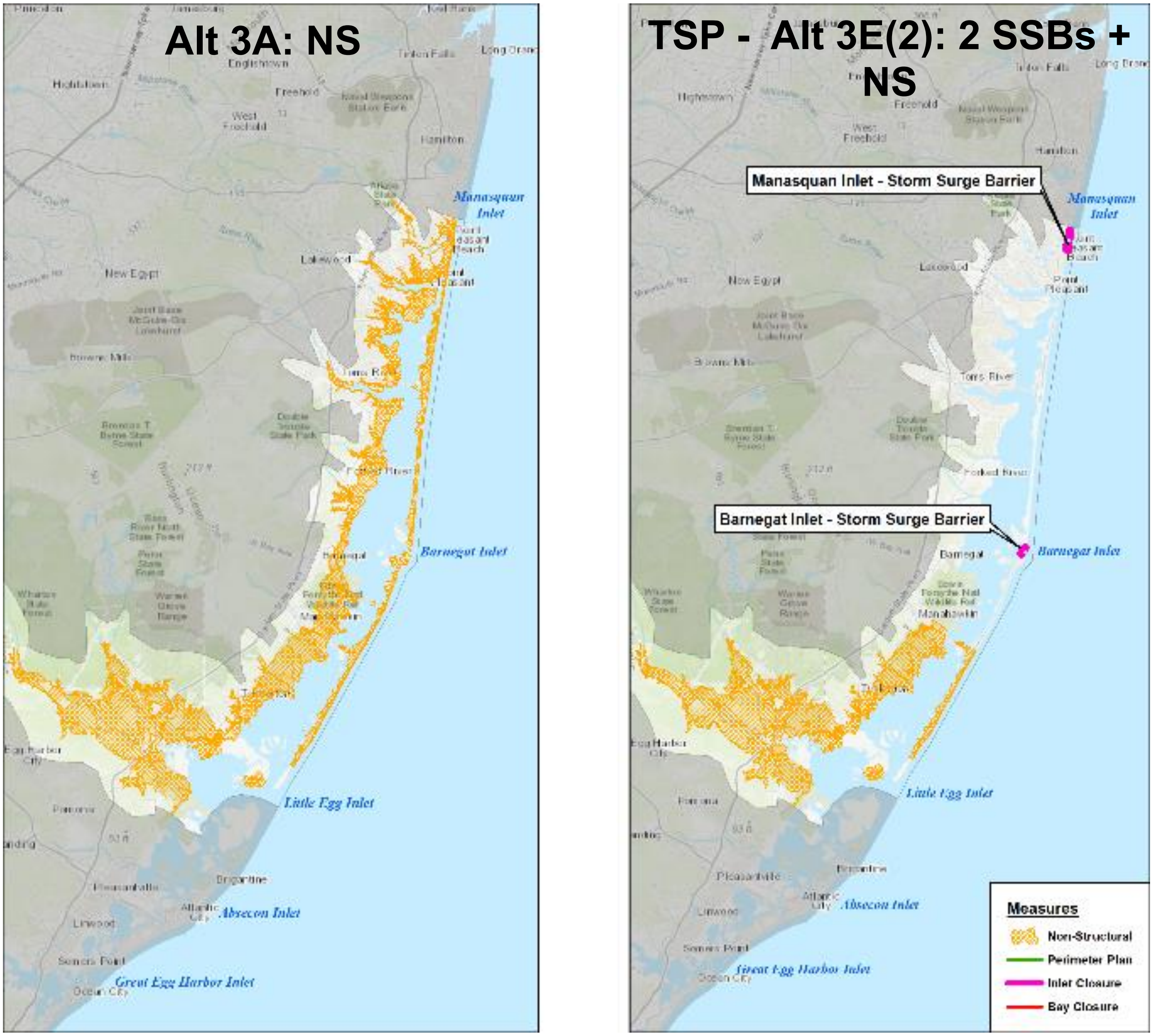
REGION	ALT	NONSTRUCTURAL Building Raising for structures with first floor w/in 20-yr floodplain	PERIMETER Floodwalls, Levees and Miter Gates	STORM SURGE BARRIER Inlet Navigable Sector Gates, Auxiliary Lift Gates, Impermeable Barriers, Levees	BAY CLOSURE Navigable Sector Gates, Auxiliary Lift Gates, Miter Gates, Sluice Gates, Impermeable Barriers, Levees	Natural and Nature-Based Features (NNBF) **Note: The measures presented here are proof of concept measures (see Appendix xx) that have not been modeled for CSRM flood reduction and economic benefits. Further evaluation of these conceptual measures will be conducted in subsequent planning phases.**

*Tentatively Selected Plan (TSP)

▲ Apparent National Economic (NED) Plan

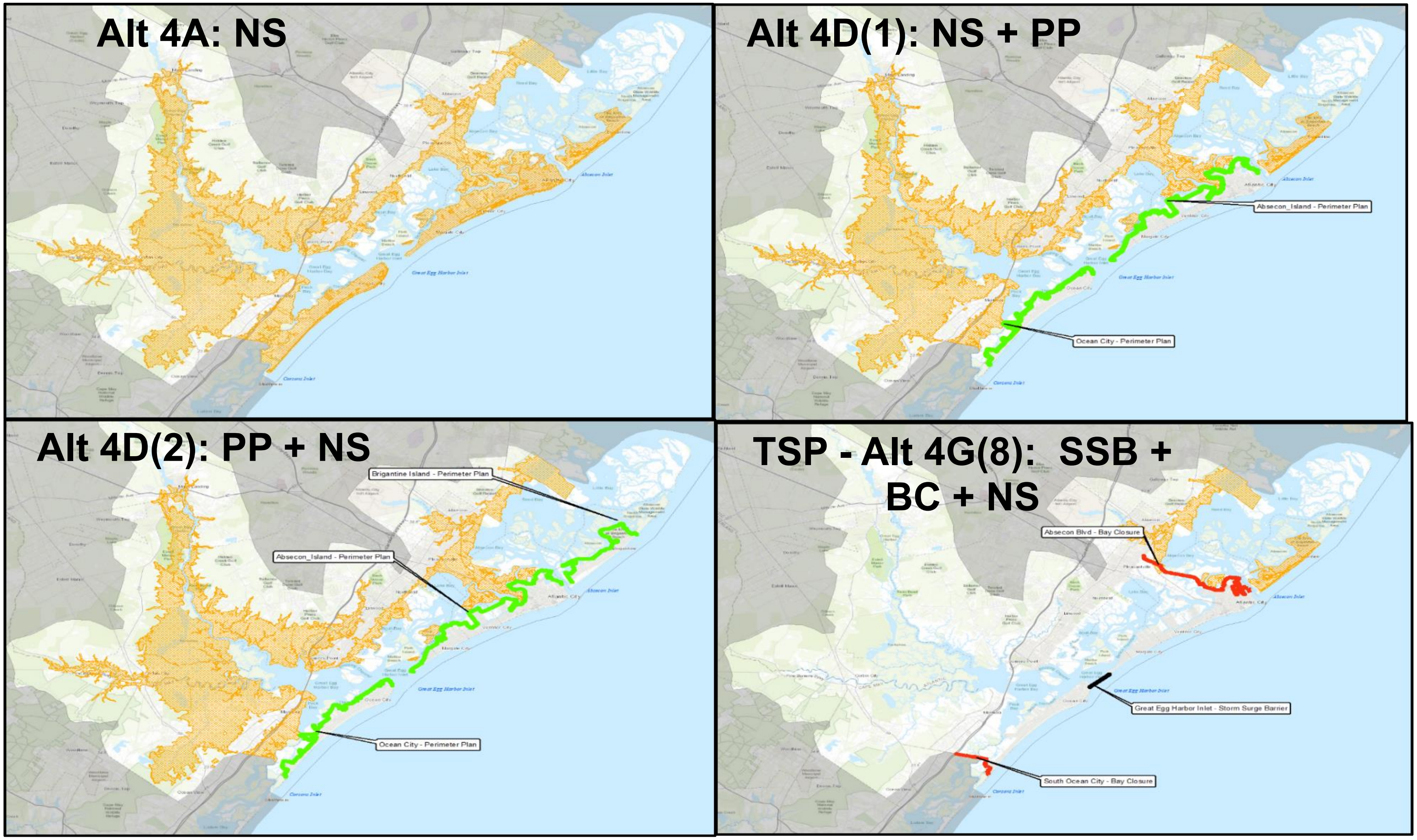
ᵻFurther Economic Analysis Warranted – Alternative or components of the alternative could be included later upon further evaluation

Strikethrough = Alternative eliminated from consideration subsequent to Interim Report



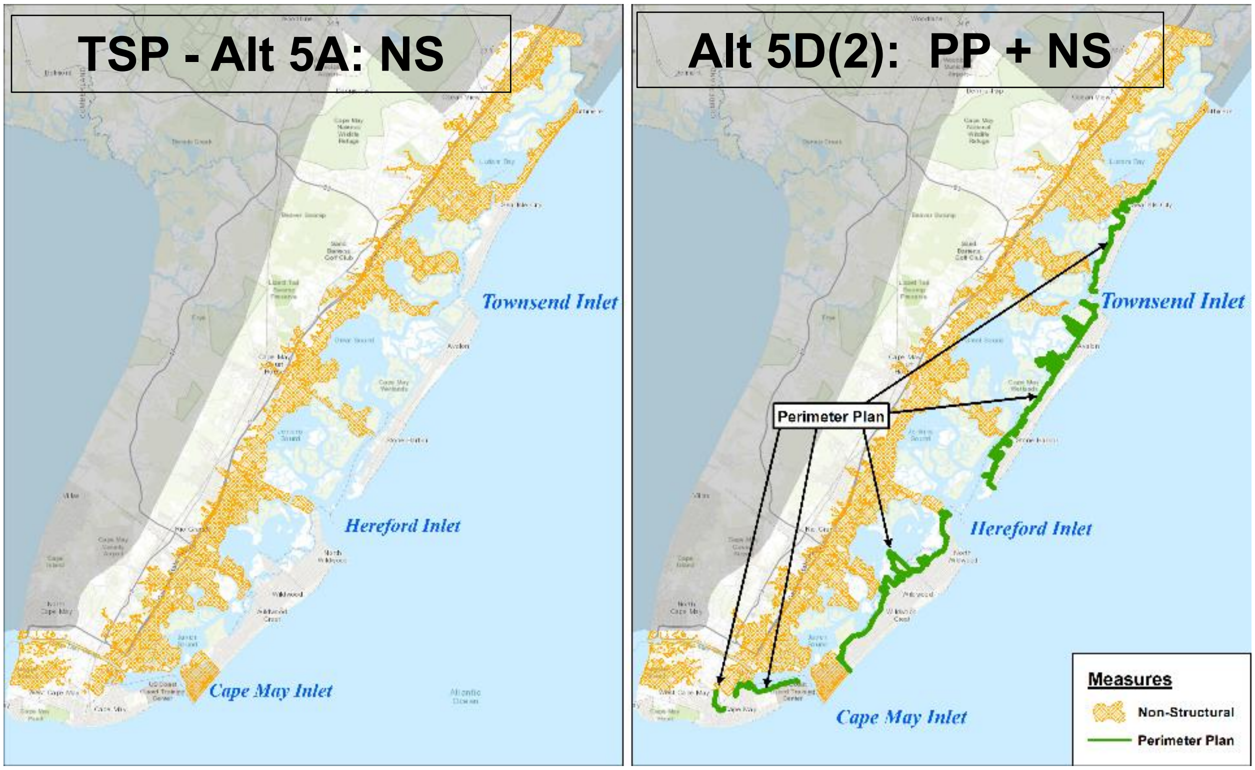
Notes: TSP = Tentatively Selected Plan; Alt = Alternative, NS = Nonstructural; SSB = Storm Surge Barrier

Figure 3. Comparison of the Non-Structural Alternative and the TSP in the North Region.



Notes: TSP = Tentatively Selected Plan; Alt = Alternative, NS = Nonstructural; SSB = Storm Surge Barrier, PP = Perimeter Plan, BC= Bay Closure (Cross Bay Barrier)

Figure 4. Comparison of the Non-Structural and Perimeter Plan Alternatives and the TSP in the Central Region.



Notes: TSP = Tentatively Selected Plan; Alt = Alternative, NS = Nonstructural; PP = Perimeter Plan

Figure 5. Comparison of the TSP and the Perimeter Plan and Nonstructural Alternative in the South Region

5.0 PROJECT DESCRIPTION

5.1 Storm Surge Barriers and Bay Closures

Three storm surge barriers at inlets (Manasquan Inlet, Barnegat Inlet, Great Egg Harbor Inlet) and two interior bay closure barriers across the bay (Absecon Blvd and Southern Ocean City) are included in the TSP. The selected storm surge barriers reduce storm surge from propagating into the bays from the ocean during storm events lowering flood elevations. The storm surge barriers across the bay (Bay Closures) reduce storm surge from propagating into Central Region from adjacent inlets (Absecon Inlet, Little Egg Inlet, and Corson's Inlet) that would remain open and unaltered in the TSP. Storm surge barriers span the inlet opening with a combination of static impermeable barriers and dynamic gates that are only closed during storm events. Each storm surge barrier includes a navigable gate (sector gate) to provide a navigable opening with unlimited vertical clearance and a series of auxiliary flow gates, vertical lift gates, to maintain tidal flow during non-storm conditions. An example of storm surge barrier at the Seabrook Flood Complex in New Orleans, LA which is constructed with a sector gate and vertical lift gates is shown in **Error! Reference source not found.**. Detailed engineering drawings, layouts and cross-sections, for the storm surge barriers are included in Appendix B. Storm surge barrier gate types and alignments are considered tentative and may change in future phases of the study with more detailed engineer analyses and designs.

Navigable sector gates span the full width of the federal navigation channel with a 10-foot buffer on either side with opening spans ranging from 120 feet at the Bay Closures to 340 feet at Manasquan Inlet. Auxiliary flow gates have an opening span of 150 feet and are located along the storm surge barrier in water depths that are deemed constructible and practical. In shallow water, where vertical lift gates are impractical, shallow water gates (SWG) consisting of 24-foot x 8-foot box culverts with sluice gates are used. Bottom sill elevations for the navigable and auxiliary flow gates are designed at or near the existing bed elevations to promote tidal flow and are well below the federally authorized depths at the federal navigation channels.

Impermeable barriers are open water structures that flank the navigable and auxiliary flow gates to tie the barrier into high ground or existing CSRM features (i.e. dunes or seawalls). Site specific impermeable barrier types have not been selected at this stage of the study but will be further investigated as the study continues. Several of the storm surge barriers, particularly the bay closures, include levees, floodwalls, and seawalls along roads, shorelines, and low-lying areas to tie into high ground or existing CSRM features (i.e. dunes or seawalls). The crest elevation of the storm surge barriers is between 17 and 20 feet NAVD88. A summary of the storm surge barrier components is provided in Table 4.

Table 4. TSP – Storm Surge Barrier Components

Storm Surge Barrier	Navigable Gate	Auxiliary Flow Gates	Impermeable Barrier	Perimeter Barrier
Manasquan Inlet Inlet Closure	1 Sector Gate Length = 340 FT Crest Elev = 20 FT Sill Elev = -18.25 FT	None	None	Levee = 7,280 FT Seawall = 2,366 FT
Barnegat Inlet	1 Sector Gate	15 Vertical Lift Gates	Length = 798 FT	Floodwall = 897 FT
Inlet Closure	Length = 320 FT	Length = 150 FT each	Area = 18,365 SF	Seawall = 795 FT
	Crest Elev = 17 FT	Crest Elev = 17 FT		1 Road Closure Gate
	Sill Elev = -25 FT	Sill Elev = -5 to -11 FT		
		18 Shallow Water Gates		
		Length = 24 FT each		
		Crest Elev = 17 FT		
		Sill Elev = -4 FT		
Great Egg Inlet Inlet Closure	1 Sector Gate Length = 320 FT Crest Elev = 19 FT Sill Elev = -35 FT	19 Vertical Lift Gates Length = 150 FT each Crest Elev = 19 FT Sill Elev = -5 to -18 FT	Length = 863 FT Area = 20,716 SF	Levee = 974 FT Seawall = 1,275 FT
Absecon Blvd.	1 Sector Gate	4 Shallow Water Gates	Length = 869 FT	Levee = 27,524 FT
Bay Closure	Length = 120 FT	Length = 24 FT each	Area = 14,772 SF	Floodwall = 28,890 FT
	Crest Elev = 13 FT	Crest Elev = 13 FT		4 Road Closure Gates
	Sill Elev = -20 FT	Sill Elev = -2 FT		5 Mitre Gates
Southern Ocean City Bay Closure	1 Sector Gate Length = 120 FT Crest Elev = 13 FT Sill Elev = -10 FT	None	None	Levee = 9,467 FT Floodwall = 4,124 FT 1 Mitre Gate 1 Sluice Gate

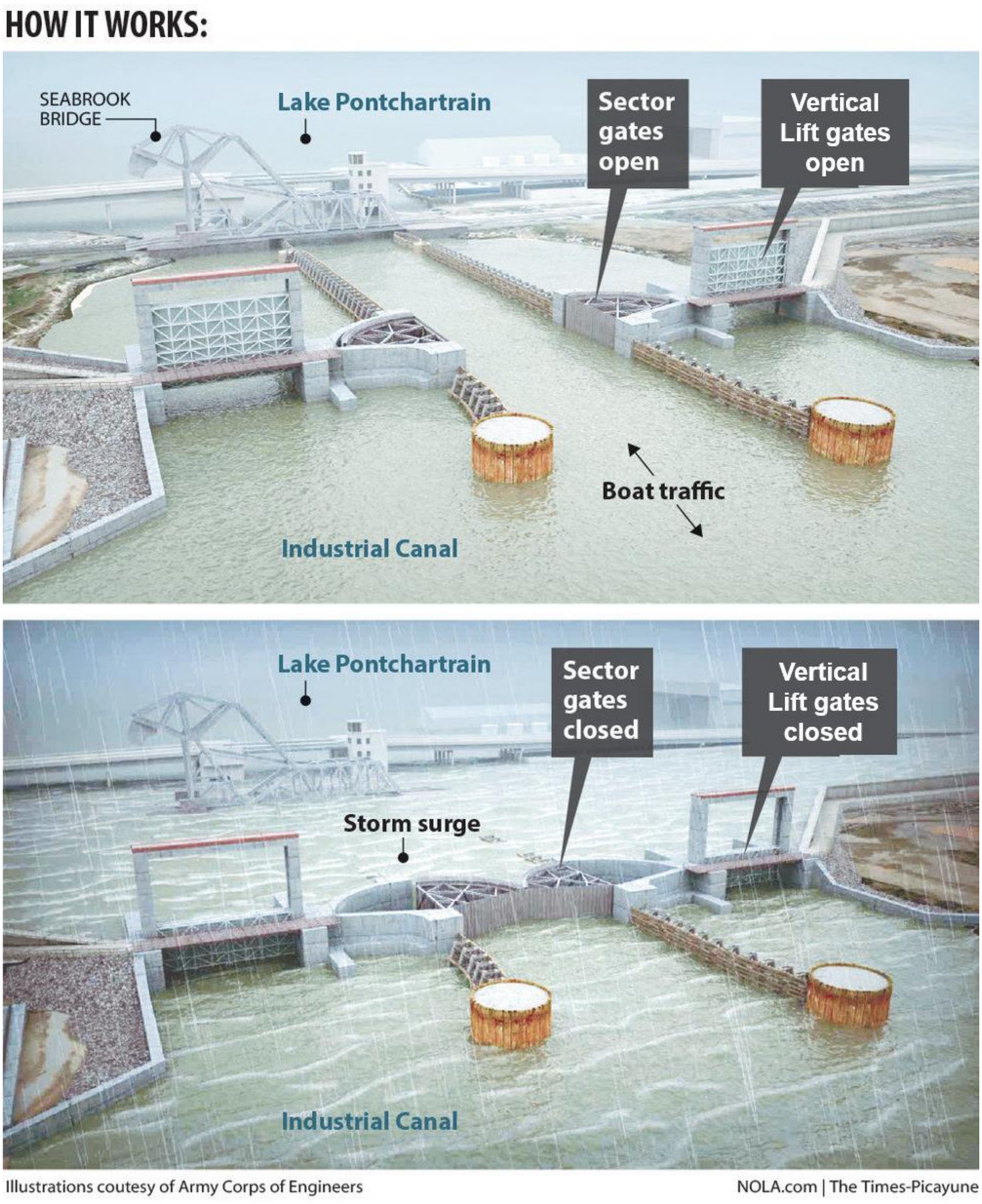


Figure 6. Example Storm Surge Barrier at Seabrook Flood Complex in New Orleans,

5.1.1 Pre-construction

Prior to construction investigations may include, wetland delineation, a subsurface geotechnical investigation, and HTRW sampling. These investigations are being developed.

5.1.2 Construction

In-water construction activities for the construction of storm surge barriers and bay closures include installation and removal of temporary cofferdams, temporary excavations, fill and rock placement, concrete work, and pile driving. On land construction activities include clearing, grading, excavations, backfilling, movement of construction equipment, concrete work, pile driving, and soil stockpiles.

5.1.3 Operation and Maintenance

The purpose of Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) is to sustain the constructed project. The most significant OMRR&R is associated with the Storm Surge Barriers. At this point of the study, it is estimated that storm surge barriers and bay closures would be closed for a 5-yr and higher storm surge event, with an average of one closure operation every five years. In the next phase of the study the storm surge barrier operations plan, and closure criteria will be revaluated. OMRR&R for storm surge barriers typically include monthly startup of backup generators/systems, annual closure of surge barrier gates pre-hurricane season, dive inspections, gate adjustments/greasing, gate rehab and gate replacement.

5.2 Nonstructural Measures

The TSP includes Nonstructural solutions, elevating structures and floodproofing, in areas where the storm surge barriers will not significantly reduce flood elevations. These areas are concentrated in the Shark River region Ocean and Atlantic Counties (between Route 72 and Absecon Blvd.) and Cape May County. A total of 18,800 structures located within the 5% AEP floodplain (20-year return period) in these areas are targeted for nonstructural solutions under the TSP; this includes 135 structures in the Shark River Region; 8,869 structures in the North Region; 1,255 structures in the Central Region; and 8,579 structures in the South region.

In addition, to the TSP, two completely nonstructural options are still under consideration.

- Non-structural measures only (elevation and floodproofing for 23,152 structures) in the North Region (Alternative 3A; see Figure 2).
- Non-structural measures only alternative (elevation and floodproofing for 10,895 structures) in the Central Region (Alternative 4A; see Figure 3).

Additionally, the number of structures under consideration for nonstructural measure changes with the perimeter plan options considered.

5.2.1 Pre-construction

Prior to construction detailed investigation of the eligibility of individual structures for non-structural measures would be conducted.

5.2.2 Construction

Nonstructural measures involve a significant construction effort whether it be from building retrofits such as elevation (including raising a structure on fill or foundation elements such as solid perimeter walls, pier, posts, columns, or pilings) or buyout/ relocations that are likely to involve demolition, grading, and soil stabilization/revegetation. The majority of the construction would occur within the footprint of the existing structure and would most likely be in upland urbanized settings.

5.2.3 Operations and Maintenance

There is no operations and maintenance associated with non-structural solutions.

5.3 Perimeter Plans

The perimeter plan options that are still being considered in the Central and South regions include floodwalls and levees that would be constructed on the western side of the barrier islands along residential bayfronts and would tie into existing dunes at the northern and southern ends of the barrier islands. Figure 7,

Figure 8, and Figure 9 show typical sections which have been used in the perimeter plan design to date.

Options. The following are the perimeter plan options still under consideration. The number of structures under consideration for nonstructural measures is noted for each perimeter plan option.

- Non-structural measures for (elevation and floodproofing for 1,189 structures) and perimeter plan alternative in the Central Region (Alternative 4D1; see Figure 3).
- Non-structural measures for (elevation and floodproofing for 2,340 structures) and perimeter plan alternative in the Central Region (Alternative 4D2; see Figure 3).
- Non-structural (656 structures) and perimeter plan alternative in the South Region (Alternative 5D2; see Figure 4).

The location, length, and construction duration for the perimeter plans for these options are presented in Table 5.

Table 5. Location, Length, and Construction Duration for Perimeter Plan Options

ALTERNATIVE	**LOCATION**	**BARRIER**	**CONSTRUCTION**
		LENGTH (LF)	**DURATION (MONTHS)**
4D1	Ocean City	78,732	89
	Absecon Is.	111,111	126
4D2	Ocean City	78,732	89
	Absecon Is.	111,111	126
	Brigantine	48,699	55
5D2	Cape May City	15,825	18
	Wildwood Is.	54,171	62
	West Wildwood	11,726	13
	Sea Isle City	35,167	40
	West Cape May	4,480	5

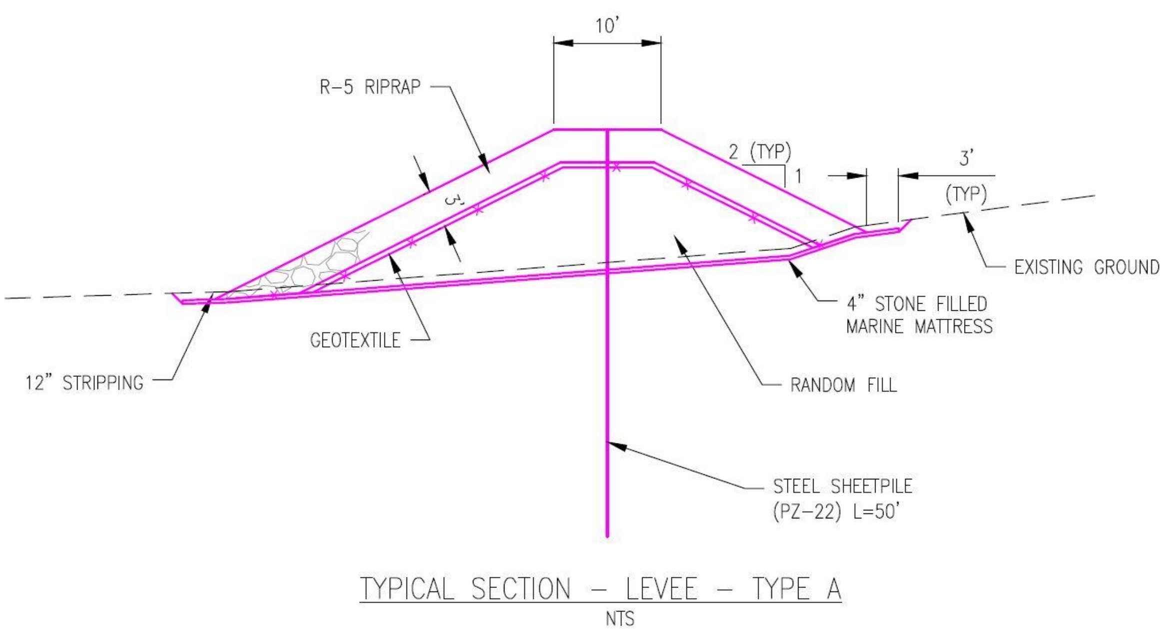


Figure 7. Typical Section – Levee – Type A

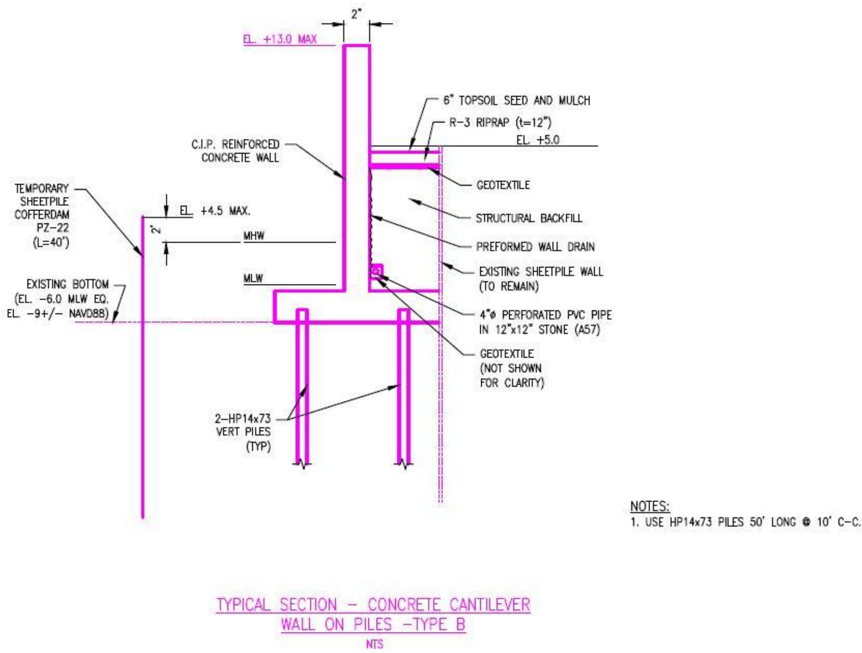


Figure 8. Typical Section – Concrete Cantilever Wall on Piles – Type B

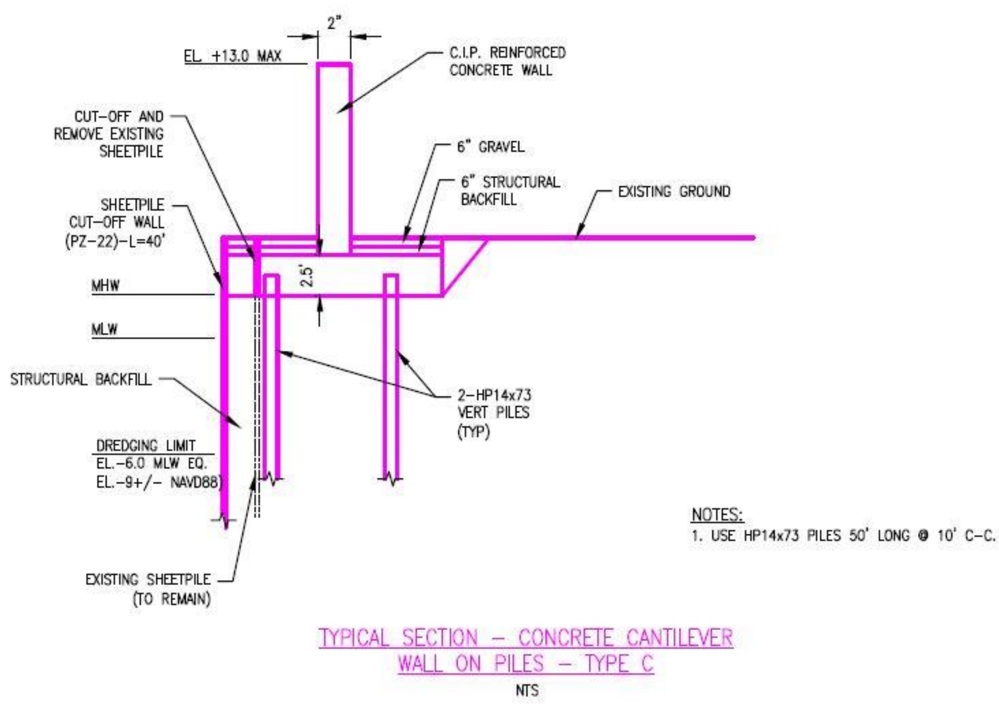


Figure 9. Typical Section – Concrete Cantilever Wall – Type C

5.3.1 Pre-construction

Prior to construction investigations may include, wetland delineation, a subsurface geotechnical investigation, and HTRW sampling. These investigations are being developed.

5.3.2 Construction

In-water construction activities for the construction of levee and floodwalls include installation and removal of temporary cofferdams, temporary excavations, fill and rock placement, concrete work, and pile driving. On land construction activities include clearing, grading, excavations, backfilling, movement of construction equipment, concrete work, pile driving, and soil stockpiles.

5.3.3 Operation and Maintenance

As part of the perimeter plan, miter gates will be installed and operated across smaller channels that require navigable access. These gates would remain open during normal conditions and would be closed during significant storm events. Regular maintenance is performed on the gates to keep the system running as designed.

5.4 Natural and Nature Based Features (NNBF)

An initial suite of NNBF opportunities for integration into the TSP are identified in this section for each of the NJBB Regions. NNBF opportunities are demonstrated in maps outlining location specific concepts. The features shown on the map are drawn to locate the general area an NNBF might be considered and are not representative of a specific design. Because these features are highly conceptual at this time, they would require subsequent rigorous site identification and planning, construction methods, impact assessments, and implementation schedules/plans. Because these features would require significant amounts of fill material, consideration would first be given to beneficial use of dredging sources and potential sources within existing dredged material confined disposal facilities (CDFs). These considerations will continue throughout the Feasibility Study Phase and into the Engineering and Design Phase as part of the Tier 2 EIS. A complete discussion of the entire range of NNBF strategies considered can be found in the Natural and Nature-Based Features Appendix G inclusive of key design concepts which are documented in Parts II and III of that Appendix.

5.4.1 Shark River and Coastal Lakes Region

Within the Coastal Lakes Region, due to the highly variable conditions of the various lakes, very few generalizable NNBF responses are possible within this region (Figure xx). The reduction of flood risk is something that must be considered on a lake-by-lake basis. However, the opportunity of terracing or lining lakes with vegetation that could serve as stormwater filters, habitat, and increased recreational amenities is one overall strategy that may be applicable. Other possibilities include the creation of islands within the river itself in order to reduce storm effects to the surrounding coastlines.

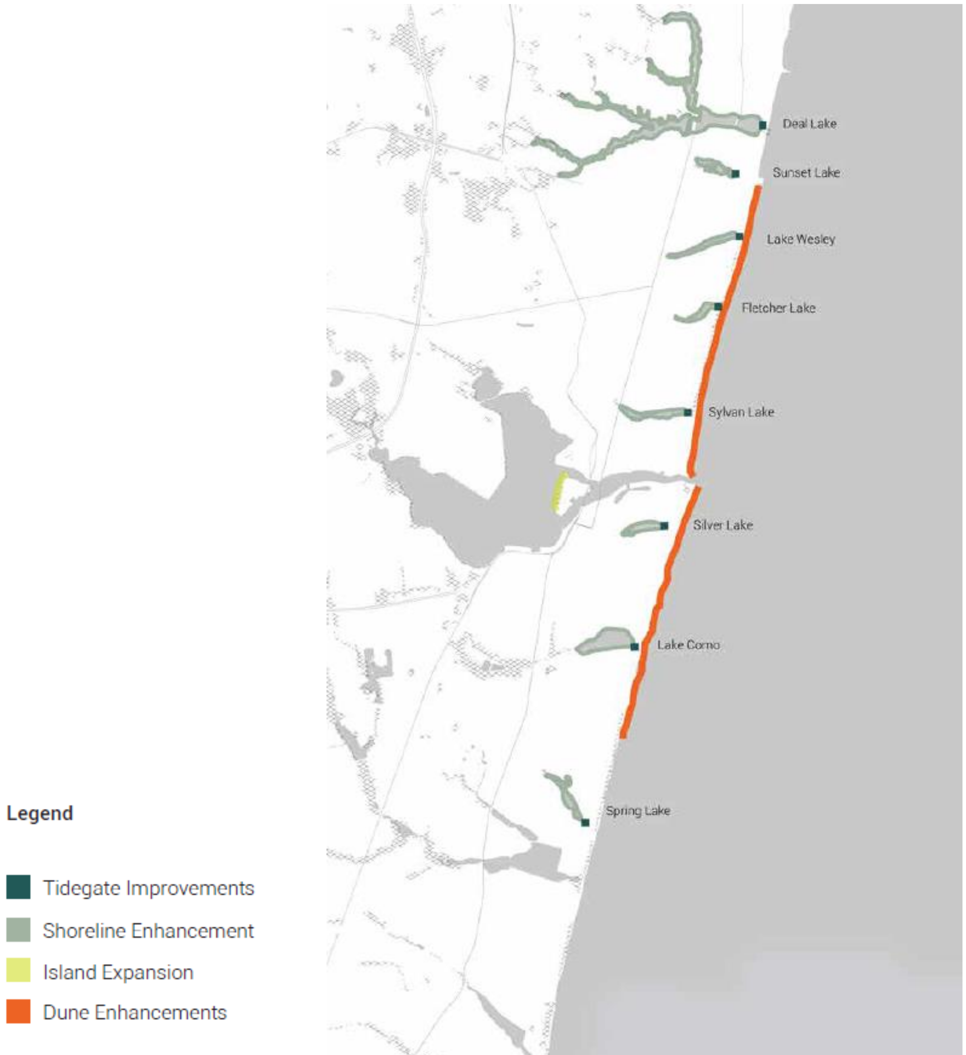


Figure 10. NNBFs within the Shark River/Coastal Lakes Region

5.4.2 North Region

As the largest region of the study, and a collection of somewhat similar conditions throughout the region, the North Region provides the opportunity to study a series of strategies that could be repeatedly deployed at large scale, calibrated to specific conditions. For this report, Barnegat Bay is used as an example for this approach, demonstrating the range of NNBF strategies that could be used at a bay-wide scale to address some of the more ubiquitous conditions there (Figure 101). Since the Holgate cross-bay barrier and the Little Egg-Brigantine Storm Surge Barrier are not included in the TSP, importance is placed on the performance of the Tuckerton Peninsula/Great Bay Boulevard wetland complex and the system of sedge islands to the northeast of the peninsula. Two possible NNBFs are included in this area, including possibilities for the Tuckerton Peninsula and the modifications of the sedge islands to enhance their performance as a surge filter.

Figure 11. NNBFs within the North Region

5.4.3 Central Region

One of the significant challenges of the Central Region is the flooding of urban areas from the bay during periods of high water. In addition to the aforementioned SSB and bay closures, there is likely to be some consideration of flood wall or levee construction to protect urban populations on the barrier islands (Figure 102). Horizontal levee opportunities exist in Ocean City. Many previously wetland creation and bayfloor shallowing opportunities exist in this region particularly in and around Reed's Bay given inclusion of the Absecon cross-bay barrier in the TSP.

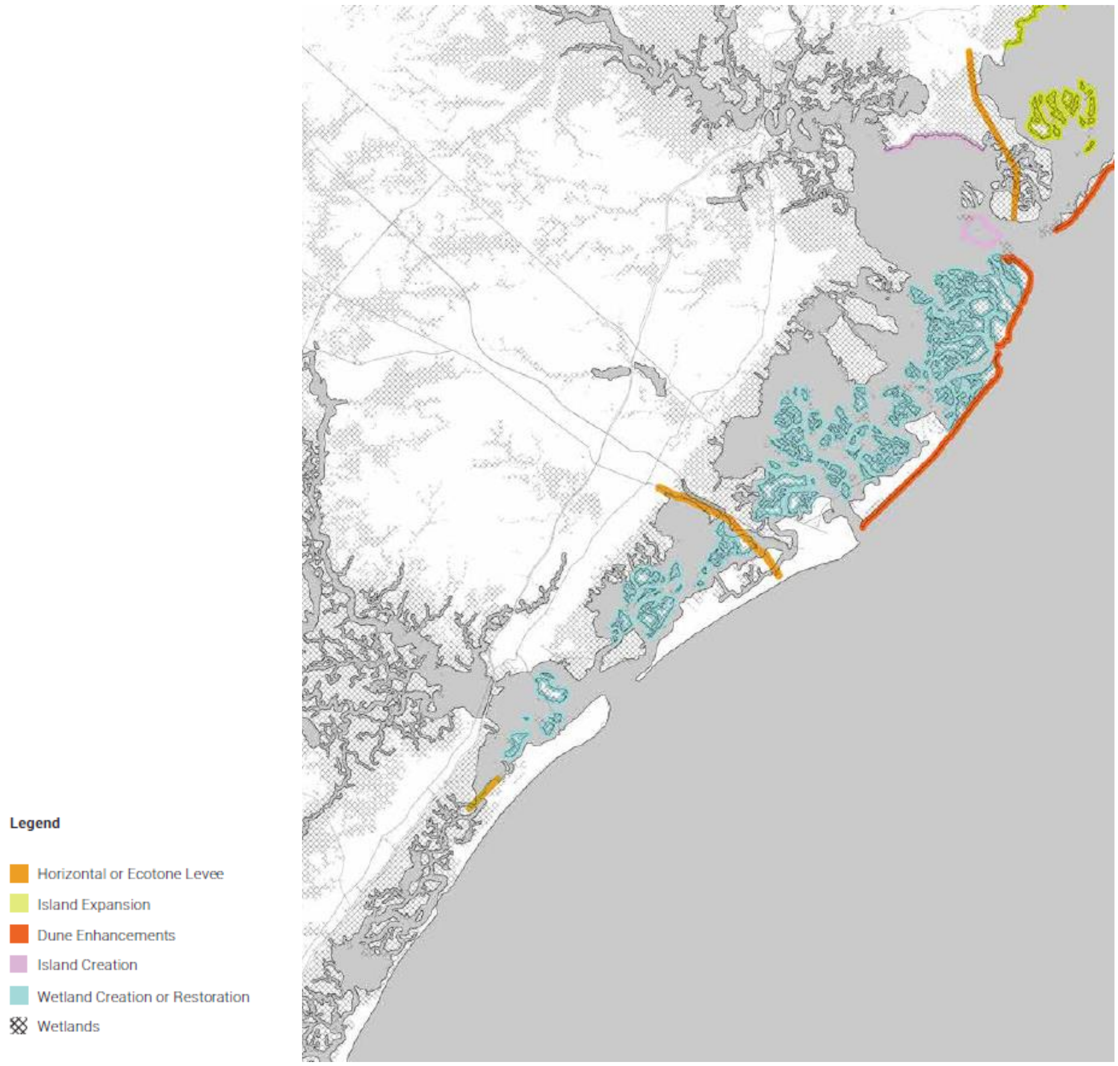


Figure 12. NNBFs within the Central Region

5.4.4 South Region

Due to the infeasibility of structural CSRM measures in the TSP in the South Region, this region will likely require significant investments to enhance wetlands to complement nonstructural strategies in order to provide enhanced storm protection (Figure 103). NNBFs similar to those described for Ocean City above or the wetland enhancement projects described elsewhere in this section may be applicable to the South Region. Dune enhancement and beach nourishment is also possible in this region as a method of protecting barrier island communities. An additional opportunity is the Seven Mile Island Innovation Lab which is a collaborative project between the USACE, the Wetlands Institute, and the State of New Jersey. It is developing innovative methods of sediment management that have significant potential to contribute to CSRM.

Figure 13. NNBFs within the South Region

5.4.5 Pre-construction

Prior to construction investigations may include, wetland delineation, a subsurface geotechnical investigation, and HTRW sampling. These investigations are being developed.

5.4.6 Construction

In-water construction activities for the construction of NNBF include installation and removal of temporary cofferdams, temporary excavations, dredging and filling and rock placement, and wetland/upland vegetation planting. On land construction activities include clearing, grading, excavations, backfilling, movement of construction equipment, and temporary roads.

5.4.7 Operation and Maintenance

NNBFs are expected to be self-sustaining with low maintenance, but still may require periodic maintenance activities such as infusions of sediments from beneficial use of dredged material navigation projects or other methods to maintain elevations of subtidal and intertidal features. Maintenance may become necessary after significant storm events, general erosion or adaptation to Sea Level Rise. Post-construction monitoring and adaptive management would identify specific maintenance issues and repair, or rehabilitation needs, and the scale and duration of construction activities required. Therefore, environmental effects and compliance would be required on a case-by-case basis at the time of need.

6.0 AIR QUALITY IMPACTS OF TSP AND OTHER ALTERNATIVE MEASURES

The TSP includes a number of structural and non-structural measures that would result in increases in emissions affecting air quality, either during construction or as part of the Operations and Maintenance (O&M) activities once the action is implemented. All of the TSP measures occur in counties that are either marginal or moderate non-attainment status for ozone. Impacts to air quality would be similar for both alternatives. Air emissions during construction would consist primarily of tailpipe emissions (due to fossil fuel combustion from dredging equipment and land-side vehicles) and fugitive dust (ground surface disturbance). Air quality impacts would include an increase in particulate matter (PM) with particle diameters of 10 micrometers or less (PM10) and particle diameters of 2.5 micrometers or less (PM2.5), sulfur dioxide (SO2), carbon monoxide (CO), nitrogen dioxide (NO2), volatile organic compound (VOC), and carbon dioxide (CO2). VOC and nitrogen oxide (NOX) emissions from these activities can combine under the right conditions to form ozone (O3), possibly increasing the concentration of O3 in the region.

Estimates of air contaminant emission rates for the New Jersey Back Bay Feasibility Study alternatives require more-detailed construction schedule and phasing details that are developed at the time of this Draft Integrated Feasibility Study and Tier 1 Environmental Impact Statement. Therefore, the following is a qualitative description of the methods that will be used to estimate air emissions and a preliminary discussion of potential impacts to air quality in the study area. It is anticipated that additional construction-related information will be developed for the alternatives as the project analysis progresses through future planning and design phases.

6.1 Structural Alternatives

Construction Emissions. Temporary increases in air pollution would result from equipment associated with the construction of the storm surge barriers, cross-bay barriers (bay closures) and perimeter plans, which may include dredge and support equipment, non-road construction equipment, on-road and employee vehicles, maintenance dredging, and landside maintenance. The marine vessel emission sources would be primarily diesel-powered engines. The off-road and on-road equipment may be assumed to be a mix of gasoline and diesel-powered vehicles. Once construction details are developed for the alternative, air contaminant emissions due to construction activities associated with this alternative will be compared to an emissions inventory for the affected counties within the study area. It is anticipated that air contaminant emissions from the construction activities associated with this alternative would result in a relative increase in emissions above those from the existing inventory of emissions sources in the affected counties. As a result, the estimated increase in emissions may also result in corresponding impact on air quality in the immediate vicinity of the project area.

The rate of emissions from project construction equipment is directly related to the horsepower rating of each engine, load factor, duration of use, and the projected amount of dredged material and surface area disturbed. The rate of emissions from employee commuter vehicles is directly related to the type of vehicle and total miles traveled for each vehicle. The combustion of diesel fuel in internal combustion engines during the construction operations would result in air emissions of particulate matter (PM10 and PM2.5), SO2, CO, NO2, VOC, and CO2. Air contaminant emissions will be estimated using emission factors currently approved or recommended by the EPA and NJDEP.

Non-Road Construction Equipment. Air contaminant emissions from non-road construction equipment used for onshore excavation and construction will be estimated based on the anticipated type of equipment, activity, horsepower, and anticipated hours of operation. Onshore construction equipment would include cranes, pile hammers, trucks, dozers, front-end loaders, backhoes, compactors, graders, dump trucks, generators, etc. The operation of construction vehicles would generate air emissions typical of vehicles powered by diesel-fueled internal combustion engines.

Marine Vessels and Support Equipment. Marine vessel emissions would include those that would be expected to result from the use of dredging vessels, tugboats, barges/scows, derricks, and miscellaneous support vessels used in support of dredging activities. Air emissions directly related with the dredging equipment will be calculated on an annual basis based on the anticipated type of engine, activity, horsepower, and anticipated hours of operation.

On-Road Mobile Sources. Mobile source emissions associated with the project construction would be generated from on-road construction vehicles, dump trucks, employee commuter vehicles, buses, and supply vehicles. Commuter vehicles may also be used to transport the crew and staff from the shore to land-side locations and back to the shore.

Operating Emissions. Operating emissions are anticipated to be minor. It is anticipated the proposed surge barrier gates across Bolivar Roads and other surge barrier gates would be electrically powered; therefore, there would be no direct emissions from routine gate operation. These gates would be operated periodically for maintenance and testing for operational readiness. It is anticipated that diesel-fueled generators would also be installed to provide power during an emergency event, such as a hurricane, which would require operation of the gate. In case of an emergency event that would result in an electrical power failure, the generator would activate to provide power for movement of the gate. It is anticipated this event would normally last until the emergency event is gone and power is restored.

Maintenance Activities. Annual maintenance activities will result in higher air contaminant emissions in the localized area of activity compared to the No-Action Alternative. Air emissions would result from the combustion of fuel used in dredging and support equipment and for land-side equipment necessary to support maintenance operations.

6.2 Nonstructural Alternatives

Nonstructural measures involve a significant construction effort whether it be from building retrofits such as elevation (including raising a structure on fill or foundation elements such as solid perimeter walls, pier, posts, columns, or pilings) or buyout/ relocations that are likely to involve demolition, grading, and soil stabilization/ revegetation. The implementation of nonstructural measures such as building retrofits or buyout/relocations will result in temporary disruptions in the communities surrounding these activities due to earth disturbance, noise, vehicles, and temporary road closures.

Similar to the structural alternatives, the nonstructural alternatives will temporarily produce emissions associated with diesel-fueled equipment relating to landside construction activities. Construction schedules and durations for any of the nonstructural alternatives are unknown at this time. Although it is likely that construction/demolition would be in phases over several years. The localized emission increases from the diesel-fueled equipment from construction will last only during the project's construction period (and primarily only locally to where work is actually taking place at any point in time). Therefore, any potential construction impacts on air quality will be temporary in nature. Implementation of buyouts or relocations may have localized permanent beneficial impacts on air quality by removing emissions sources in residential and commercial areas. However, the effect of the relocation of residents and business on air quality to other locations is unknown.

6.3 Natural and Nature-Based Features

NNBF’s in the form of standalone features or as a complementary feature to a structural feature would include but not be limited to: storm surge filters, islands, horizontal (ecotone) levees, living shorelines, reefs, wetland restoration, submerged aquatic vegetation (SAV), and modifications to structural measures including habitat benches to restore more natural slope along shorelines and textured concrete to support colonization of algae and invertebrates.

Similar to the structural and nonstructural alternatives, the NNBFs will temporarily produce emissions associated with diesel-fueled equipment relating to water and landside construction activities. Construction schedules and durations for any NNBFs are unknown at this time. Although it is likely that construction would be in phases over several years. The localized emission increases from the diesel-fueled equipment from construction will last only during the project’s construction period (and primarily only locally to where work is actually taking place at any point in time). Therefore, any potential construction impacts on air quality will be temporary in nature. Because no NNBF are being proposed at this time, a detailed accounting of associated emissions is not available.

7.0 CONFORMITY OF GENERAL FEDERAL ACTIONS – GENERAL CONFORMITY DETERMINATION

The NJBB Study, as a Federal action, is subject to the General Conformity Rule promulgated by the EPA pursuant to the CAA, Section 176(c)(1). The rule mandates that the Federal government does not engage in, support, or provide financial assistance for licensing or permitting, or approving any activity not conforming to any of the NAAQS in each air quality region within the state.

General Conformity is applicable only to nonattainment or maintenance areas and refers to the process of evaluating plans, programs, and projects to determine and demonstrate they meet the requirements of the CAA and the SIP. The General Conformity Rule establishes conformity in coordination with and as part of the NEPA process.

The TSP alternatives will include components located within Monmouth, Ocean, Burlington, Atlantic, and Cape May counties. With exception to Monmouth County, these counties are part of the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE ozone nonattainment area that is currently classified as "marginal" in terms of its degree of compliance with the current 8-hour ozone standard. Monmouth County is part of the New York-N. New Jersey-Long Island, NY-NJ-CT ozone nonattainment area that is currently classified as "moderate".

As previously stated, the details necessary to estimate the air contaminant emissions rates for the action alternatives are not available at the time of this Tier 1 EIS. If it is determined during future planning and design phases of the study for the action alternatives that air contaminant emissions resulting from construction activities would exceed VOC and NOX thresholds during any year of the anticipated duration of the construction period, then it will be necessary to prepare a General Conformity Determination (GCD) along with a Statement of Conformity (SOC) for estimated emissions of NOX and VOC emissions for these activities. Table 6 provides a qualitative list of alternatives and their measures for their potential for requiring a GCD. Factors to be considered are the duration of the activity, degree/magnitude and types of emission generators (large construction equipment, tiered engines, etc.). The potential for GCD may be modified as more information is gained in subsequent phases. If a General Conformity Determination is prepared, then following a 30-day comment period, the USACE will be required to publish a "Final General Conformity Determination" prior to project construction. This document will include concurrence from the NJDEP and the EPA that this project is consistent with the SIP.

Table 6. Potential for NJBB CSRM Alternatives to Require a General Conformity Determination During any Construction Year or O&M Activities

Alternative	CSRM Measure	Est. Construction Duration (Months)	Potential for GCD Required During Any Construction Year	Potential for GCD Required During Any O&M Year
2A*	Non-structural	Unknown	Low-Moderate	Low
3A	Non-structural	Unknown	Low-Moderate	Low
3E(2)*	Manasquan SSB	81	Moderate-High	Moderate

Alternative	CSRM Measure	Est. Construction Duration (Months)	Potential for GCD Required During Any Construction Year	Potential for GCD Required During Any O&M Year
	Barnegat SSB	105		Moderate
	Non-structural	Unknown		Low
4A	Non-structural	Unknown	Low-Moderate	Low
4D(1)	Perimeter Plans	89-126	Moderate	Low
	Non-structural	Unknown		Low
4D(2)	Perimeter Plans	55-126	Moderate	Low
	Non-structural	Unknown		Low
4G(8)*	GEHI SSB	126	Moderate-High	Moderate
	Absecon Blvd. BC	50		Low - Moderate
	S. Ocean City BC	49		Low-Moderate
	Non-structural	Unknown		Low
5A*	Non-structural	Unknown	Low-Moderate	Low
5D(2)	Perimeter Plans	5-62	Moderate	Low
	Non-structural	Unknown		Low
NNBFs	All	Unknown	Moderate-High	Low
*TSP Alternative				

7.1 Potential Air Quality Mitigation Measures

If General Conformity is required, then mitigation measures and emissions tracking will become necessary. Since these actions occur in New Jersey, they would be developed and coordinated through the Regional Air Team (RAT), which is represented by EPA Region 2, USACE, NJDEP and a number of other agencies within the region. Measures that could be used to reduce emissions for the project would consider the equipment used for the project over the expected life of the project and the feasibility and practicality of such measures. Alternatives considered for their ability to reduce or mitigate emissions are those that may provide for enhanced energy efficiency, lower NOX-emitting technology, repowering, etc., as appropriate, for the construction and operating equipment and vehicles to be used. Efforts to reduce emissions from the construction and operation of the project could include the following.

Dredging Mitigation Options

• Contracting with dredging companies that have energy efficient equipment

• Design of the dredging operation and schedule to reduce overall fuel use and hours of operation

• Repowering/refitting with cleaner diesel engines; i.e., those that would emit less air contaminant emissions

• Selection of newer dredges with more efficient engines, if possible

• Selection of dredges equipped with emissions control equipment; e.g., selective catalytic reduction, etc., if available

Land-side Mitigation Options

• Use of vehicles fueled by compressed natural gas or liquefied petroleum gas – compressed natural gas and liquefied petroleum gas could provide a reduction in CO2 emissions compared to the use of gasoline fuel

• Repowering/refitting with cleaner, more-fuel-efficient, diesel engines

• Use of newer vehicles with more-fuel-efficient engines, if possible

• Use of non-road ultra-low sulfur diesel fuel