APPENDIX D: STATE AND DISTRICT OF COLUMBIA ANALYSES

NORTH ATLANTIC COAST COMPREHENSIVE STUDY:
RESILIENT ADAPTATION TO INCREASING RISK

STATE CHAPTER

D-5: State of New York

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I. Introduction

The purpose of the North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk (NACCS) is to catalyze and spearhead innovation and action by all to implement comprehensive coastal storm risk management strategies (CSRM). Action is imperative to increase resilience and reduce risk from, and make the North Atlantic region more resilient to, future storms and impacts of sea level change. Resilience is defined by the U.S. Army Corps of Engineers (USACE) and National Oceanic and Atmospheric Administration's (NOAA) Infrastructure Systems Rebuilding Principles as the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies.

The goals of the NACCS are to:

- Provide a risk management framework, consistent with NOAA/USACE Infrastructure Systems Rebuilding Principles; and
- Support resilient coastal communities and robust, sustainable coastal landscape systems, considering future sea level and climate change scenarios, to reduce risk to vulnerable populations, property, ecosystems, and infrastructure.

The NACCS Main Report addresses the entire study area at a regional scale and explains the development and application of the NACCS Coastal Storm Risk Management Framework from a broad perspective. This State Coastal Risk Framework Appendix discusses state specific conditions, risk analyses and areas, and comprehensive coastal storm risk management (CSRM) strategies in order to provide a more tailored Framework for the State of New York (NY). Attachments include the New York-New Jersey Harbor and Tributaries Focus Area Analyses (FAA) Report and the Nassau County Back Bays FAA Report, as well as the State of NY response to the USACE State Problems, Needs, and Opportunities correspondence. A link to a digital Map Book composed of maps on a reach-by-reach basis for areas of high risk is also provided.

II. Planning Reaches

Planning reaches for New York have been developed to offer smaller units than state boundaries from which CSRM and resilient coastal community decisions can be made. These planning reaches are based on natural and manmade coastal features including shoreline type, USACE CSRM projects, and the 1 percent floodplain (Figure 1).

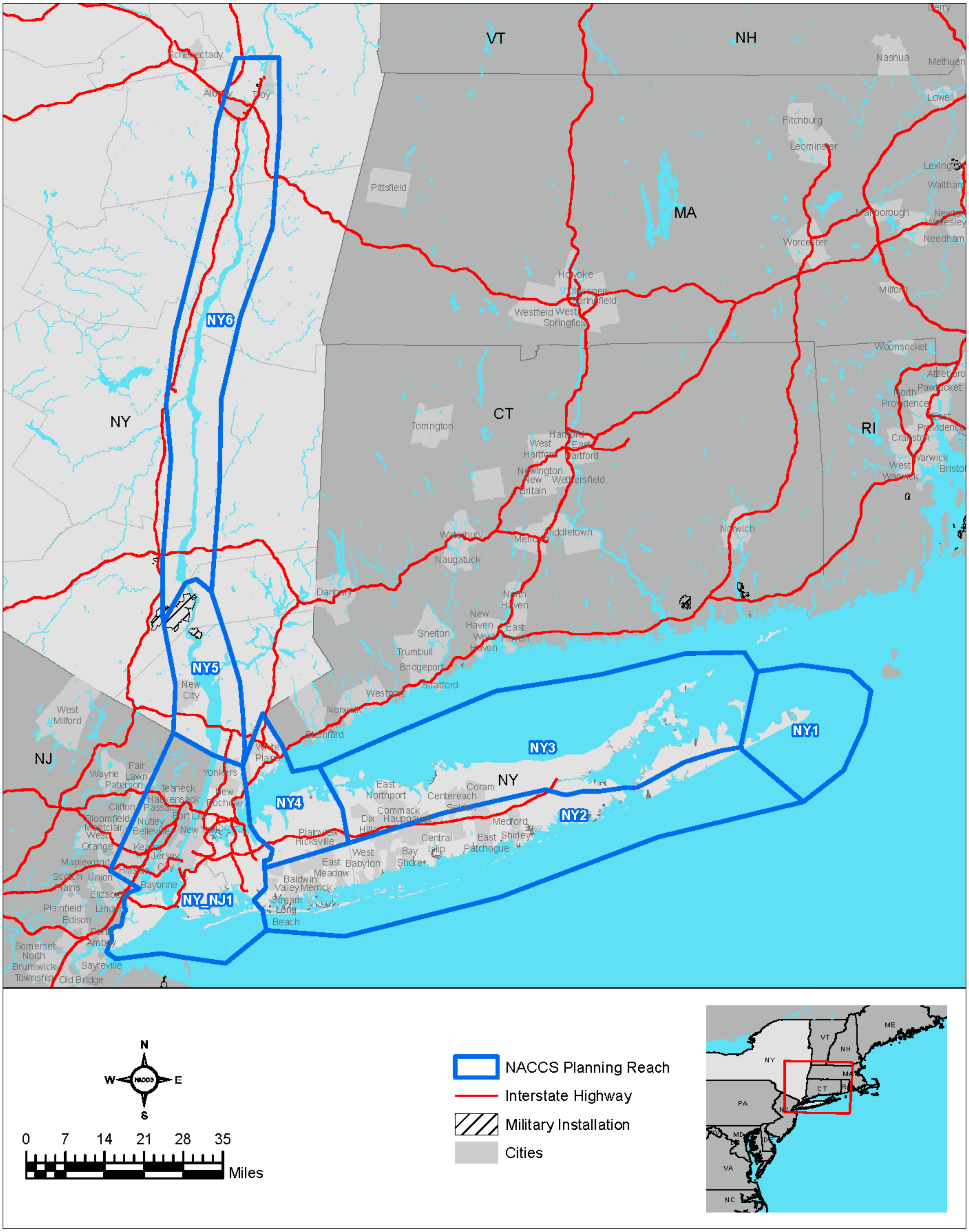


Figure 1. Planning Reaches for the State of New York.

There are six planning reaches in New York, designated as NY1 to NY6. NY1 includes the eastern end of Long Island, which includes the hamlet of Montauk. NY2 includes the southern shore of Long Island, extending from Nassau County to Montauk, and includes the Towns of East Hampton, South Hampton, and the Villages of Freeport and Long Beach. NY3 includes the northern shore of Suffolk County on Long Island, including portions of Southold, Mattituck, Port Jefferson, and Huntington, Asharoken. NY4 includes the northern shore of Nassau County and the eastern shore of Westchester County. Major cities/towns include Rye, New Rochelle, Mamaroneck, Glen Cove, Bayville, Roslyn, and Port Washington. NY5 includes the Hudson River Valley, from Westchester and Rockland Counties up to Putnam and Orange Counties. NY6 extends along the Hudson River from Putnam and Orange Counties up to Albany and Rensselaer Counties, which is the northern extent of tidal influence on the Hudson River.

Additionally, New York and New Jersey share one planning reach. NY_NJ1 comprises the New York and New Jersey Harbor estuary in northeastern New Jersey and Southern New York. Major cities/towns include Hoboken, Newark, Jersey City, Elizabeth, Yonkers, and New York City (Manhattan, The Bronx, Brooklyn, Queens, and Staten Island).

III. Existing and Post-Sandy Landscape Conditions

III.1. Existing Conditions

The existing conditions are the conditions immediately after the landfall of Hurricane Sandy. This existing conditions analysis includes consideration of the population, supporting critical infrastructure, environmental conditions, inventory of existing CSRM projects and associated project performance during Hurricane Sandy, the Federal Emergency Management Agency (FEMA) and Small Business Administration response and recovery efforts, FEMA flood insurance claims, and shoreline characteristics that were vulnerable to coastal flood risk associated with Hurricane Sandy. Development of detailed existing conditions across the study area illuminates the vulnerabilities to storm damage that exist. This process helps to identify coastal risk reduction and resilience opportunities. The existing condition serves as the base against which all proposed risk reduction and resilience are compared. Further discussion of the existing conditions is provided in Appendix C – Planning Analyses.

While coastal storm risk is managed along the Atlantic Ocean coast of NYC and Long Island by a number of Federal coastal storm risk management projects, additional coastal storm risk management improvements to these shorelines should be identified. In addition, portions of the Nassau County back bays are at risk due to the limited number of coastal storm risk management projects. The existing conditions are discussed herein through an analysis of the population and supporting critical infrastructure affected by Hurricane Sandy within the study area. Figure 2 and Table 1 summarize pertinent information regarding the population figures for counties affected by Hurricane Sandy.

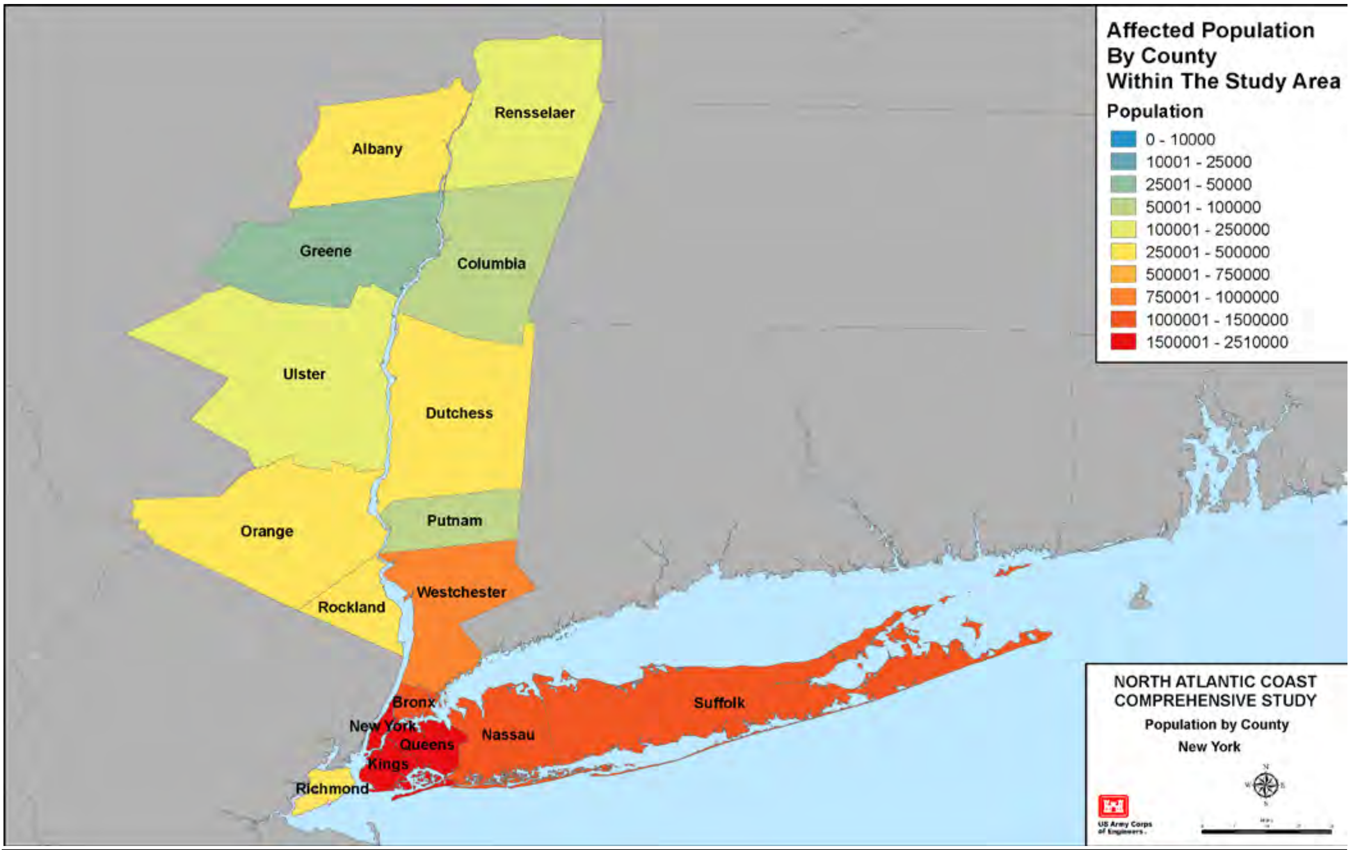


Figure 2. Affected Population by Hurricane Sandy for the State of New York (2010 U.S. Census data)

Table 1. Affected Population by Hurricane Sandy for the State of New York.

County	Population
Albany	304,204
Bronx	1,385,108
Columbia	63,096
Greene	49,221
Kings	2,504,700
Nassau	1,339,532
New York	1,585,873
Orange	372,813
Putnam	99,710
Queens	2,230,722
Rensselaer	159,429
Richmond	468,730
Rockland	311,687
Suffolk	1,493,350
Westchester	949,113
Total Population Affected	**13,797,269**

Figure 3 and Table 2 summarize pertinent information regarding infrastructure affected by Hurricane Sandy. Critical infrastructure elements include sewage, water, electricity, academics, trash, medical and safety.

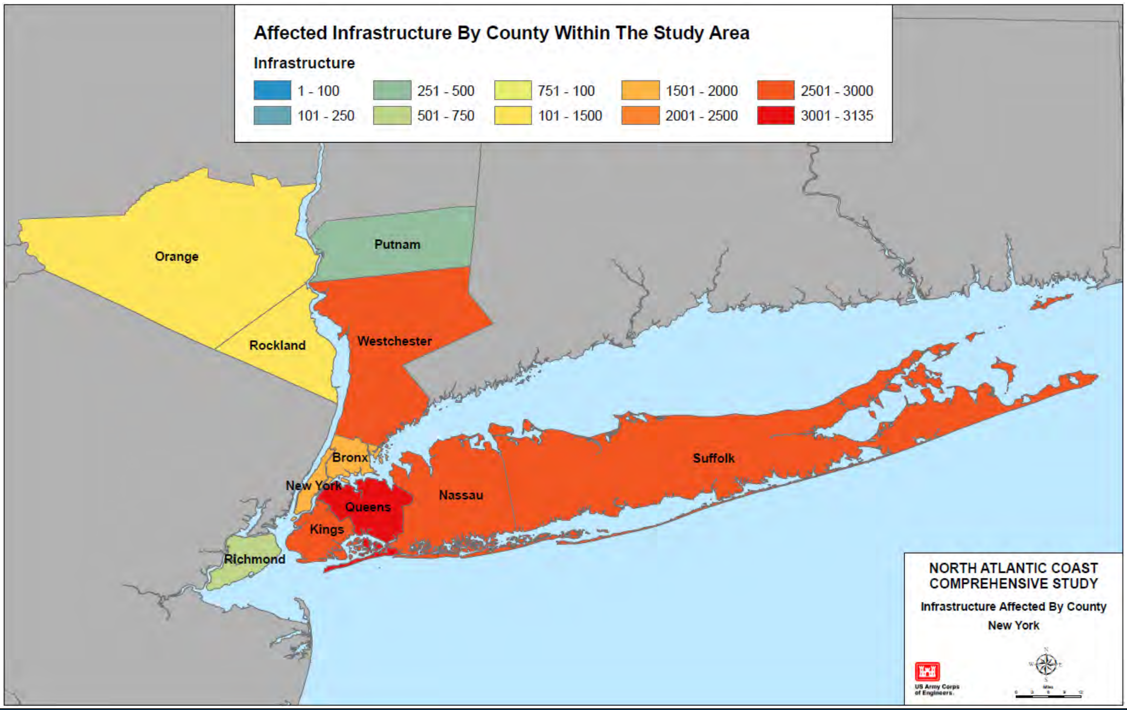


Figure 3. Affected Infrastructure by Hurricane Sandy for the State of New York

Table 2. Affected Infrastructure Elements by Hurricane Sandy for the State of New York

County	Infrastructure
Bronx	1,537
Kings	2,714
Nassau	2,580
New York	1,902
Orange	1,374
Putnam	323
Queens	3,056
Richmond	712
Rockland	772
Suffolk	2,773
Westchester	2,795
Total Infrastructure Affected	**20,538**

A detailed discussion of the environmental existing conditions is provided in the Environmental and Cultural Resources Conditions Report.

III.2. Post-Sandy Landscape

The post-Sandy landscape condition is defined as the forecasted scenario or most likely future condition if no NACCS CSRM 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. A base year of 2018 has been identified when USACE projects discussed below will be implemented/constructed.

A total of 29 existing USACE projects in New York are included in the post-Sandy landscape condition. Eighteen are CSRM projects, one is a coastal ecosystem restoration project, and ten are navigation (NAV) projects (Figure 4). A complete list of existing USACE projects within the entire study area is presented in Appendix C – Planning Analyses.

The post-Sandy landscape condition also includes active (at the time of Hurricane Sandy's landfall) state and local/communities CSRM projects in the State of NY. Some of these projects may have been damaged during Hurricane Sandy. USACE understands that the State of NY and the local communities are in the process of rebuilding and restoring the shoreline and damaged infrastructure and property to pre-Sandy conditions under emergency authorities and programs. Given this priority, and the apparent current lack of resources to commence new CSRM efforts at this time, USACE has made the assumption that the states' most likely future condition will be the pre-Sandy condition. The State of New York and the New York City (NYC) were queried with regards to the statement's accuracy in letters dated May 23, 2013, and there was no disagreement as to the accuracy of the statement. Ongoing State of New York CSRM projects were inventoried and mapped as shown on Figure 5.

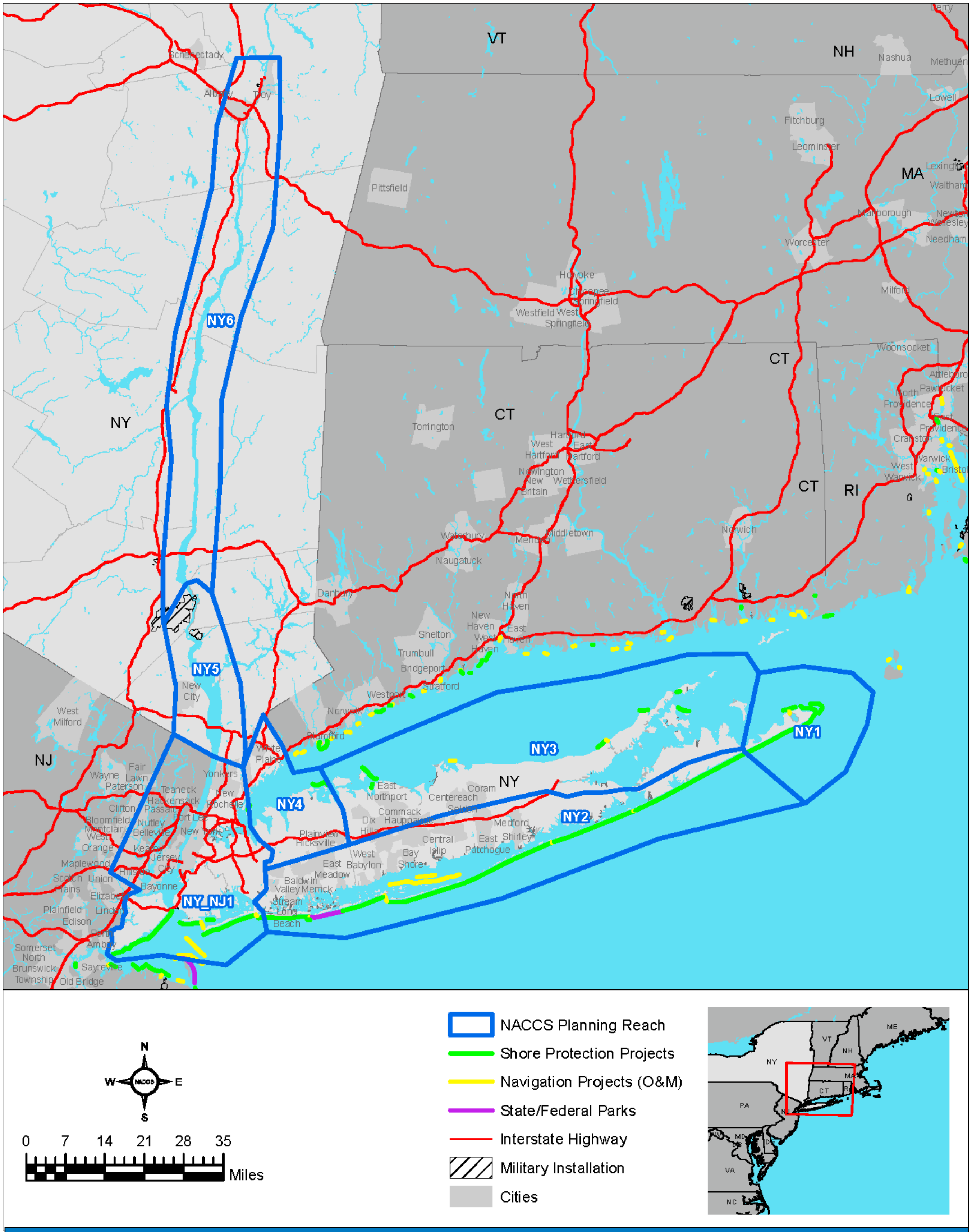


Figure 4. Federal Projects included in the Post-Sandy Landscape Condition

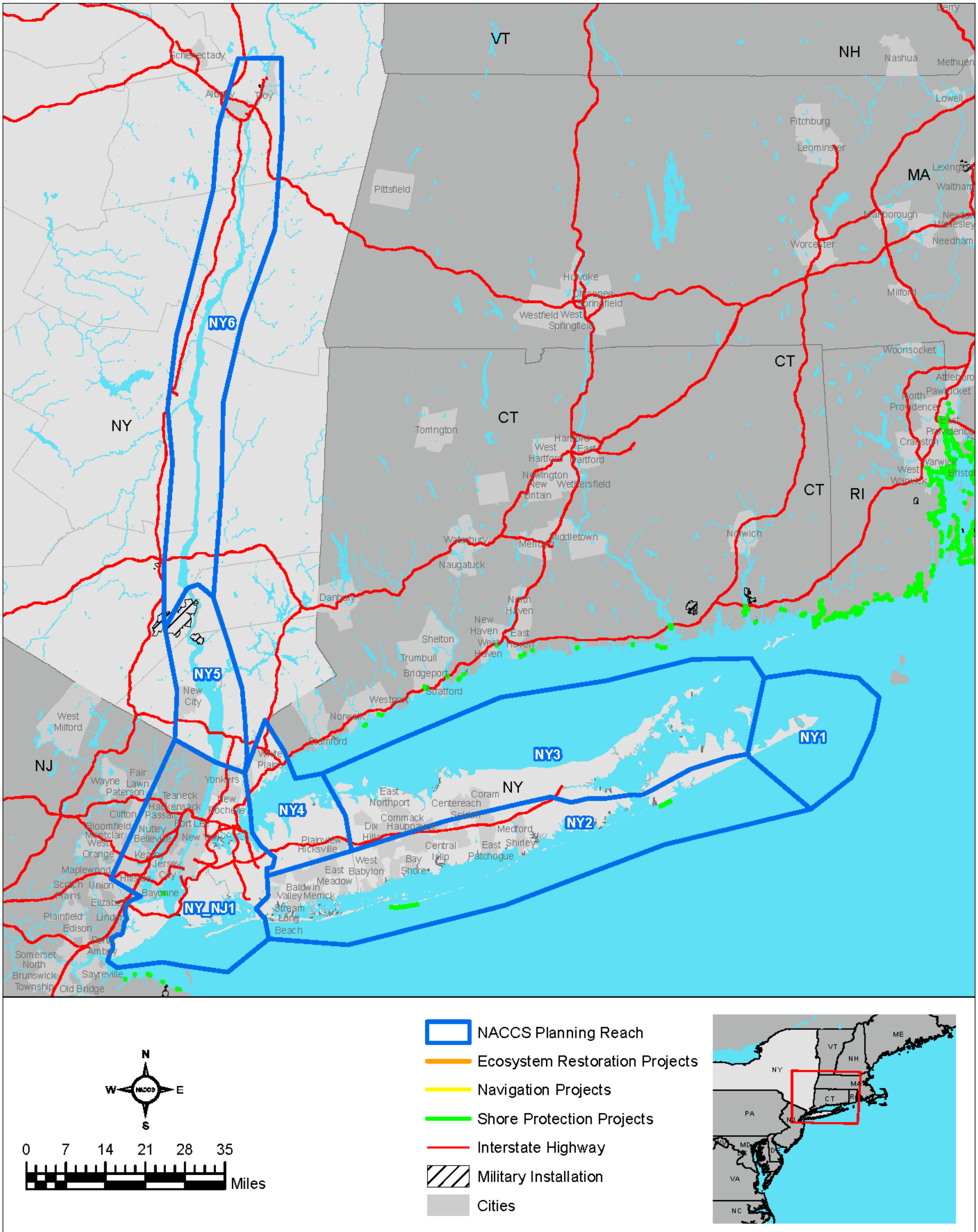


Figure 5. State Projects included in the Post-Sandy Landscape Condition

Sea Level Change

The current USACE guidance on development of sea level change (USACE, 2013) outlines the development of three scenarios: Low, Intermediate, and High for the State of NY (Figure 6) and NYC (Figure 7). The NOAA High scenario (NOAA, 2012) is also plotted in Figure 6 and Figure 7. The details of different scenarios and their application to the development of future, local relative sea level elevations for the NACCS study area are discussed in greater detail in Chapter IV of the NACCS Main Report.

These USACE and NOAA future SLC scenarios have been compared to state or region specific sea level change scenarios. The scenarios presented in the New York State (NYS) Sea Level Rise Task Force Report to the Legislature (2010) and the NYC Panel on Climate Change Climate Risk Information 2013, Climate Methods Memorandum (December, 2013), are frequently referenced, if unofficially, by various bureaus within the State of New York including the New York State Department of Environmental Conservation (NYSDEC) and the NYC Mayor's Office of Recovery and Resiliency. Comparison of the USACE Low, Intermediate, and High and NOAA High relative sea level change scenarios (for the Battery, NY NOAA tide gauge) with the NYS Sea Level Rise Task Force Report to the Legislature (2010) and the NYC Panel on Climate Change Climate Risk Information 2013, Climate Methods Memorandum (2013) scenarios for the State of New York indicate similar trends, but some uncertainty in future water levels. Thus, importance should be placed on scenario planning rather than on specific, deterministic single values for future sea level change. Such sea level change scenario planning efforts will help to provide additional context for state and local planning and assessment activities.

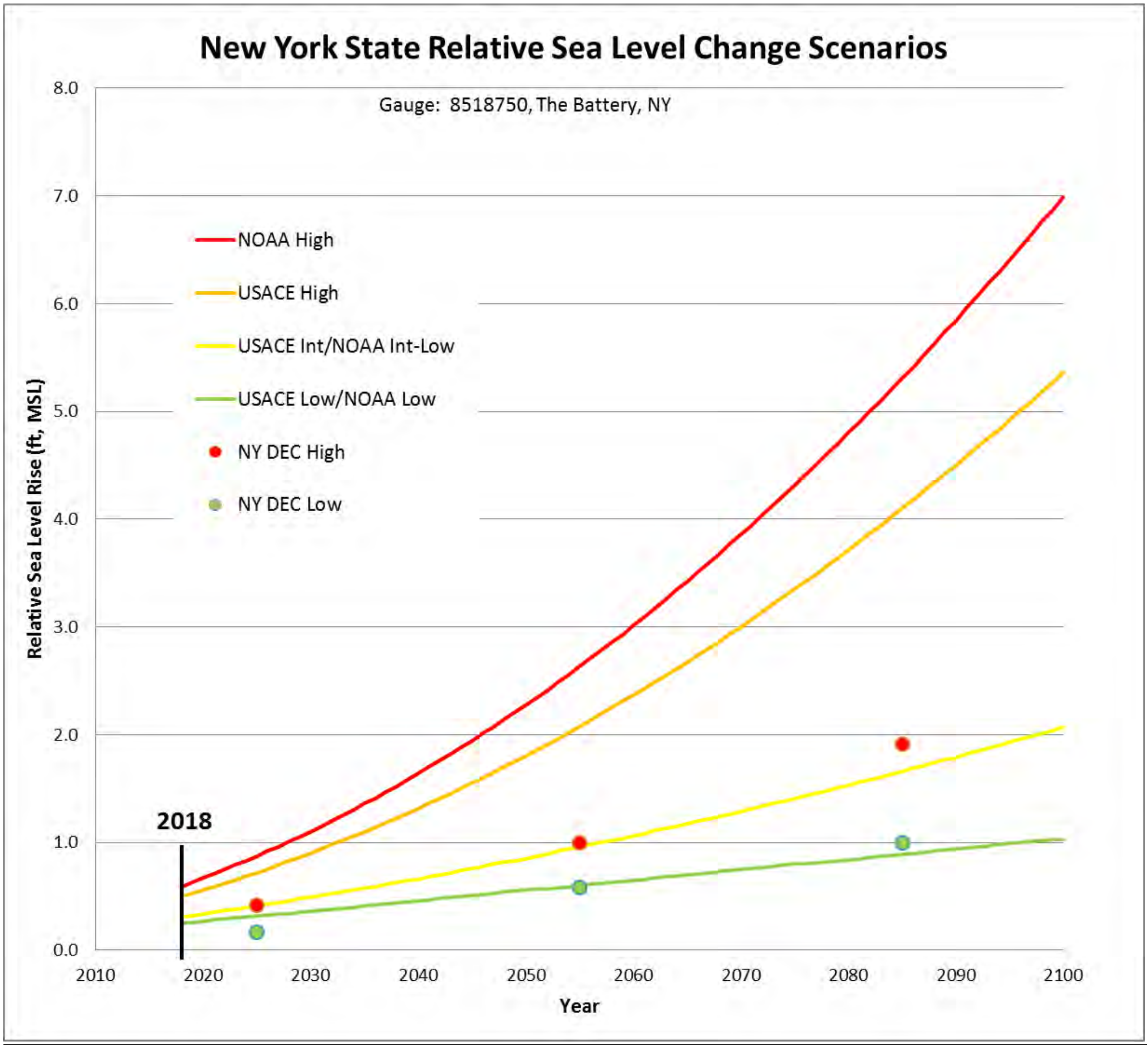


Figure 6. Relative Sea Level Change for the State of New York (NY State Sea Level Rise Task Force Report to the Legislature, [2010]), for the Battery, NY, for USACE and NOAA Scenarios.

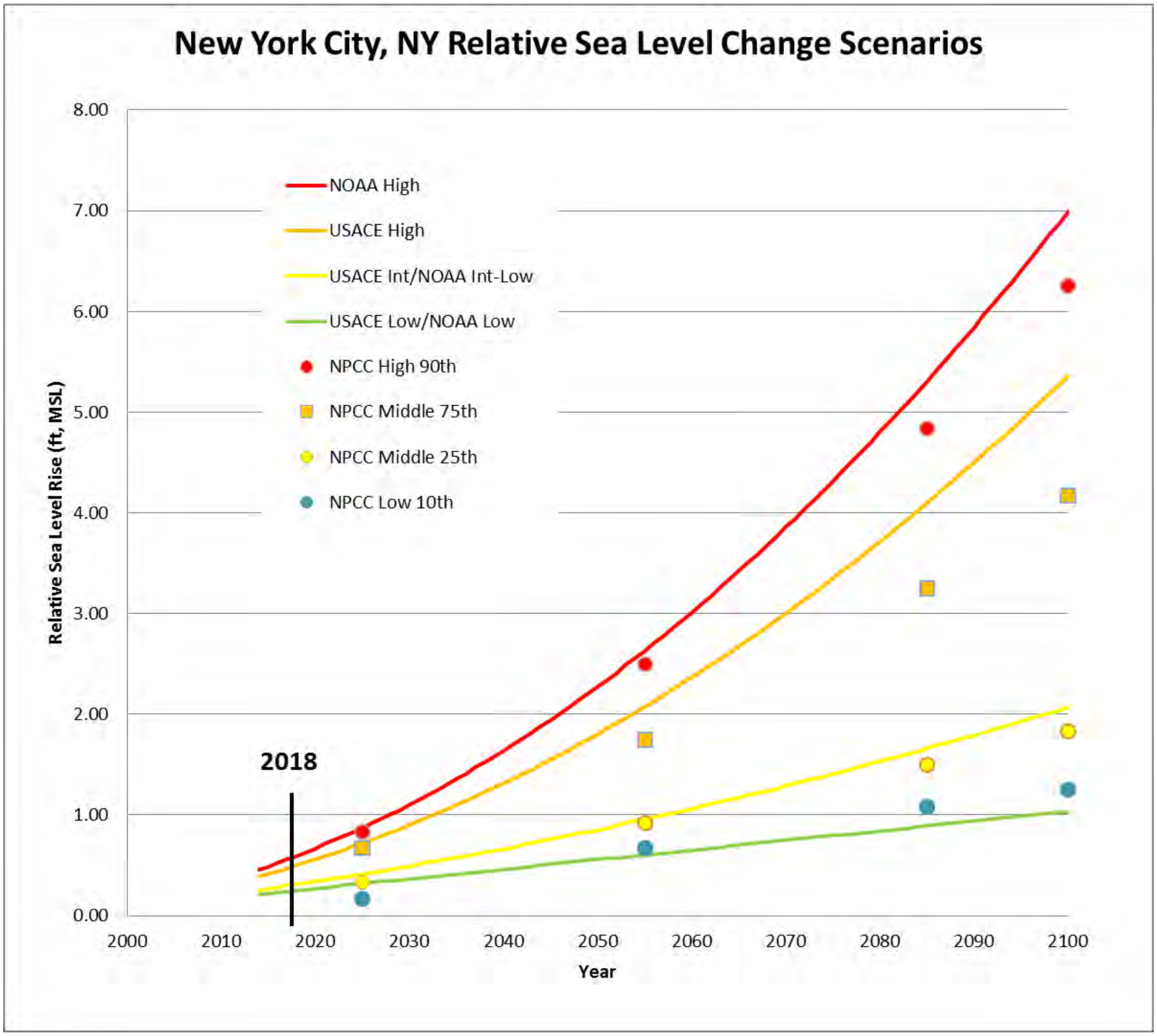


Figure 7. Relative Sea Level Change for the New York City (NYC Panel on Climate Change, Climate Risk Information 2013, Climate Methods Memorandum [December, 2013]), for the Battery, NY, for USACE and NOAA Scenarios.

To consider the effects of sea level change on the future landscape change, future sea level change scenarios have been developed by the USACE (ER 1100-2-8162, 2013) and NOAA (2012). Figure 8 shows areas that would be below mean sea level at four future times (2018, 2068, 2100) based on the USACE "High" scenario. Figure 9 shows areas that are based on the USACE “High” scenario with forecasted residential development density increase. A detailed discussion of mapping basis and technique for this and other mapping is provided in Appendix C – Planning Analyses.

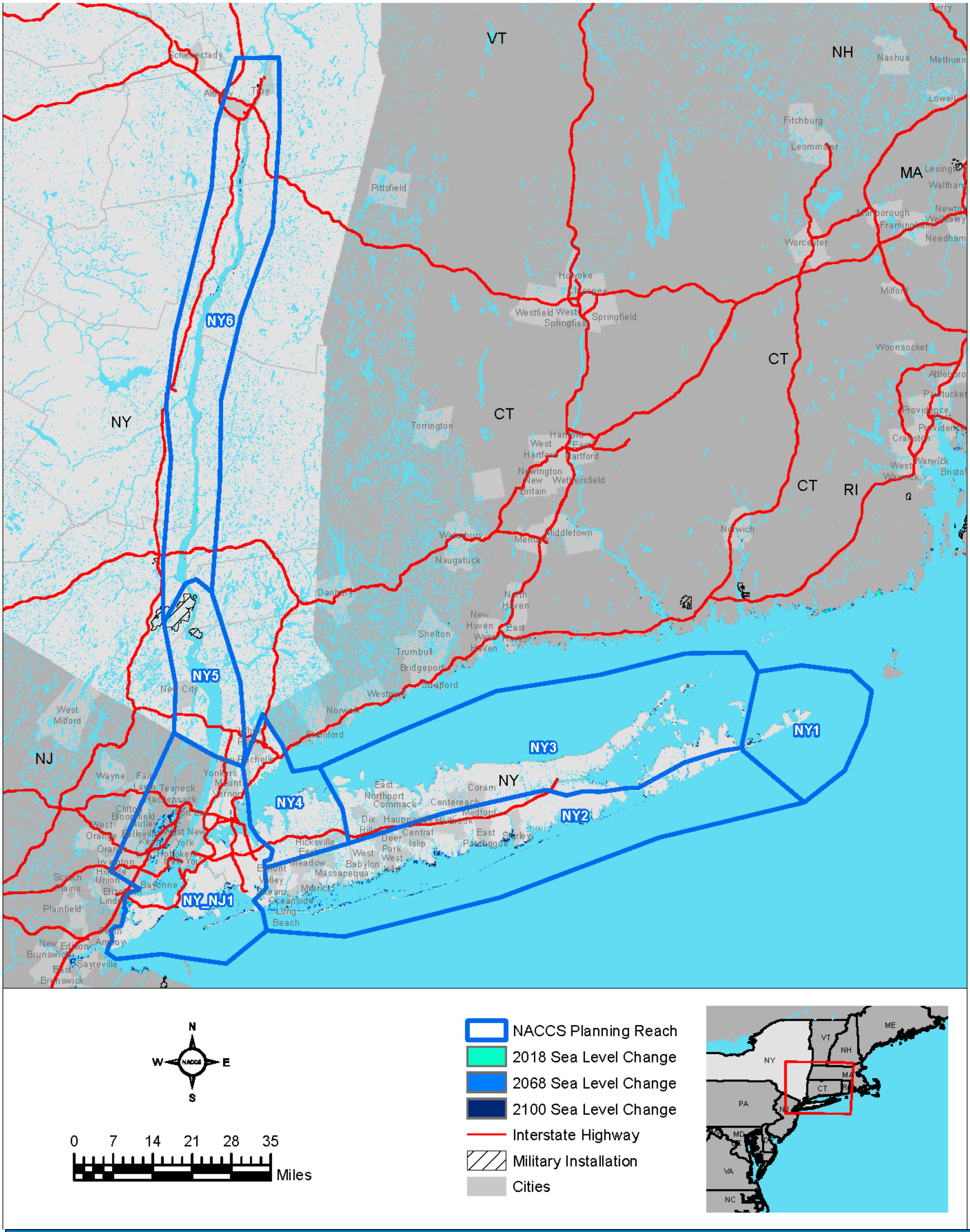


Figure 8. USACE High Scenario Future Mean Sea Level Mapping for the State of New York

Forecasted Population and Development Density

Using information and datasets generated as part of the U.S. Environmental Protection Agency's (EPA) Integrated Climate and Land Use Scenarios (ICLUS), inferences to future population and residential development increases by 2070 were evaluated (EPA, 2009). Figure 9 present the USACE High scenario inundation and the forecasted increase in residential development density derived from ICLUS data for New York. Changes to environmental and cultural resources and social vulnerability characteristics will not be considered as part of the overall forecasted exposure index assessment. Discussions of likely future impacts with respect to SLC on environmental and cultural resources will be considered in the Environmental and Cultural Resources Conditions Report. Additional information related to the forecasted population and development density is included in Appendix C – Planning Analyses.

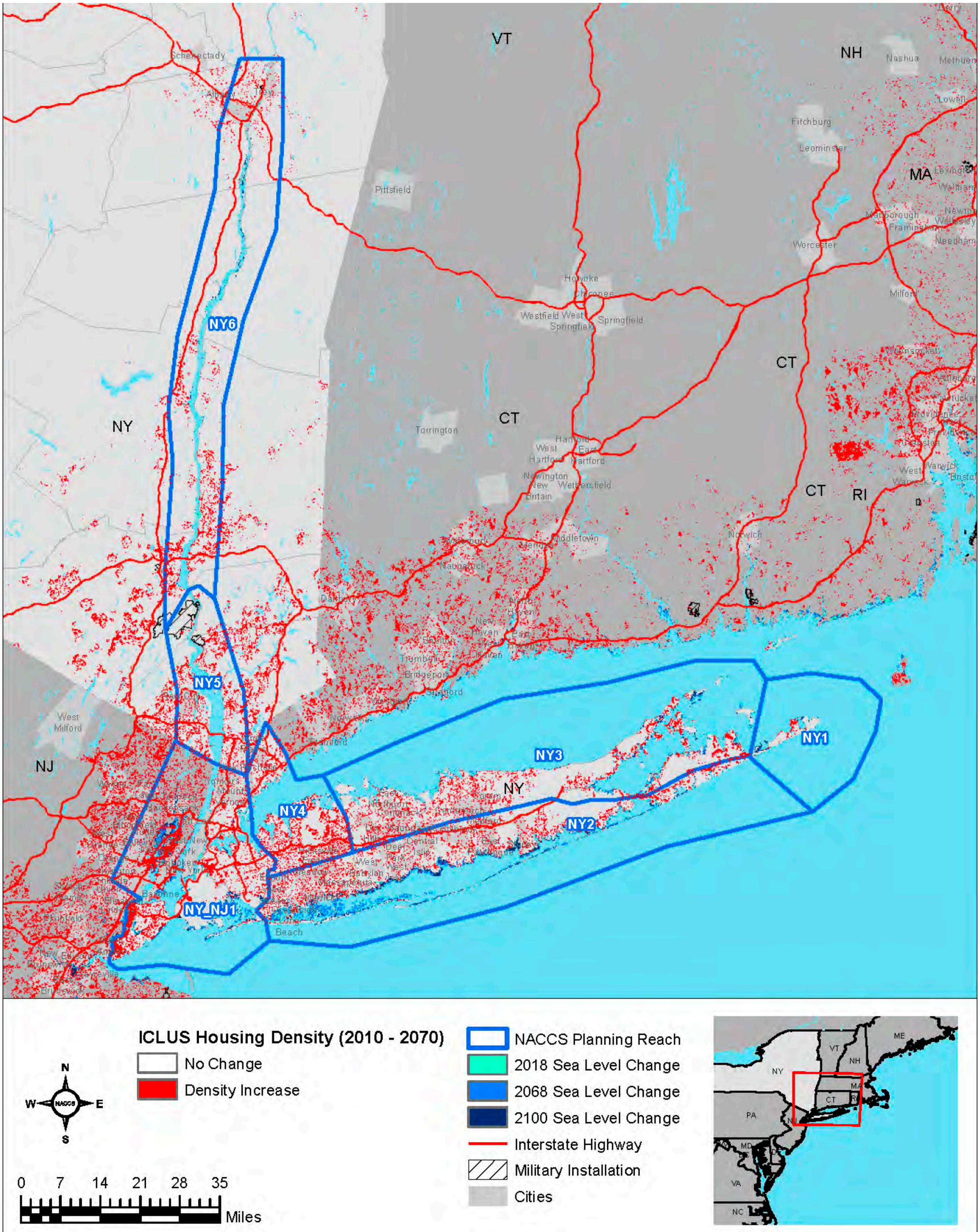


Figure 9. USACE High Scenario Future Mean Sea Level Inundation and Forecasted Residential Development Density Increase for the State of New York.

Extreme Water Levels

As part of the CSRM Framework, the extent of coastal flood hazard was completed by using readily available 1 percent flood mapping from FEMA, preliminary 10 percent flood values from the USACE Engineer Research and Development Center (ERDC) extreme water level analysis, and the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) modeling conducted by NOAA. The inundation zones identified by the SLOSH model depict areas of possible flooding from the maximum of maximum (MOM) event within the five categories of hurricanes by estimating the potential surge inundation during a high tide landfall. Although the SLOSH inundation mapping is not referenced to a specific probability of occurrence (unlike FEMA flood mapping, which presents the 0.2 percent and 1 percent flood elevation zones), a Category 4 hurricane making landfall during high tide represents an extremely low probability of occurrence but high magnitude event. In most cases it is only possible to provide risk management to some lower level like the 1 percent flood. Figure 10 presents the SLOSH hydrodynamic modeling inundation mapping associated with Category 1 through 4 hurricanes.

Figure 11 presents the approximate 1 percent floodplain plus 3 feet for the same area to illustrate areas exposed projected inundation levels which is closely aligned with the USACE high scenario for projected SLC by year 2068 as well as NYC's new building ordinance. Areas between the Category 4 and 1 percent plus 3 feet floodplain represent the residual risk for those areas included in the NACCS study area and Category 4 MOM floodplain.

Figure 12 presents the limit of the current 10 percent floodplain (an area with a 10 percent or greater chance of being flooded in any given year). The purpose of the 10 percent floodplain is to consider the possibility of surge reduction related to some natural and nature-based features (NNBF) management measures such as wetlands, living shorelines, and reefs.

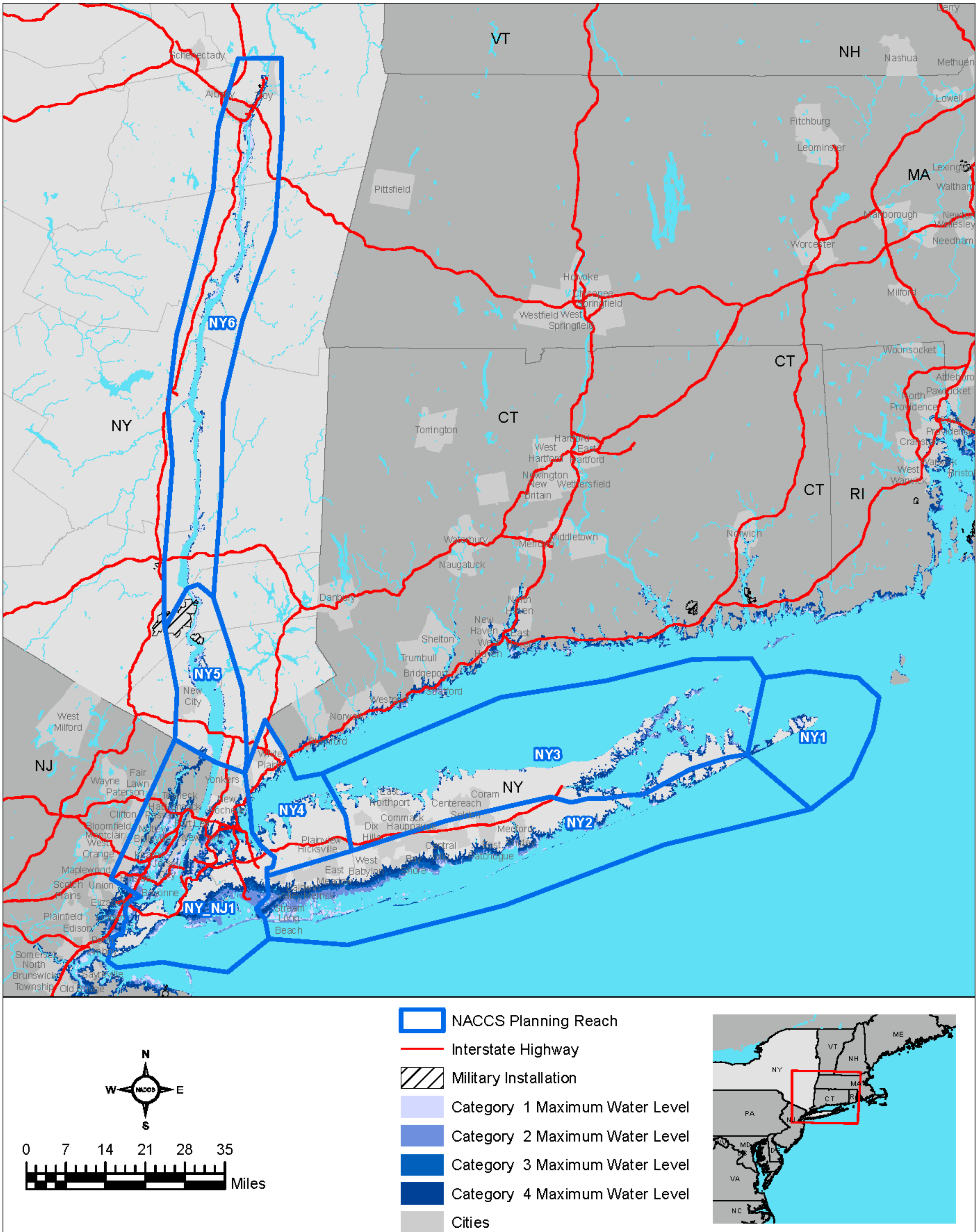


Figure 10. Impacted Area Category 1-4 Water Levels for the State of New York

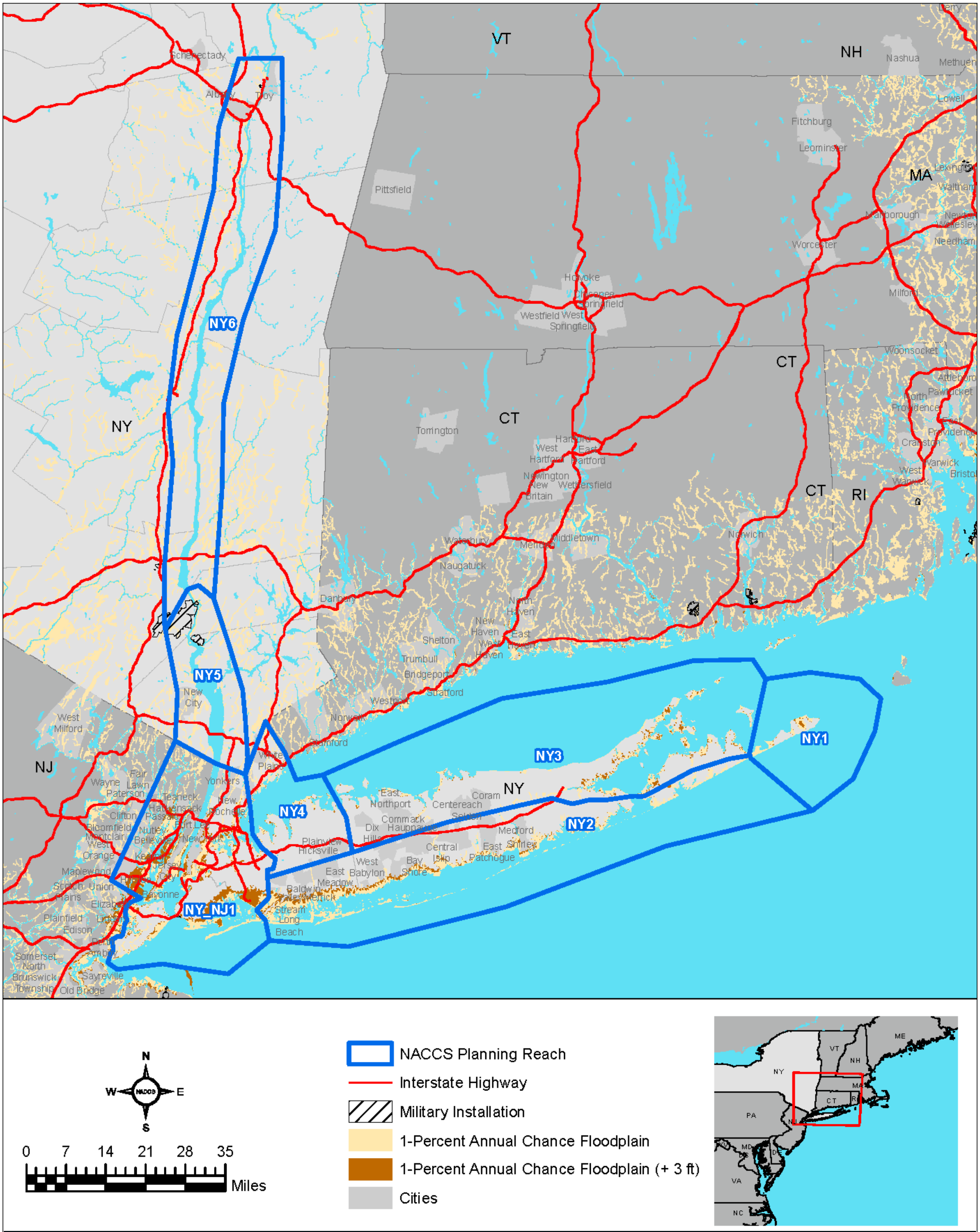


Figure 11. Impacted Area 1 Percent Flood + 3 feet Water Surface for the State of New York.

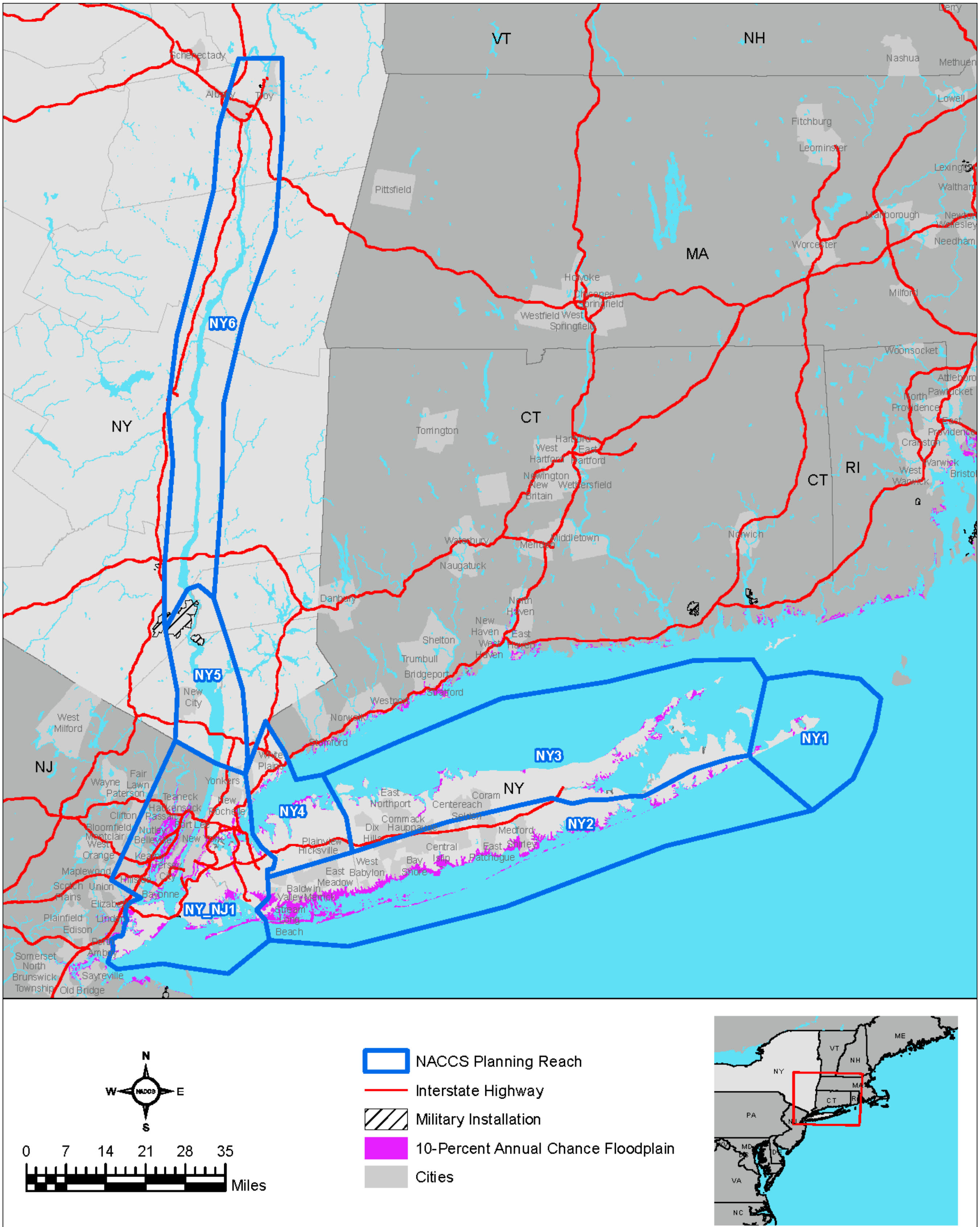


Figure 12. Impacted Area 10 Percent Flood Water Surface for the State of New York.

Environmental Resources

The majority of the New York's shoreline within the USACE New York District Area of Responsibility has a long history of inlet and beach management activities and beach nourishment. While these projects can provide many benefits, such as creation and protection of habitat, artificial disruptions to natural process such as closure of breaches can disrupt the natural process of beach migration, bay flushing, wetland formation, and barrier island replenishment.

The majority of this region is highly urbanized with most shorelines modified, few remaining natural beaches and little space for migration. CSRM measures interfere with the survival of estuarine beaches by both blocking migration and affecting sediment retention. As sea levels change, remaining beaches will erode to the point in front of CSRM structures and it is assumed that they would be eventually lost without continual beach nourishment.

In areas with adequate sediment supply and no artificial or natural barriers, shoreline habitat will be able to migrate landward. However, at increased rates of sea level change and in cases of inadequate sediment supplies, it is likely that there will be significant loss of habitat, accelerated erosion, and limited landward migration of beach dune systems.

Many embayment, maritime beaches, and dune systems within New York State contain regionally significant fish and wildlife habitat for a diversity of species. Because of the importance of beach species (e.g., invertebrates, horseshoe crabs) for estuarine food webs, along with the critical habitat these beaches provide for shorebirds, diamondback terrapins and rare species, serious ecological implications may result from the loss of estuarine beaches.

Barrier islands within the region are limited to the south shore of Long Island. These islands reduce risk to the coast from severe storms and support unique ecological communities. In response to sea level change, barrier islands migrate landward as sand is transported across the island from the ocean to the bay. The greatest impact to barrier islands over a 30-50 year planning period can be expected from storms and disruption of sediment transport by human activity (Tanski, 2007; NYS SLR Task Force, 2010). Over longer planning time frames, an increasing sea level means we will be faced with erosion problems for the foreseeable future (Tanski, 2007). High rates of projected sea level change may lead to increased overwash, breaching of new inlets, and the eventual disappearance of barrier islands altogether if the system cannot supply a sufficient amount of sand (Tanski, 2007, NYS SLR Task Force, 2010).

There are extensive wetlands, including vegetated marsh islands and non-vegetated tidal flats present throughout Long Island. These wetlands provide nesting and feeding habitat for a variety of shorebirds, wading birds and waterfowl and support rare bird and plant species. The remaining significant marsh resources within the Hudson Raritan Estuary provide valuable ecological and socioeconomic benefits, still, shorelines and inland reaches of this highly urbanized area continue to be developed and armored. Although NYC's Waterfront Revitalization Program (WRP) requires the use of nonstructural alternatives, planners expect that the only sizeable areas in the NYC metropolitan area that are unlikely to be protected are portions of the three Special Natural Waterfront Areas (SNWAs) designated by NYC: Northwest Staten Island/Harbor Heron SNWA; East River–Long Island Sound SNWA; and Jamaica Bay SNWA (Titus and Strange, 2008).

Marshes may be able to migrate landward in some areas if there is room to retreat. To this end, New York State requires a 75-foot buffer around tidal wetlands to make room for migration (NYS DOS, 2006). However, development and shoreline protection are widespread and permitted outside this buffer. Furthermore, there are locations in the study area with naturally steep shorelines that will interfere to varying degrees with marine transgression of tidal wetlands in response to rising seas (Titus and Strange, 2008). The loss of vegetated low marsh reduces habitat for several rare birds, small resident and transient fishes and diamondback terrapins.

Seagrass distribution within the USACE New York District Area of Responsibility is limited to areas of the South Shore estuaries of Long Island, the Long Island Sound, the Peconic Estuary, and the Hudson River. This limited distribution is due to both natural and anthropogenic conditions that characterize this highly urban environment. Currently, seagrass populations in New York State are declining due to threats associated with excess nitrogen (affecting water quality), persistent and sustained algal blooms, and fishing and shellfishing gear impacts (NYS Seagrass Task Force, 2009). SLC may pose significant threats to remaining populations due to potential implications of increased water depth such as increased water temperatures and limited light penetration. Additionally, manmade alterations to the shoreline often disrupt the natural conditions necessary for such activities as eelgrass growth and forage fish spawning. Hardened shorelines change the physical environment of near-shore waters by reflecting wave energy and changing erosion/accretion dynamics. Wave energy reflection can be a significant detriment to shallow eelgrass populations. Docks reduce the amount of light that reaches eelgrass, and propeller wash can stir up the bottom, decreasing light and increasing erosion to the eelgrass bed.

A more detailed explanation of these effects can be found in the Environmental and Cultural Resources Conditions Report.

IV. NACCS Coastal Storm Exposure and Risk Assessments

The extent of flooding, as presented in Figures 10 to 12, was used to delineate the areas included in the coastal storm risk and exposure assessments. An exposure index was created for population density and infrastructure, social vulnerability characterization, and environmental and cultural resources. In addition, the three individual indices were combined to create a composite exposure index. The purpose of combining individual exposure indices into a composite index was to provide an illustration of example values for features of the system, with population density and infrastructure weighted at 80 percent of the total index, and social vulnerability characterization and environmental and cultural resources weighted at 10 percent each. For the purpose of the Framework, the overall composite exposure assessment identified areas with the potential for relative higher exposure to flood peril considering collectively the natural, social, and built components of the system. Additional information related to the development of the NACCS risk and exposure assessments is presented in Appendices B – Economics and Social Analyses, and C – Planning Analyses.

IV.1. NACCS Exposure Assessment

The Tier 1 assessment first required identifying the various categories to best characterize exposure. Although a myriad of factors or criteria can be used to identify exposure, the NACCS focused on the following categories and criteria, as emphasized in Public Law (PL) 113-2.

Population Density and Infrastructure Index

Population density includes identification of the number of persons within an areal extent across the study area; infrastructure includes critical infrastructure that supports the population and communities. These factors were combined to reflect overall exposure of the built environment. Figure 13 presents the population density and infrastructure exposure index. Figure 14 presents the percentages of infrastructure included within the population density and infrastructure exposure index.

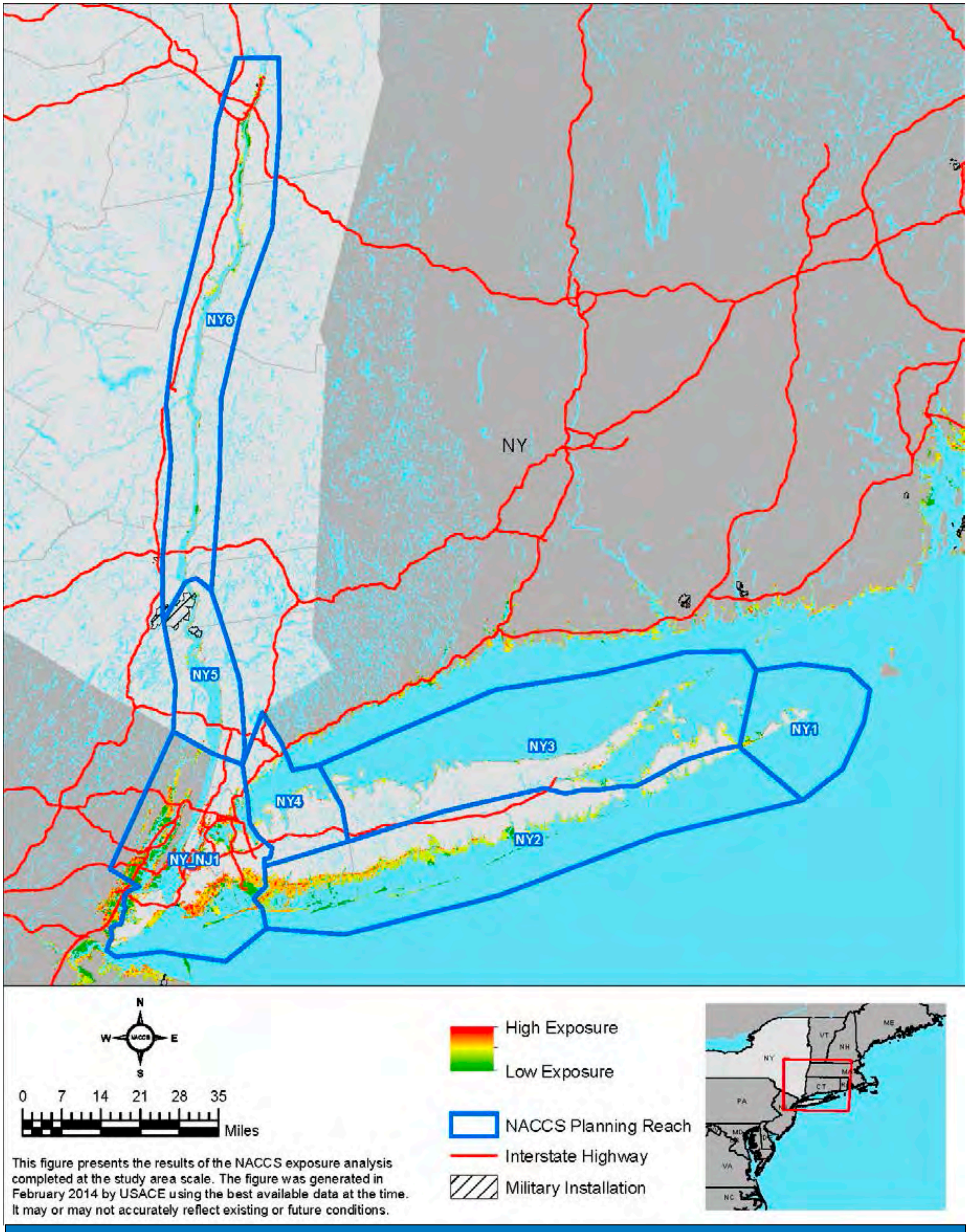


Figure 13. Population and Infrastructure Exposure Index for the State of New York.

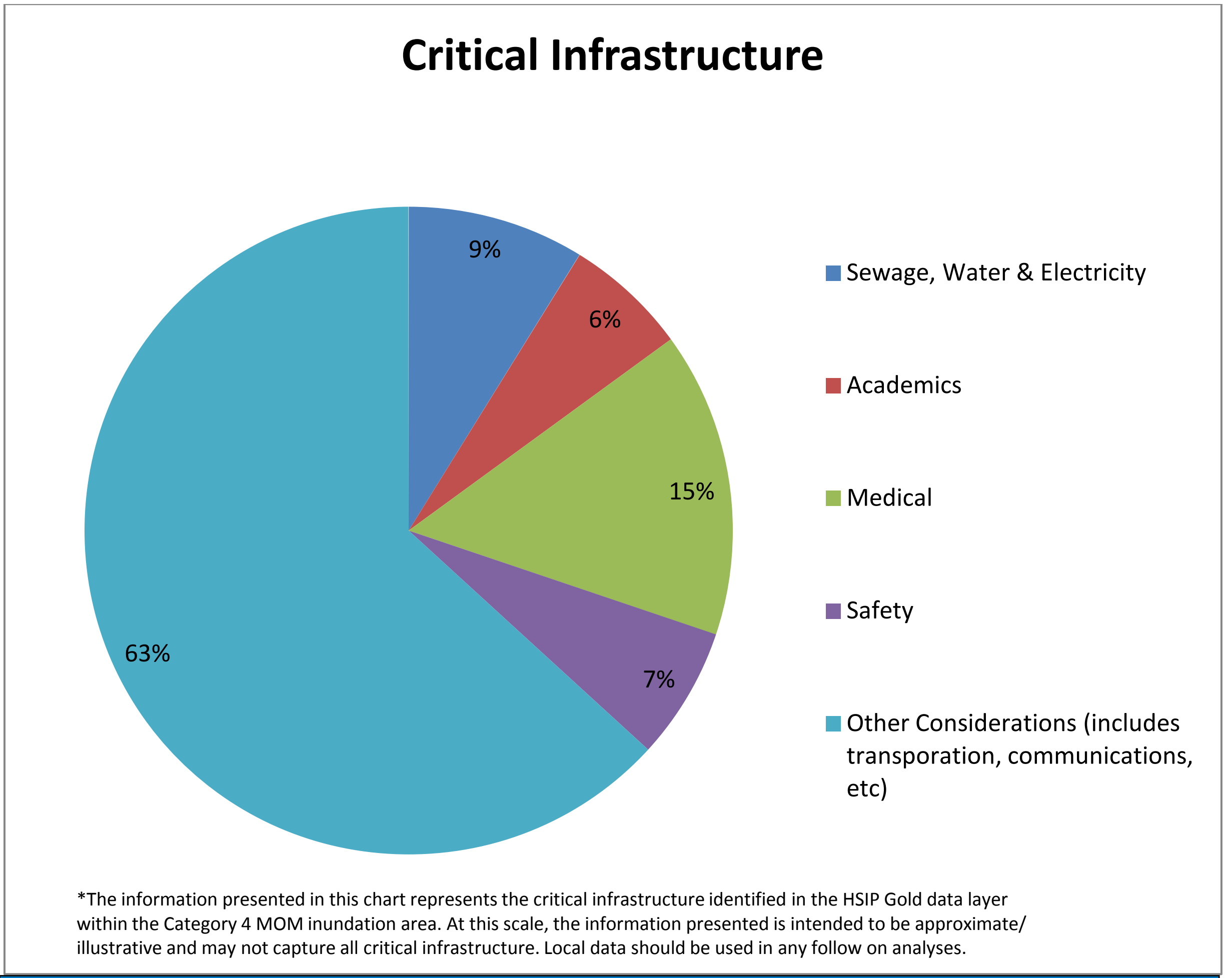


Figure 14. Vulnerable Infrastructure Elements Within the Category 4 MOM Inundation Area in the State of New York.

Social Vulnerability Characterization Index

The social vulnerability characterization captures certain segments of the population that may have more difficulty preparing for and responding to natural disasters, and was completed using the U.S. Census Bureau 2010 Census data. Important factors in social vulnerability include age, income, and inability to speak English.

Figure 15 presents the social vulnerability characterization exposure index for the State of New York. Areas with relatively higher concentrations of vulnerable segments of the population are identified from this analysis.

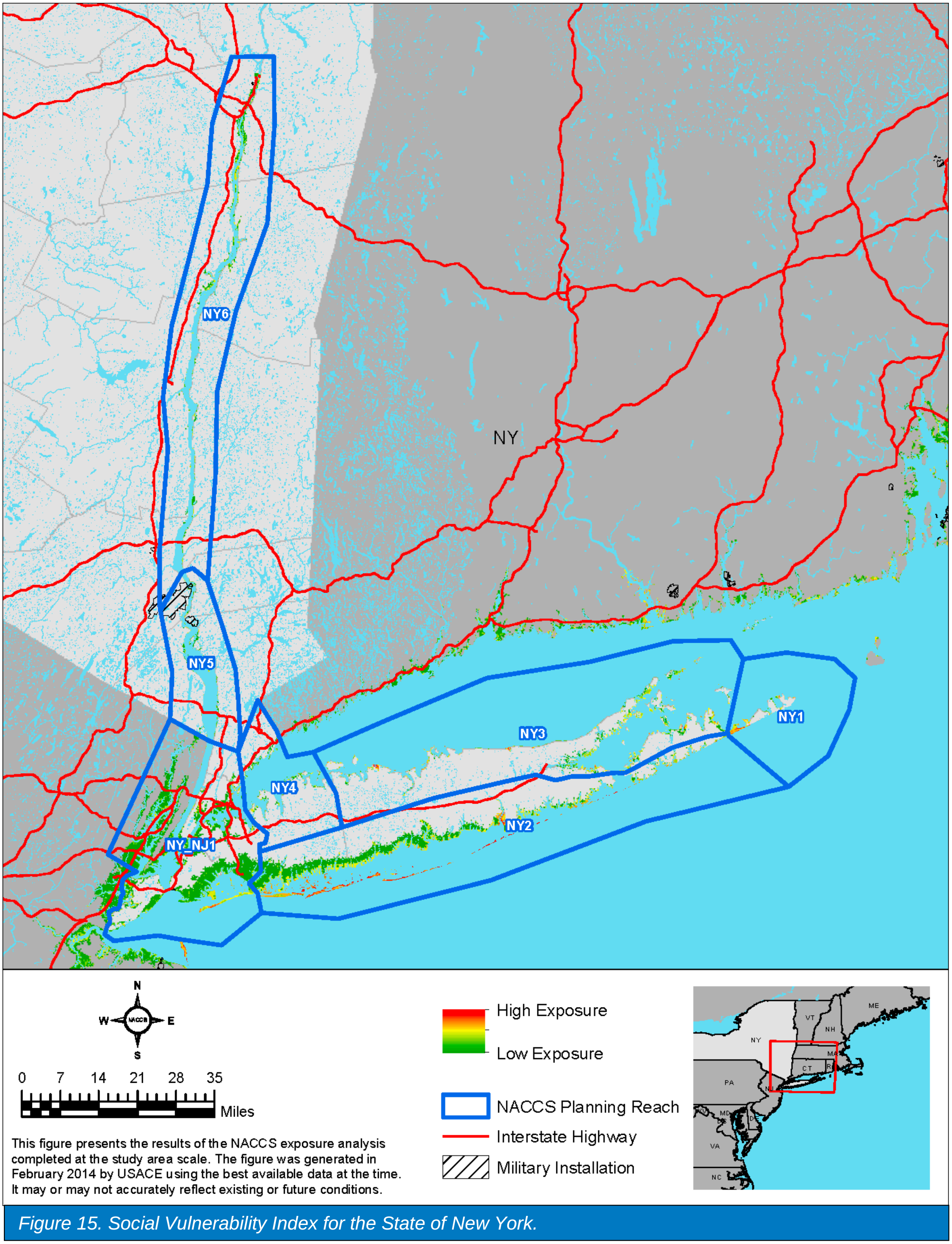


Figure 15. Social Vulnerability Index for the State of New York.

The identification of risk areas based on the social exposure analysis is provided on a reach by reach basis for each of the planning reaches in the State of New York. Social exposure captures certain segments of the population that may have more difficulty preparing for and responding to natural disasters. This includes individuals over age 65 or under age 5, as well as low income populations.

Reach: NY1

Based on the social vulnerability analysis, no areas were identified within this reach as having relatively high social vulnerability (index values above 70.0).

Reach: NY2

Based on the social vulnerability analysis, fourteen areas were identified within this reach as areas with relatively high social vulnerability. These areas were located within census tracts 4072.01, 4144, 4067.02, 4068.02, 4068.01, 4142.01, and 4143.01 (Nassau County, NY), 1010.02, 1032.01, 1010.01 (Queens County, NY) and 1456.02, 1462.01, 1462.02, and 1237.01 (Suffolk County, NY). The areas in census tracts 4072 .01, 4144, 4067.02, 4068.02, 4068.01, 4142.01 4143.01, 1456.02, 1462.01, 1462.02, and 1237.01 were identified as vulnerable mainly due to a large percent of the population being non-English speakers. Census tracts 4143.01 and 1010.02 were identified as vulnerable due to a considerable percent of the population being over 65 years old. And, census tracts 1032.01 and 1010.01 had both a moderate amount of the population being non-English speakers as well as below the poverty level.

Reach: NY3

Based on the social vulnerability analysis, four areas were identified within this reach as areas with relatively high social vulnerability. These areas were located within census tracts 1580.07, 1584.10, 1112.01, and 1701.01 (Suffolk County, NY). The areas in census tracts 1112.01 and 1701.01 were identified as vulnerable mainly due to a considerable percent of the population being non-English speakers. The area in census tract 1580.07 was identified mainly due to a large percent of the population below the poverty level. And, census tracts 1584.10 and 1701.01 were identified as vulnerable due to a large percent of the population being over 65 years old.

Reach: NY4

Based on the social vulnerability analysis, eight areas were identified within this reach as areas with relatively high social vulnerability. These areas were located within census tracts 3042.04 (Nassau County, NY), 1551.01 (Queens County, NY), and 63, 79, 94, 80, 57.02, 59.01 (Westchester County, NY). The areas in census tracts 3042.04, 63, 79, 94, 80, 57.02, and 59.01 were identified as vulnerable mainly due to a considerable percent of the population being non-English speakers. And, census tracts 1551.01, 63, 57.02, and 59.01 were identified as vulnerable due to a large percent of the population being over 65 years old.

Reach: NY5

Based on the social vulnerability analysis, ten areas were identified within this reach as areas with relatively high social vulnerability. These areas were located within census tracts 115.05, 115.06, 107.02, 107.03 (Rockland County, NY), and 143, 116, 9810, 9820, 9840, 133.01 (Westchester County, NY). The areas in census tracts 115.05, 115.06, 107.02, 107.03, 143, 116, and 133.01 were identified as vulnerable due to a large percent of the population being non-English speakers. Census tracts 115.05, 115.06, 9810, 9820, and 133.01 were identified as vulnerable due to a large percent of the population being under the poverty level. Census tracts 115.05 and 115.06 were identified as vulnerable due to a considerable percent of the population being under 5 years old. And, census tract 9840 was identified as vulnerable due to a large percent of the population being over 65 years old.

Reach: NY6

Based on the social vulnerability analysis, two areas were identified within this reach as areas with relatively high social vulnerability. These areas were located within census tracts 4.04 in Albany County, and 6400.02 in Duchess County. The areas were identified as vulnerable due to a large percent of the population being below the poverty level.

Reach: NY_NJ1

Based on the social vulnerability analysis, 808 areas were identified within this reach as areas with relatively high social vulnerability. These areas were located within the following census tracts, by county:

- Hudson County, NJ (39 census tracts): 30, 31, 62, 132, 161, 162, 163, 164, 166, 167, 168, 169, 170, 174, 175, 176, 177, 178, 153, 155, 156, 157, 159, 160, 78, 152.02, 145.02, 150.02, 17.01, 158.02, 324, 136, 143, 2, 9.02, 12.02, 18, 19, and 20.
- Bergen County, NJ (8 census tracts): 181, 412, 192.03, 192.04, 413.01, 413.02, 236.02, and 411.
- Union County, NJ (6 census tracts): 306, 313, 316.01, 316.02, 398, and 317.
- Middlesex, County, NJ (4 census tracts): 45, 46, 49, and 50.
- Essex County, NJ (35 census tracts): 82, 87, 89, 91, 92, 93, 3, 96, 9, 230, 106, 227, 111, 124, 2, 5, 8, 14, 26, 39, 48.02, 57, 67, 68, 69, 70, 71, 72, 73, 75.01, 75.02, 76, 77, 78, and 79.
- Passaic County, NJ (12 census tracts): 1756.02, 1757.03, 1758.01, 1758.02, 1753.02, 1752, 1755, 1759, 1251, 1753.01, 1754.01, and 1754.02.
- Queens County, NJ (178 census tracts): 803.01, 837, 845, 853, 855, 857, 859, 861, 863, 865, 136, 148, 871, 918, 149, 153, 157, 161, 265, 266, 267, 947, 471, 473, 475, 479, 481, 482, 483, 849, 869, 33, 85, 269.01, 271, 273, 275, 277, 279, 281, 283, 285, 287, 289, 291, 293, 485, 489, 499, 797.02, 998.02, 254, 444, 309.02, 327, 337, 339, 347, 351, 353, 361, 517, 535, 361, 517, 535, 181.01, 253.02, 269.02, 309.03, 437.01, 437.02, 443.01, 365, 373, 375, 377, 379, 381, 399, 401, 403, 545, 547, 549, 551, 553, 557, 559, 565, 443.02, 713.04, 717.01, 717.02, 797.01, 972.03, 405, 407, 409, 411, 413, 415, 1010.02, 426, 427, 439, 446.01, 446.02, 448, 450, 452, 587, 457, 459, 460, 461, 462, 463, 465, 467, 469, 1032.01, 179, 189, 198, 212, 1010.01, 235, 236, 238, 240, 243, 245, 1123, 1157, 1159, 1161, 1163, 1167, 1171, 259, 261, 263, 14, 16, 1185, 1187, 1189, 1191, 1201, 1203, 1205, 1227.02, 25, 39, 43, 47, 51, 1551.01, 1341, 1385.02, 69, 75, 79, 1451.01, 1463, 1567, 972.02, 679, 683, 697.01, 719, 721, 87, 743, 745, 889.01, and 799.
- Bronx County, NY (171 census tracts): 213.01, 215.02, 387, 283, 429.01, 67, 277, 330, 328, 319, 421, 77, 60, 133, 220, 153, 195, 215.01, 235.02, 115.02, 161, 373, 92, 48, 25, 379, 425, 123, 54, 62, 131, 64, 363, 431, 141, 301, 149, 197, 367, 365.01, 157, 361, 175, 223, 263, 399.01, 145, 193, 27.02, 229.01, 255, 385, 199, 201, 86, 243, 365.02, 229.02, 72, 371, 381, 251, 393, 56, 169, 369.01, 285, 407.01, 70, 52, 237.04, 403.04, 44, 235.01, 27.01, 23, 155, 435, 257, 151, 233.01, 230, 79, 89, 216.01, 250, 289, 253, 173, 65, 189, 129.01, 147.01, 147.02, 177.01, 177.02, 179.01, 179.02, 181.01, 181.02, 183.01, 183.02, 205.01, 205.02, 221.01,

221.02, 224.03, 237, 245.02, 267.01, 267.02, 43, 119, 87, 135, 224.01, 231, 247, 39, 233.02, 71, 391, 75, 213.02, 69, 121.01, 19, 73, 332.02, 383.01, 383.02, 403.03, 405.01, 405.02, 200, 217, 237.02, 127.01, 241, 41, 225, 415, 35, 85, 121.02, 211, 403.02, 19, 51, 63, 76, 90, 93, 117, 159, 185, 209, 33, 227.01, 389, 401, 163, 83, 239, 399.02, 236, 265, 375.04, 50.01, 50.02, and 53.

- Richmond County, NY (5 census tracts): 27, 11, 74, 81, and 133.01.
- New York County, NY (64 census tracts): 271, 240, 229, 247, 249, 219, 170, 239, 2.01, 182, 223.01, 277, 235.02, 189, 241, 188, 263, 237, 245, 243.02, 225, 232, 223.02, 253, 309, 251, 291, 283, 25, 2.02, 8, 41, 14.02, 194, 243.01, 143, 285, 36.01, 193, 174.01, 24, 178, 27, 29, 6, 18, 10.02, 22.01, 20, 16, 279, 184, 186, 261, 196, 269, 94, 293, 192, 168, 119, 242, 299, and 238.02
- Kings County, NY (271 census tracts): 298, 300, 302, 304, 306, 314, 326, 174, 176, 178, 180, 328, 330, 340, 342, 350, 352, 354, 182, 185.01, 190, 192, 194, 196, 208, 210, 360.01, 360.02, 361, 362, 364, 366, 369, 373, 382, 1144, 386, 387, 388, 389, 391, 392, 395, 398, 400, 402, 403, 404, 408, 808, 1237, 126, 348, 409, 411, 412, 413, 414.01, 416, 417, 418, 419, 493, 494, 496, 498, 505, 506, 460, 1058.04, 1198, 356.01, 356.02, 374.01, 374.02, 516.01, 610.03, 610.04, 507, 509, 511, 523, 525, 527, 529, 530, 531, 532, 533, 534, 535, 537, 212, 214, 216, 218, 220, 1058.01, 538, 539, 545, 547, 550, 552, 554, 558, 560, 222, 224, 226, 230, 232, 234, 238, 240, 242, 246, 248, 250, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594.01, 596, 252, 254, 255, 256, 257, 258, 259.01, 259.02, 260, 264, 266, 268, 270, 272, 274, 276, 278, 1190, 600, 608, 612, 281, 421, 422, 423, 424, 426, 427, 428, 429, 430, 431, 431, 432, 433, 434, 435, 436, 437, 438, 439, 441, 443, 878, 902, 906, 908, 910, 912, 445, 453, 456, 462.01, 462.02, 464, 468, 474, 478, 480, 482, 944.02, 486, 488, 489, 490, 491, 492, 2, 20, 1034, 1070, 22, 23, 29.01, 606, 1134, 1142.02, 1146, 1152, 1156, 1160, 1170, 1176.01, 52.01, 68, 72, 74, 76, 78, 1188, 1192, 1210, 1214, 546, 610.02, 616, 80, 82, 84, 85, 88, 90, 92, 94, 96, 98, 100, 101, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 128.01, 702.02, 282, 283, 284, 285.02, 286, 287, 288, 289, 290, 292, 294, 296, 130, 132, 138, 140, 762, and 788.
- Westchester County, NY (census tracts): 63, 1.01, 1.03, 2.01, 3, 4.01, 5, 10, 11.01, 11.02, 12, 13.02, 130.03, 35, 36, 37, and 62.

All of the census tracts were identified as vulnerable due to a large or considerable percent of the population being non-English speakers, with the exception of the following census tracts, located in Union, Middlesex, Essex, and Passaic Counties in New Jersey, and Richmond and Westchester Counties in New York: 62, 78, 192.03, 82, 92, 9, 230, 106, 227, 111, 124, 14, 26, 39, 48.02, 67, 918, 266, 254, 565, 972.03, 1010.02, 426, 452, 1032.01, 1010.01, 1027.02, 43, 1551.01, 1385.02, 972.02, 87, 319, 153, 141, 301, 367, 157, 175, 145, 86, 371, 169, 369.01, 285, 44, 435, 230, 173, 177.01, 205.02, 224.03, 224.01, 231, 71, 332.02, 283.02, 217, 90, 163, 375.04, 53, 27, 11, 81, 133.01, 240, 249, 235.02, 189, 243.02, 232, 194, 143, 193, 174.01, 184, 186, 94, 168, 119, 242, 238.02, 185.01, 361, 369, 373, 1144, 387, 403, 411, 1058.04, 516.01, 1058.01, 242, 572, 255, 257, 259.01, 259.02, 1190, 281, 878, 902, 906, 908, 910, 912, 464, 468, 474, 944.02, 1034, 1070, 23, 29.01, 1134, 1152, 1156, 1160, 1176.01, 52.01, 1188, 1192, 1210, 1214, 85, 702.02, 283, 285.02, 289, 1.03, 4.01, 10, and 11.02.

The following census tracts were identified as vulnerable due to a large percent of the population being under the poverty level: 82, 9, 227, 14, 26, 39, 48.02, 67, 1758.02, 972.03, 426, 39, 43, 1385.02, 972.02, 213.01, 319, 220, 115.02, 48, 25, 123, 367, 361, 175, 193, 27.02, 385, 229.02, 393, 369.01, 44, 23, 89, 147.01, 147.02, 177.01, 177.02, 221.02, 391, 217, 237.02, 41, 121.02, 403.02, 19, 117, 159, 163, 239, 399.02, 375.04, 133.01, 240, 219, 25, 186, 196, 192, 352, 361, 362, 395, 808, 1237, 507, 509, 525, 529, 531, 533, 537, 214, 539, 547, 232, 259.02, 906, 908, 910, 912, 944.02, 29.01, 1134, 1142, 1152, 1156, 1188, 1192, 1210, 1214, 85, 120, 702.02, and 283.

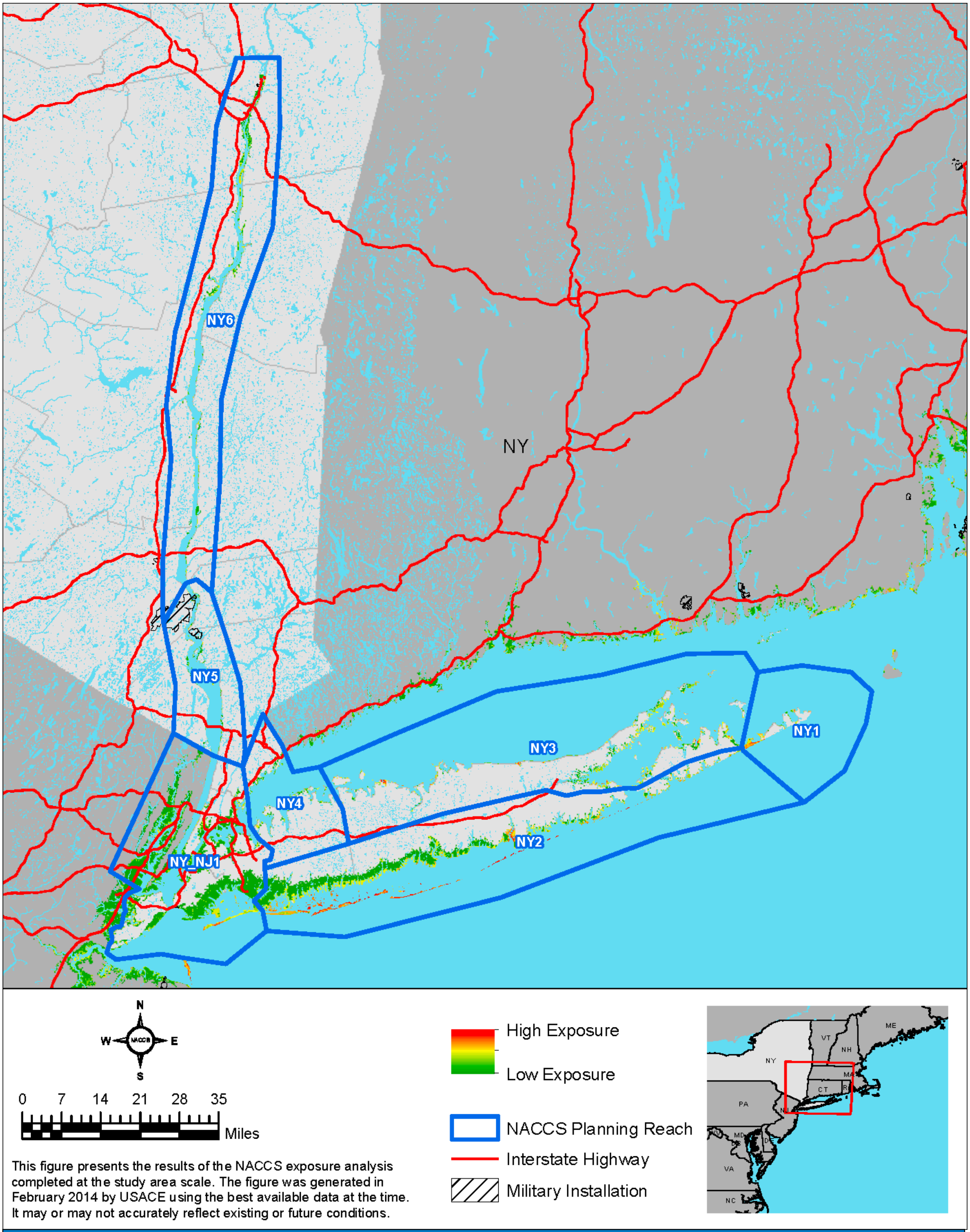
The following census tracts were identified as vulnerable due to a considerable percent of the population under 5 years old, predominantly in Kings County, with a few in Queens and Bronx Counties in New York and Passaic County in New Jersey: 1754.02, 379, 1237, 507, 509, 525, 529, 531, 533, 535, 218, 232, 234, 236, 238, 240, 242, 468, 2, 1142.02, 120, and 702.02.

The following census tracts were identified as vulnerable due to a considerable percent of the population over 65 years old dispersed throughout Reach NY_NJ1: 31, 62, 169, 78, 145.02, 158.02, 143, 9.02, 12.02, 192.03, 192.04, 413.02, 230, 111, 124, 48.02, 1757.03, 837, 845, 853, 865, 136, 918, 153, 266, 947, 473, 428, 269.02, 281, 285, 287, 499, 998.02, 443.01, 713.04, 717.01, 717.02, 797.01, 1010.02, 426, 450, 452, 236, 243, 245, 1157, 1159, 1161, 1163, 1187, 1201, 1203, 1205, 1551.01, 1341, 75, 1463, 679, 683, 719, 721, 743, 745, 889.01, 59.02, 301, 371, 285, 435, 250, 183.01, 205.02, 224.01, 75, 332.02, 27, 81, 170, 2.01, 277, 189, 241, 25, 2.02, 8, 41, 14.02, 143, 174.01, 24, 27, 29, 6, 10.02, 20, 16, 196, 94, 168, 119, 238.02, 300, 302, 304, 306, 314, 174, 176, 178, 330, 340, 342, 350, 352, 354, 208, 210, 360.01, 360.02, 366, 373, 386, 388, 392, 398, 400, 402, 404, 408, 808, 414.01, 416, 418, 1058.04, 356.01, 365.02, 374.01, .74.02, 610.04, 532, 1058.01, 538, 552, 558, 560, 236, 240, 242, 582, 586, 588, 592, 594.01, 596, 260, 270, 272, 274, 278, 600, 608, 612, 422, 426, 428, 430, 432, 878, 910, 462.10, 1070, 22, 606, 1146, 52.01, 546, 610.02, 616, 114, 282, 284, 285.02, 286, 288, 290, 292, 294, 296, 132, 140, 63, 5, and 36.

Environmental and Cultural Resources Index

Environmental and cultural resources were also evaluated as they relate to exposure to the Cat 4 maximum inundation. Data from national databases, such as the National Wetlands Inventory and The Nature Conservancy Eco-regional Assessments; data provided from USFWS, including threatened and endangered species habitat and important sites for bird nesting and feeding areas; shoreline types; and historic sites and national monuments, among others were used in this analysis to assess environmental and cultural resource exposure. It should be noted that properties with restricted locations, typically archaeological sites, and certain other properties were omitted from the analysis due to site sensitivity issues.

Figure 16 depicts the environmental and cultural resources exposure index for the State of New York. This exposure analysis is intended to capture important habitat, and environmental and cultural resources that would be vulnerable to storm surge, winds, and erosion. It should be noted though, that mapped areas displaying high exposure index scores (shown in red and orange) may not include all critical or significant environmental or cultural resources, as indexed scores are additive; the higher the index score, the greater number of resources present at the site. Impacts and recovery opportunity would vary across areas and depending on the resource affected.



This figure presents the results of the NACCS exposure analysis completed at the study area scale. The figure was generated in February 2014 by USACE using the best available data at the time. It may or may not accurately reflect existing or future conditions.

Figure 16. Environmental and Cultural Resources Exposure Index for the State of New York.

It should be noted that some regions that may be recognized as important in one category or another may not show up on the maps as a location identified as a high (red and orange) environmental and cultural resource exposure area. These areas may have met only one or just a few of the criteria used in the evaluation. Further, due to the minority contribution of cultural resources in the analysis (40 percent) and their general lack of proximity to key natural resource areas, historic properties may not be strongly represented.

A description of the high environmental and cultural resource exposure areas for each planning reach is described below.

Reach: NY1

This analysis resulted in nearly 500 acres of high (red and orange) environmental and cultural resource exposure area in reach NY1.

Big Reed Pond; Oyster Pond; Montauk Point form nearly 480 acres of the Coastal Barrier Resources System (CBRS) in the high environmental and cultural resources exposure index area. Over 498 acres of habitat is provided for roseate terns, piping plovers, red knots, and rare colonial waterbirds. Approximately 290 acres of The Nature Conservancy (TNC) priority conservation area exists in these exposure areas; as well as 420 acres of city, county, and state parks larger than 10 acres in size.

The shoreline is coarse grained (95 acres). Approximately 145 acres of tidal emergent marsh, 1 acre of freshwater emergent marsh, and 24 acres of freshwater forested/shrub wetlands can also be found in these exposure areas.

There is one historic site (Montauk Point Lighthouse) and 500 acres of cultural resources buffer in the high environmental and cultural resources exposure index area in reach NY1.

Reach: NY2

This analysis resulted in approximately 18,600 acres of high (red and orange) environmental and cultural resources exposure index area in reach NY2.

Napeague, Southampton Beach, Tiana Beach, Amagansett; Georgica/Wainscott Ponds, Sagaponack Pond; Mecox, Pond, and Fire Island form nearly 17,500 acres of the CBRS in the high environmental and cultural resources exposure index area.

Over 16,909 acres of habitat is provided for roseate terns, piping plovers, red knots, and rare colonial waterbirds. Approximately 18,500 acres of TNC priority conservation area exists in these exposure areas; as well as 1,500 within U.S. Fish and Wildlife Service (USFWS) Refuges, 7,600 acres of city, county, and state parks larger than 10 acres in size. Fire Island National Seashore is within reach NY2.

The shoreline of the high exposure index areas are composed of about 2,000 acres of fine unconsolidated material (muds) and 2,800 acres of coarse-grained sandy beaches. Approximately 2,600 acres of seagrass, 5,300 acres of tidal emergent marsh, 160 acres of freshwater emergent marsh, and 140 acres of freshwater forested/shrub wetlands can also be found in the exposure area.

There is one Federal park (Fire Island National Seashore), one historic site (Fire Island Light Station), and 18,400 acres of cultural resources buffer within the high environmental and cultural resources exposure index area in reach NY2.

Reach: NY3

This analysis resulted in nearly 2,970 acres of high (red and orange) environmental and cultural resources exposure index area in reach NY3.

Fisher Island Barriers, Crane Neck, Old Field Beach, Cedar Beach, Acabonack Harbor, Gardiners Island Barriers, Sands Point; Prospect Point, Dosoris Pond, the Creek Beach, Centre Island, Lloyd Beach, Lloyd Point, Lloyd Harbor, Centerpoint Harbor, Hobart Beach, Eatons Neck, Crab Meadow, Sunken Meadow, Stony Brook Harbor, Wading River, Baiting Hollow, Luce Landing, Mattituck Inlet, Goldsmith Inlet, Truman Beach, Plum Island, Orient Beach, Pipes Cove, Conkling Point, Southold Bay, Cedar Beach Point, Hog Neck Bay, Little Creek, Downs Creek, Robins Island, East Creek , Indian Island, Flanders Bay, Red Creek Pond, Squareuire Pond, Cow Neck, North Sea Harbor, Clam Island, Mill Creek, Short Beach, Gleason Point, Shell Beach, Crab Creek, Hay Beach Point, Shelter Island Barriers, Mashomack Point, Smith Cove, Fresh Pond, Northwest Harbor, Sammys Beach, and Hog Creek form nearly 2,900 acres of the CBRS in the high environmental and cultural resources exposure index area.

Over 2,960 acres of habitat is provided for roseate terns, piping plovers, red knots, and rare colonial waterbirds. Approximately 74 acres of USFWS protected area exists in the NY3 high exposure index areas; as well as 620 acres of city, county and State parks larger than 10 acres in size.

The shoreline is comprised of 29 acres of fine unconsolidated material (muds and organics) and 139 acres of coarse-grained sand and gravel beaches. Approximately 39 acres of seagrass, 2,340 acres of tidal emergent marsh, 0.25 acres of freshwater emergent marsh, and 10 acres of freshwater forested/shrub wetlands can also be found in these exposure areas.

Historic sites within the high environmental and cultural resources exposure index area in reach NY3 include the William Cauldwell House, Cedar Island Lighthouse, Smith-Taylor Cabin, and Josiah Woodhull House. There are also 2,950 acres of cultural resources buffer in the high exposure index areas of NY3.

Reach: NY4

This analysis resulted in approximately 55 acres of high (red and orange) environmental and cultural resources exposure index area in reach NY4.

Sands Point; Prospect Point, Dosoris Pond, the Creek Beach, Centre Island, Lloyd Beach, Lloyd Point form nearly 52 acres of the Coastal Barrier Resources System (CBRS) in the high environmental and cultural resources exposure index area. Approximately, 2 acres of habitat is provided for the threatened piping plover.

Approximately 85 acres of USFWS protected area exists in these exposure areas. There are 2 acres of county and State parks larger than 10 acres in size.

Within the exposure area, the shoreline is comprised of 7 acres of fine-grained unconsolidated material (mud) and there are 45 acres of tidal emergent marsh. There are also 55 acres of cultural resources buffer.

Reach: NY5

This analysis resulted in no high (red or orange) environmental and cultural resources exposure index areas in reach NY5.

Reach: NY6

This analysis resulted in no high (red or orange) environmental and cultural resources exposure index areas in reach NY6.

Reach: NY_NJ1

This analysis resulted in approximately 234 acres of high (red and orange) environmental and cultural resources exposure index areas in reach NY_NJ1.

Jamaica Bay and Sandy Hook contribute to 228 acres of the CBRS in the high environmental and cultural resources exposure index area.

Approximately 6 acres of TNC priority conservation area exists in these exposure areas. Over 231 acres of habitat is provided for roseate terns, piping plovers, red knots, and rare colonial waterbirds. There are 2 acres of city, county and State parks larger than 10 acres in size. There are no USFWS protected areas in this exposure area, but there are approximately 36 acres of Federal parks (units of the National Parks of New York Harbor).

The 36 acre shoreline is comprised of coarse-grained unconsolidated sand and gravel shoreline. Approximately 4 acres of freshwater emergent marsh and 2 acres of tidal emergent marsh can also be found in these exposure areas.

Reach NY_NJ1 has one National Monument, Fort Tilden, and two Federal parks (Breezy Point and Jacob Riis Parks) within the high environmental and cultural resources exposure index area. There are also nearly 230 acres of cultural resources buffer in NY_NJ1.

Composite Exposure Index

All three of the exposure indices were summed together to develop one composite index that displays overall exposure. Figure 17 depicts the Composite Exposure Index for the State of New York.

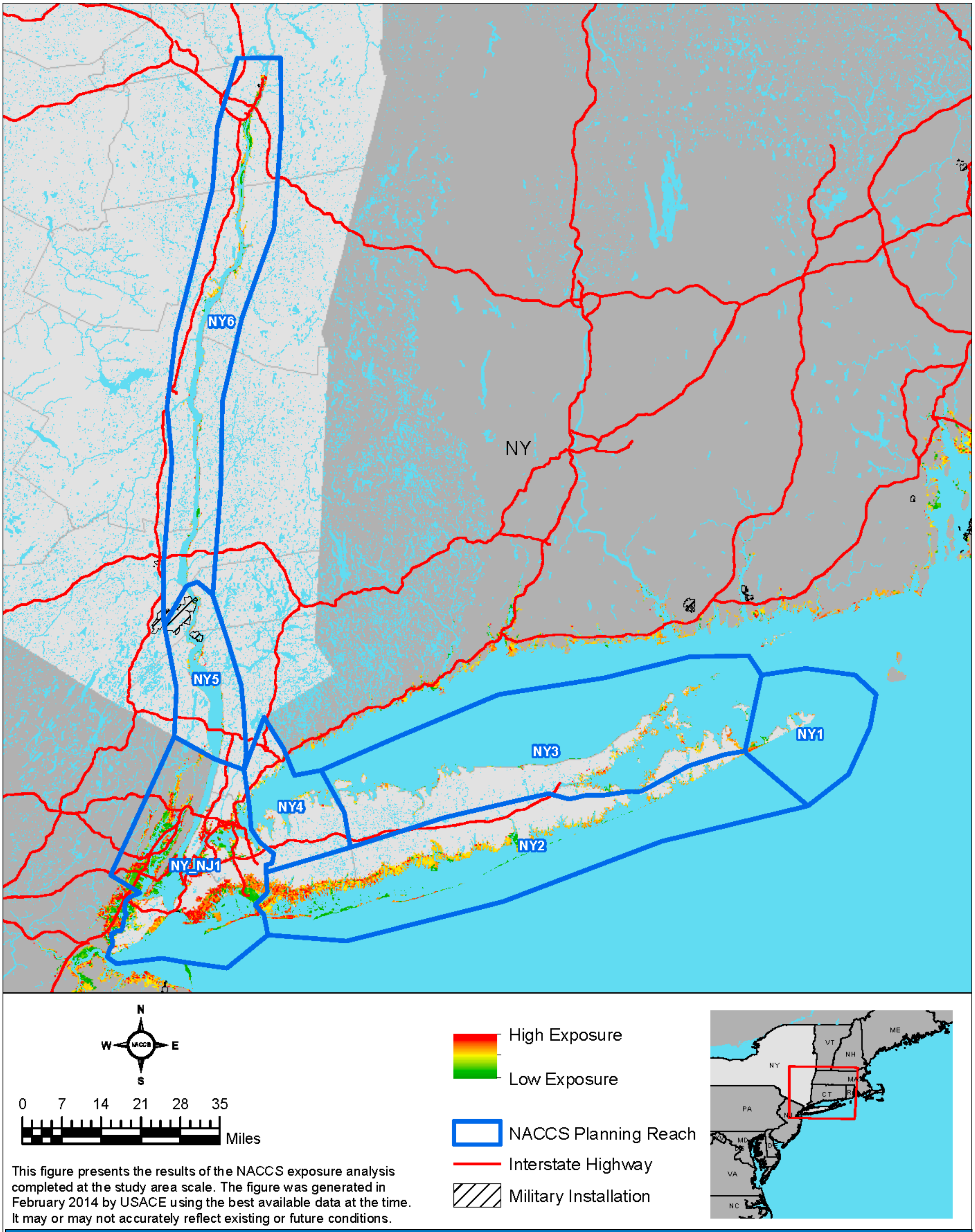


Figure 17. Composite Exposure Index for the State of New York.

IV.2. NACCS Risk Assessment

Exposure and coastal flood inundation mapping is used to identify the specific areas at risk. Once the exposure to flood peril of any area has been identified, the next step is to better define the flood risk. The Framework defines risk as a function of exposure and probability of occurrence. For each of the floodplain inundation scenarios, Category 4 MOM, 1 percent flood plus three feet, and the 10 percent flood, three bands of inundation were created. The bands correspond with the flooding source to the 10-percent inundation extent, the 10-percent to the 1-percent plus three feet extent, and the 1-percent plus three feet to the CAT4 MOM inundation extent. The 1-percent plus three feet extent was defined as the CAT2 MOM because at the study area scale there were areas that did not include FEMA 1-percent flood mapping. This process was completed for the composite exposure assessment in order to generate the NACCS risk assessment. The data was symbolized to present areas of relatively higher risk, which based on the analysis, corresponds with the three bands that were used in the analysis. Subsequent analyses could incorporate additional bands, which would present additional variation in the range of values symbolized in the figure. Figure 18 depicts the results of this risk assessment using the composite exposure data for the State of New York.

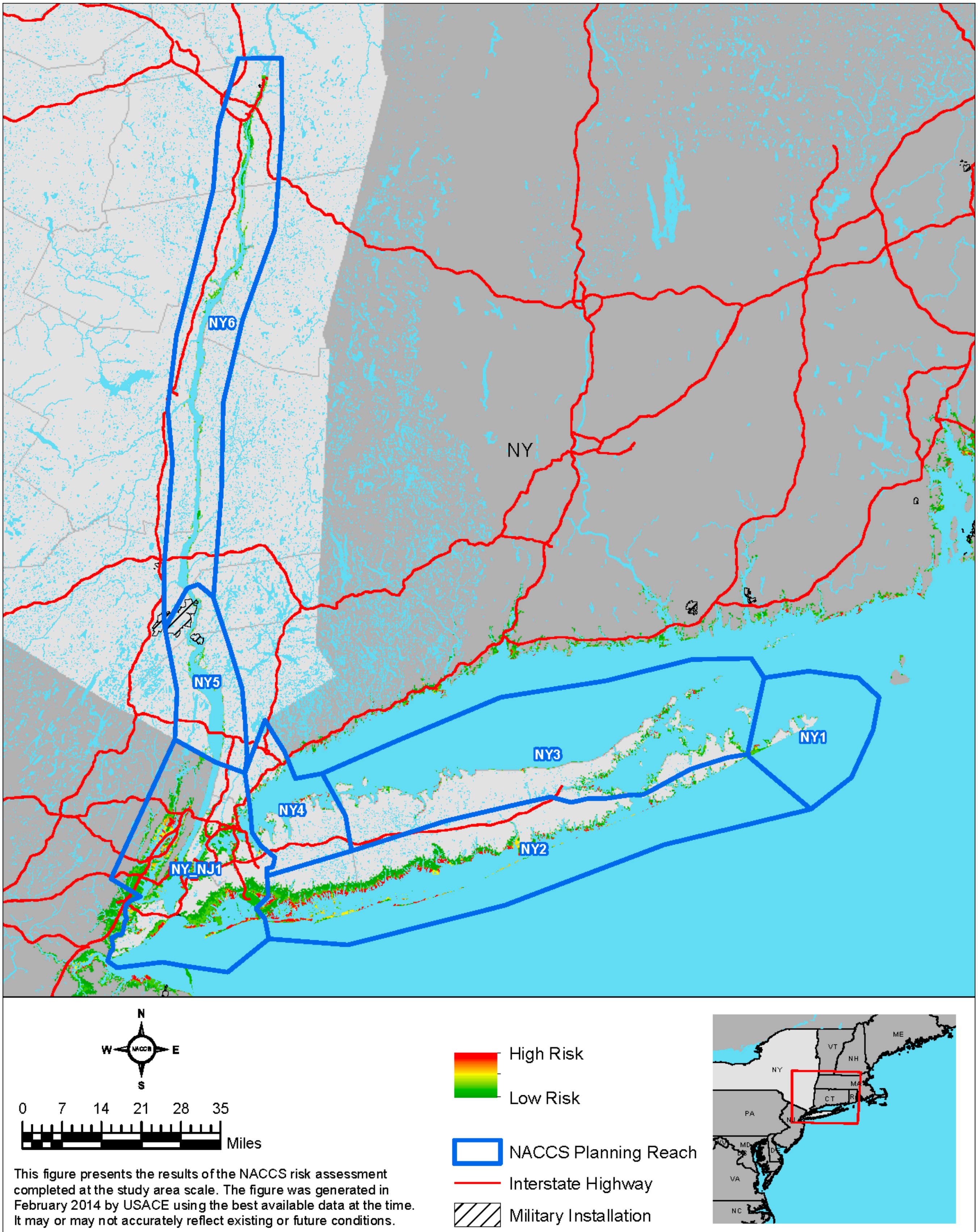


Figure 18. Risk Assessment for the State of New York.

IV.3. NACCS Risk Areas Identification

Applying the risk assessment to the State of New York identified 51 areas for further analysis (Figure 19). These locations are identified by reach in Figure 20 through Figure 26 and are described in more detail throughout this section.

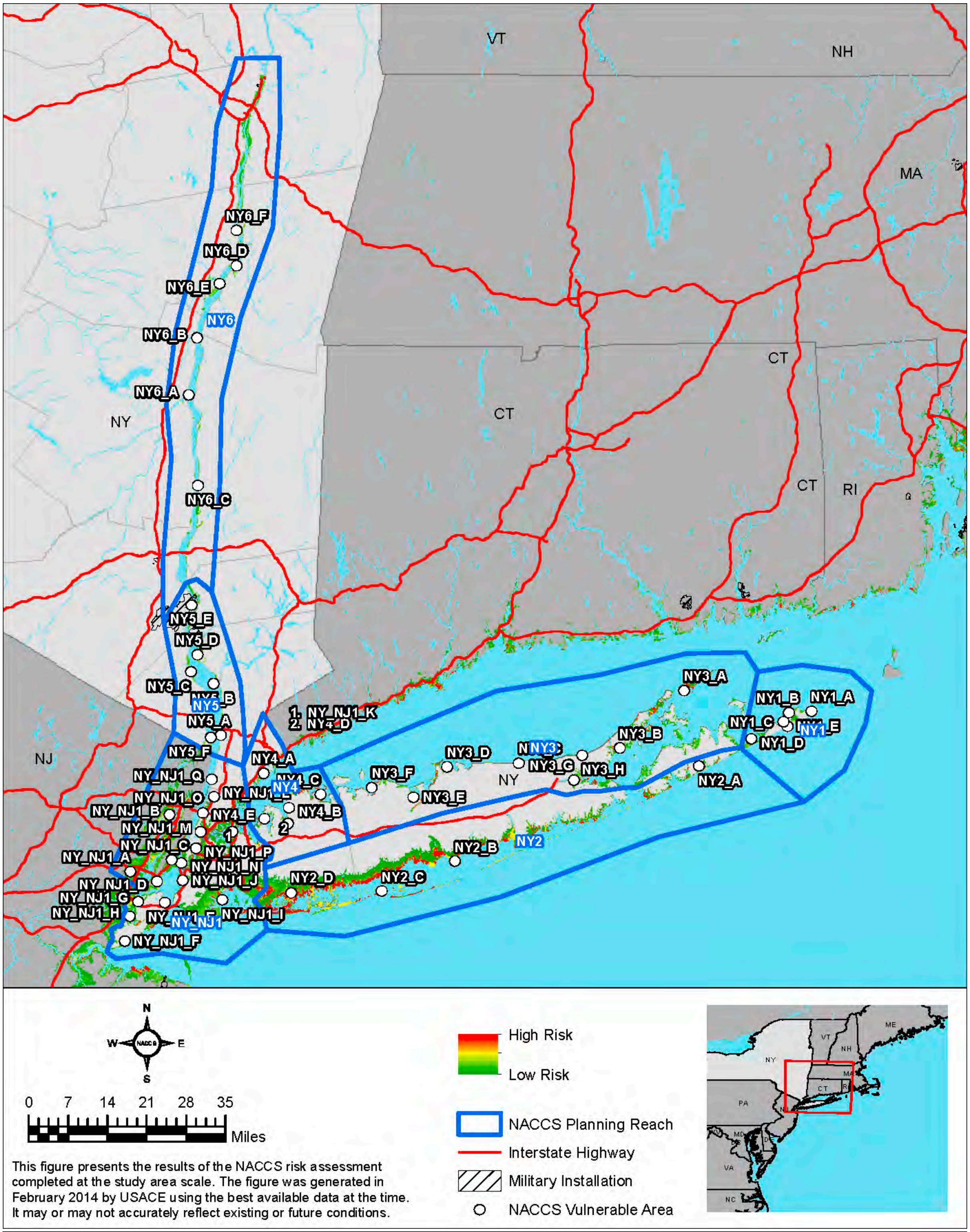


Figure 19. Risk Areas in the State of New York.

Reach: NY1

The shoreline of New York Reach 1 (Figure 20) on the eastern end of Long Island is classified as beach, with some bluff, limited presence of USACE coastal flood risk management projects, and moderate floodplain. Five areas of high risk were identified in this reach and are described in this section.

NY1A: Montauk Point Lighthouse

Bluff erosion threatens a cultural resource that has an authorized but unconstructed project. The Montauk Point study area, including the historic lighthouse, is located on a bluff at the eastern end of the southern fork of Long Island in the Town of East Hampton, Suffolk County, NY. The area surrounding the lighthouse is operated as a State park and is used primarily by fishermen and sightseers. The Montauk Point Lighthouse was commissioned by President Washington and completed in 1796, and is on the National Register of Historic Places. Since its construction, the lighthouse has served as an important navigation aid for the first land encountered by ships headed for New York/New Jersey Harbor and Long Island Sound, as well as other ports on the eastern seaboard. Its original position was approximately 300 feet from the eastern tip of Long Island, but the combined forces of storm induced erosion and long term constant erosion now leave less than 50 feet of land in front of the structure. The entire State park, which surrounds the lighthouse complex, is being increasingly threatened by the loss of protective beachfront land.

NY1B: Lake Montauk Harbor

Lake Montauk Harbor is located on the south fork of eastern Long Island, within the Town of East Hampton, Suffolk County, NY. Shoreline erosion threatens the cluster of residences located along the west side of Montauk Lake Harbor, the Coast Guard Station on Star Island, and Montauk Airport on the eastern side of Lake Montauk Harbor. There is a ferry that runs between Lake Montauk and Block Island, Martha's Vineyard, and New London, CT. There is an existing Federal navigation project at Lake Montauk Harbor. A dual purpose Feasibility Study is currently underway to address storm risk management and navigation improvements.

NY1C: Fort Pond

Fort Pond is located within the Town of East Hampton. The problem area is the shorefront along Fort Pond Bay, from Tuthill Road westward along Navy Road. A Naval Training Station and Naval Aviation Base were established here during World War I. The Air Base is inactive. There are electrical and power facilities located within this problem area. Structures along the shore of Fort Pond Bay are threatened by shoreline erosion.

NY1D: Lazy Point – Napeague

The communities of Lazy Point and Napeague are located along low-lying shorefront, within the Town of East Hampton. According to local lore, the name of Napeague derives from a Native American meaning, "Land overflowed by the sea."[1] This area was submerged during the Hurricane of 1938. No infrastructure was identified within this problem area.

[1] http://blog.1townandcountry.com/2010/12/09/whats-in-the-name-napeague/

NY1E: Downtown Montauk/Ditch Plains

The hamlet of Montauk and the community of Ditch Plains are located on the southern shore of Long Island. Situated between the Atlantic Ocean and Fort Pond, these are developed residential communities with strong tourism and recreational fishing industries. As these communities straddle the Montauk Highway, which is the high ground, they are threatened by tidal flooding from both the Atlantic Ocean and Fort Pond. The Long Island Rail Road terminates at Montauk.

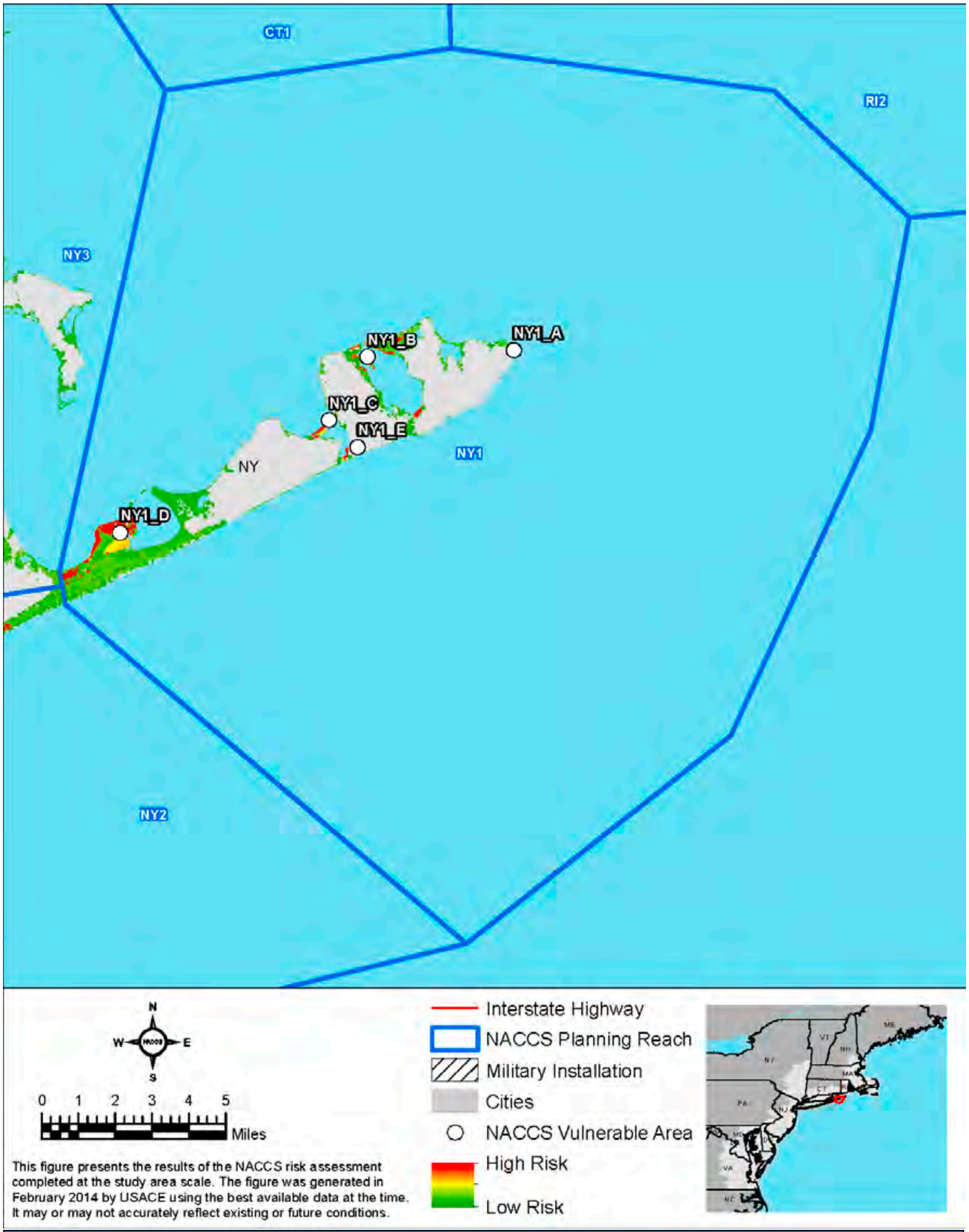


Figure 20. NY1 Reach Risk Areas

Reach: NY2

The shoreline of New York Reach 2 (Figure 21) on the south shore of Long Island is beach, with significant presence of USACE coastal flood risk management projects, and extensive 1 percent floodplain. The south shore of Long Island is a managed system of Federal and local navigation channels and inlets, in addition to USACE shore projects. Four areas of high risk were identified in this reach and are described in this section.

NY2A: South Hampton and East Hampton coastal ponds

Within the boundaries of the Towns of Southampton and East Hampton, the coastal ponds and several bodies of water are situated just landward of the southern shorefront. The largest of these water bodies include Hook Pond, Georgica Pond, Sagaponack Lake, Mecox Bay and Agawam Lake. These ponds, to varying degrees are hydraulically connected to the ocean. There are low-lying, expensive developments within Amagansett, East Hampton, Wainscott, Sagaponack, Bridgehampton, Water Mill, and Southampton that are flooded when the mouths to the coastal ponds breach. Overall, development tends to be less dense, and generally constructed with greater setbacks from the ocean. As a result, damages to the existing infrastructure tend to be localized.

NY2B: Fire Island Inlet to Montauk Point (FIMP) – Fire Island Inlet to Shinnecock Inlet

One significant critical area is on the southern shore of Suffolk County, from Fire Island Inlet extending eastward to Shinnecock Inlet, in the towns of Islip, Brookhaven, and Southampton. It includes the barrier island chain from Fire Island Inlet to Southampton inclusive of the Atlantic Ocean shorelines, and adjacent back bay areas along Great South, Moriches, and Shinnecock Bays, and extends landward to Montauk Highway. There is an authorized Fire Island to Montauk Point project that is currently under a reformulation study. The study area extends eastward beyond NY2B to Montauk Point; NY2B corresponds to the western segment of the study area.

Within NY2B, along the barrier islands, storm damages to developed areas are due to wave attack, erosion of the beach and dune, and tidal flooding of infrastructure. But in addition to storms impacting infrastructure on the barrier island, the barrier island itself is also vulnerable to storms which can erode the beach and dune system, which experience overwash and ultimately breach (inlet formation) in areas of the barrier island. When a breach occurs, it impacts both the barrier island and back bays system not only during the storm, but for an extended period after the storm. When a breach opens, it tends to be relatively small, but if not closed quickly, can grow rapidly over time. As these breaches grow, they also may migrate (move along the island) and can overwash or destroy buildings and other infrastructure on the barrier island. Breaches also impact the hydraulic stability of the existing maintained inlets, which can result in increased sediment deposition in the inlet channels, and compromised navigability of the inlet. One of the potentially greatest impacts on the system is the hydrodynamic impact. When a breach occurs, it can increase flooding in the back bay environment due to tides and storm activity, and this effect continues to increase as the breach grows.

Conditions in the back bay environment are significantly different than that along the Atlantic Ocean shoreline. Like the ocean shoreline, this area is vulnerable to tidal flooding that occurs as a result of hurricanes and nor’easters. When a storm impacts the area, storm surge and waves impact the Ocean shoreline. That surge is propagated into the bays through the inlets. The passage through the relatively narrow inlets limits the height of flooding in the bays, and also dramatically reduces wave heights in the bay. During storm events there can also be a pronounced water level setup in the bay that occurs due to winds. The height of flooding in the back bays is generally lower than along the ocean, but the impact of flooding in this area is great. The terrain of the south shore of Long Island is low and flat. Much of the study area has been heavily developed, and in many areas the development was built prior to the National Flood Insurance Program, and is subject to frequent flooding. These areas flood due to water that enters through the inlets and is setup in the bay. The problem of flooding, however, is made much worse if there is a breach of the barrier island. Breaches of the barrier island provide additional pathways connecting the ocean and the bay which allows for the increased penetration of ocean surges into the bay. When a storm impacts the area, when the barrier island does not breach, there are approximately 9,000 mainland buildings which would be inundated by a 1 percent flood.

NY2C: Fire Island Inlet and Shores Westerly. Ocean Parkway, DOT Roadwork

This problem area is on the eastern side of the Jones Beach Island, a barrier island on the west side of Fire Island Inlet. The problem area on Jones Beach Island extends to approximately the border between Nassau and Suffolk counties. Ocean Parkway, on which New York State Department of Transportation has had significant investment in protecting, runs east-west along the island. Jones Beach Island, and the smaller barrier islands behind it, provides protection to the associated back bay communities. At the eastern end of NY2C, the Robert Moses Causeway links the barrier islands to the rest of Long Island and serves as a critical evacuation route.

NY2D: Nassau County Back Bays, Jones Beach Island, and Long Beach

Problem area NY2D includes the barrier islands of Jones Beach and Long Beach, and includes the back bays in Nassau County and Suffolk County up to the Robert Moses Causeway to the east. There are densely populated communities from Valley Stream to West Slip with the attendant infrastructure, including airports, ports, hospitals, wastewater treatment plants, electrical facilities, and extensive rail and bus networks in the back bay area. The barrier island (partially covered under NY2C) is not densely populated, but measures on it would provide protection to the back bay.

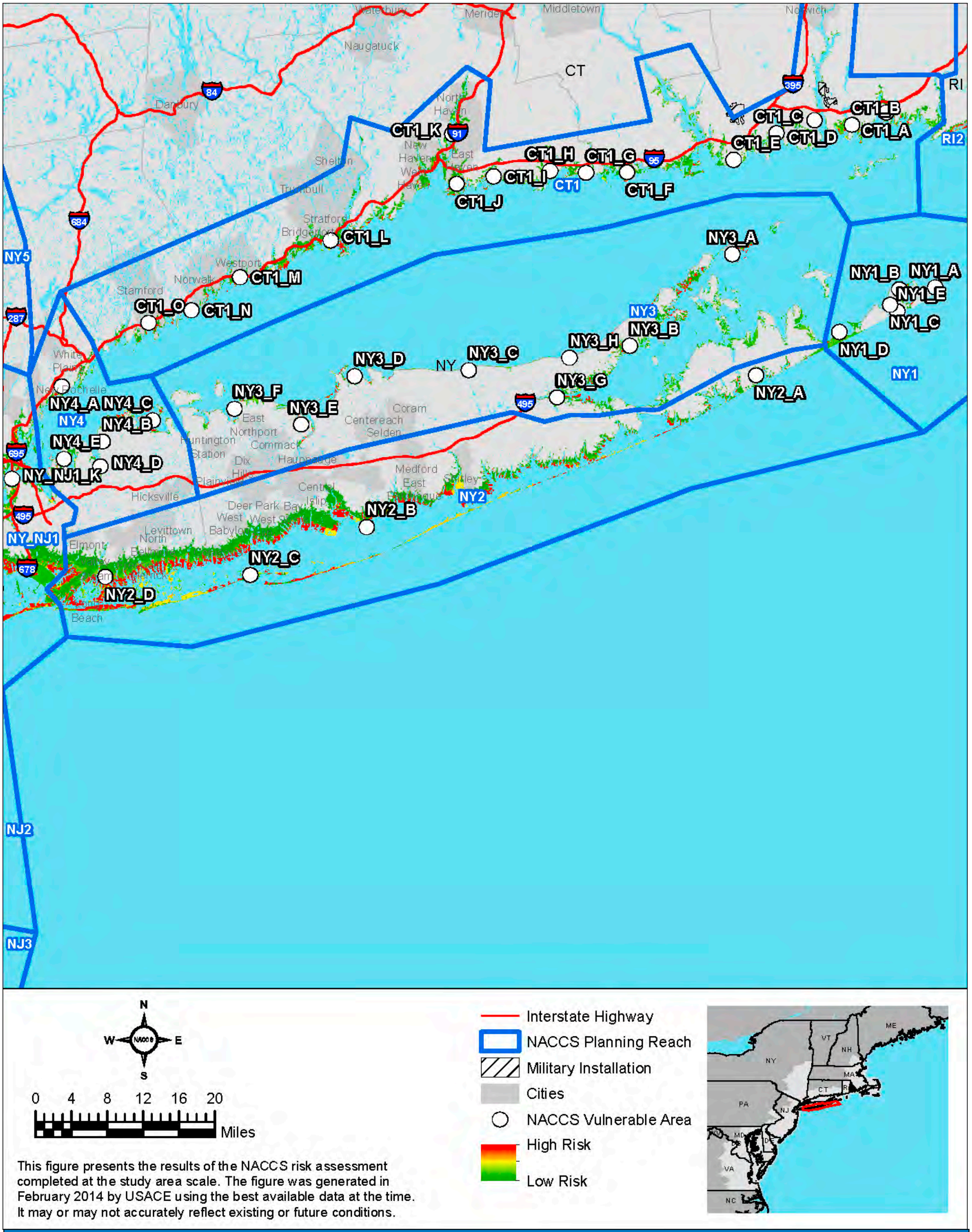


Figure 21. NY2 Reach Risk Areas.

Reach: NY3

The shoreline of New York Reach 3 (Figure 22) on the north shore of Long Island is beach, with some urban shoreline, very limited presence of USACE coastal flood risk management projects, and moderate floodplain. Eight areas of high risk were identified in this reach and are described in this section.

NY3A: Hashamomuck Cove

Hashamomuck Cove is located on the north (Long Island Sound) shore of the north fork of Long Island. There is an existing USACE Feasibility Study for coastal flood risk management. The study area extends along both sides (Long Island Sound and Peconic Bay) of the north fork, east to Orient Point and west to, and including, both sides of Goldsmith's Inlet. Communities include Orient Point, Orient, East Marion, Greenport, Greenport West, and Southold within the Town of Southold. There are several businesses and private homes that are subject to substantial overwashing and erosion during coastal storms. Additionally, County Road 48 may be subject to undermining along Hashamomuck Cove. A Federal emergency shoreline stabilization project (CAP Section 14) along State Route 25, completed in 2011, was damaged due to erosion of the shoreline. Residential development is relatively sparse, and there is some commercial and recreational boating. The primary problem in NY3A is erosion, followed by flooding and wave attack.

NY3B: Mattituck Inlet and Creek

Mattituck Harbor is located on the north fork of Long Island, 85 miles east of New York City. The problem area is bordered on the north by Long Island Sound and Great Peconic Bay to the south. Mattituck Inlet and Creek serves as the only safe harbor along the North Shore from Mount Sinai to Orient Point. The existing navigation project includes a 2-mile long 7-foot (MLW) deep channel, entrance jetties, and an anchorage area. There is significant beach and dune erosion at Mattituck, as the jetties and the creek flow tend to block some of the long shore sediment transport that would normally nourish the area and replace some of the beach material lost to normal shoreline erosion. The Hurricane Sandy coastal barrier remaining between the waters of Long Island Sound and Mattituck Creek has narrowed and could be breached by coastal storms. A breach would render the stabilized inlet inoperative and would immediately create severe navigation and economic dislocations. Communities affected include Mattituck, Laurel, Cutchogue, and New Suffolk.

NY3C: Long Island Power Authority (LIPA), Northport

A Long Island Power Authority (LIPA) plant is located on the north shore between Shoreham and Wildwood, including power generator plants, substations, and units. There is also a nuclear power plant at Shoreham, decommissioned in 1994, and a port in the problem area. The facility provides power to parts of Long Island.

NY3D: Mt. Sinai Harbor, Stony Brook Harbor, and Port Jefferson

This problem area includes Mt. Sinai Harbor, Port Jefferson, and Stony Brook Harbor within the Town of Brookhaven. It includes the villages of Stony Brook, Old Field, Setauket, East Setauket, Poquott, Port Jefferson, Mt. Sinai, Belle Terre, Head of the Harbor, and the eastern portion of Nissequogue. These are small boat harbors with shorefront communities. Residential development and coastal structures are relatively sparse, except for Port Jefferson where there is industrial, residential, and recreational development and a commercial center in Stony Brook. Historically, flooding from Long

Island Sound and Port Jefferson Harbor have caused major damages in the area, especially in downtown Port Jefferson, Poquott, Old Field, and Stony Brook. Flooding from Mt. Sinai Harbor affects the communities of Mt. Sinai and Belle Terre. Transportation infrastructure includes a major ferry between Port Jefferson and Bridgeport, CT, and an airport.

NY3E: Nissequogue River

Within the Town of Smithtown, the communities on the Nissequogue River include Nissequogue to the east and Kings Park on the west. Kings Park is more densely populated than Nissequogue. The primary problem in this problem area is erosion, with long term erosion rates estimated as high as 3.5 feet per year. Generally speaking, the flooding problem in this area is limited by the presence of high bluffs and extensive undeveloped areas.

NY3F: Asharoken, Huntington Bay and Northport Bay

This problem area includes Huntington Bay, Northport Bay, and the Village of Asharoken within the Town of Huntington. It extends from Sandy Point in Huntington Harbor eastward to Blanchard Lake. Communities within this stretch include Eatons Neck, Asharoken, Northport, Centerport, Halesite, and Huntington Bay. Eastward from the south end of West Beach on Eatons Neck, the shorefront is mostly privately owned except for West Beach, the U.S. Coast Guard Station on Eatons Neck, and the Centerport Beach and Park. This section is mostly sparse residential development with some industrial development east of Asharoken Beach. Numerous bulkheads line the shore along Long Island Sound at the southern end of Asharoken Beach with the major feature being the stabilized inlet adjacent to the LIPA Northport power plant. Within this section, the primary problem is predominantly the result of erosion along Asharoken Beach and the associated lack of a protective beach. This continued erosion has reached rates of up to 7 feet per year and threatens to sever Asharoken Avenue, the only access to the community of Eatons Neck. The area is also susceptible to storm surge. Additionally, severe bluff erosion at Eatons Neck Point has been observed adjacent to the Coast Guard Station which has led to the construction of several segments of bluff stabilization measures. There is an existing USACE Storm Damage Protection and Beach Erosion Control Study to investigate solutions to this problem at Asharoken.

West of Eatons Neck, from the Huntington Bay/Centerport Village boundary, this section of shoreline is densely populated with residences as well as private beaches and yacht clubs. In contrast to the eastern portion of NY3F, the primary problem here is flooding from Huntington Bay caused by storm surge. During severe storms, flood waters and waves inundate low lying areas causing extensive flood damage, with buildings along the Huntington Bay shoreline suffering extensive damage. Impacts were widespread with damages reported from Sandy Point at the entrance to Huntington Harbor to Knollwood Beach at the entrance to Centerport Harbor. Erosion is not a major problem in the western portion of NY3F.

NY3G: Riverhead (Peconic River floodplain)

This problem area is located at the beginning of the North Fork of Long Island, which is developed to Mattituck. In this stretch, the communities of Riverhead, Riverside, Flanders, Aquebogue, and Jamesport are vulnerable to storm surge from Flanders Bay, Reeves Bay, and the Peconic River, the head of which is located at Riverhead. Riverhead is the county seat of Suffolk County and is also the eastern terminus of the Long Island Expressway.

NY3H: Northville Petroleum Depot

The Northville facility consists of nearly two dozen holding tanks off of Sound Shore Road, with capacity for up to 5 million barrels of oil on 280 acres, and an offshore docking platform for giant crude oil tankers, the only one on the East Coast. It was recently sold by Phillips 66 to United Refining.[2] The Northville Petroleum Depot is a major node in the petroleum distribution network on Long Island.

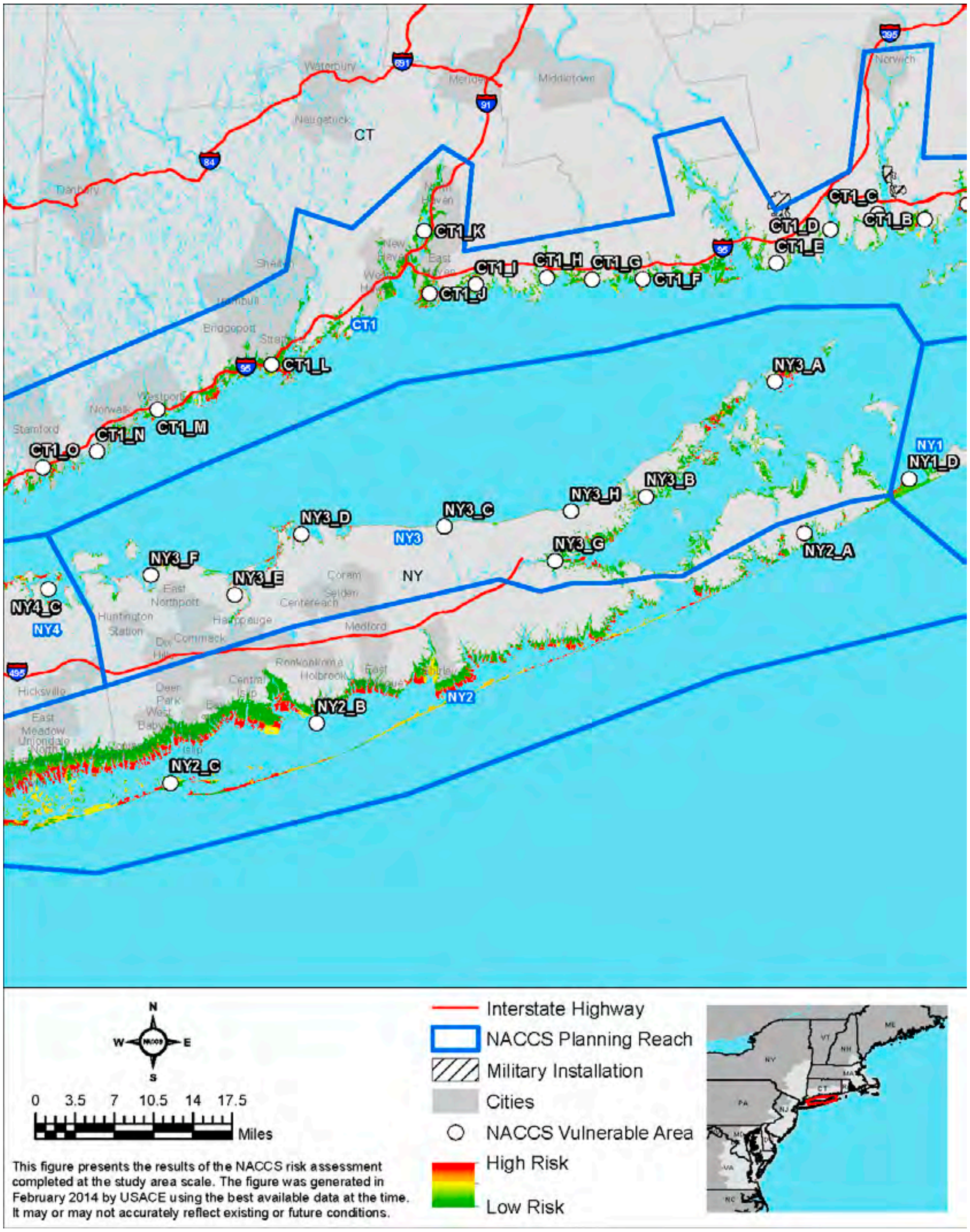


Figure 22. NY3 Reach Risk Areas.

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[2] http://www.forbes.com/sites/christopherhelman/2012/10/10/billionaire-catsimatidis-buys-long-island-oil-terminal-from-phillips-66/

Reach: NY4

The shoreline of New York Reach 4 (Figure 23) on the northwest shore of Long Island and coastal Westchester is urban, with limited beach, no USACE coastal flood risk management projects, and moderate floodplain. Five areas of high risk were identified in this reach and are described in this section.

NY4A: Coastal Westchester

Flooding due to storm surge can occur from the Long Island Sound and along tidal portions of the Hutchinson River, Blind Brook, Mamaroneck and Sheldrake Rivers, and the Byram River. Affected municipalities include the Cities of Rye and New Rochelle, the Villages of Pelham, Pelham Manor, Port Chester, Larchmont and Mamaroneck, and the Towns of Mamaroneck and Harrison. The coast is fully developed, with extensive rail systems, ports, nursing homes, and schools. During Hurricane Sandy, inundation between 2.5 and 3.1 feet was reported from New Rochelle, Rye, and Mamaroneck.

NY4B: City of Glen Cove, Glen Cove Creek

Within the City of Glen Cove off Hempstead Harbor, tidal flooding occurs through Glen Cove Creek and the shoreline along Mosquito Cove. The City is heavily developed. Within the problem area, there are ports, marinas, a law enforcement facility, fire facility, and a ferry.

NY4C: Bayville and Oyster Bay, Dosiris Island

This problem area spans Dosiris Island to Cove Neck on the North Shore of Long Island, including the villages of Bayville, Mill Neck, Centre Island, Cove Neck, and Lattingtown, and Oyster Bay Cove. The population center is in Bayville. Extensive tidal flooding from Long Island Sound and Mill Neck Creek/Oyster Bay affects the Village of Bayville. During severe storms, waves overtop the numerous bulkheads and seawalls, smashing homes and inundating low lying areas. Concurrently, floodwaters from Mill Neck Creek and Oyster Bay inundate the south side of Bayville. Severe problems arise in Bayville as floodwaters overtop the line of protection along Long Island Sound, and become trapped in the interior of Bayville by West Harbor Drive. Several areas, such as Centre Island, may be isolated as access roads over-wash. Additionally, erosion and flooding problems have been reported landward near Oyster Bay's Ransom and Stebli Beach areas and at roadways along Mill Neck with flooding at these locations restricting access to Bayville. Reports from residents indicate that once tides and waves overtop perimeter seawalls and roadways, flooding is so rapid, it creates a highly dangerous condition. Erosion in this reach could result in the possible isolation of residents of Centre Island and is considered a severe problem. There is an existing USACE Storm Damage Protection and Beach Erosion Control Study to investigate solutions to these problems at Bayville.

NY4D: Roslyn Harbor and Hempstead Harbor

The shorefront along Roslyn Harbor and Hempstead Harbor is heavily developed within the communities of Roslyn, Greenvale, Glenwood Landing, and Roslyn Harbor. The shorefront has been modified with groins, revetments, bulkheads and seawalls. Tidal flooding occurs through the harbors. Infrastructure features include electrical facilities, ports, and rail networks.

NY4E: Port Washington and Manhasset Bay: Sands Point, Kings Point

Flooding from Long Island Sound and Manhasset Bay could potentially affect the communities of Kings Point, Great Neck, Kensington, Thomaston, Manhasset, Plandome, Port Washington, Baxter Estates, Manor Haven, and Sands Point. Historically, erosion and flooding have affected the villages of Kings Point, Sands Point, Manhasset and Plandome. In Kings Point, erosion undermined a 200 foot section of Lighthouse Road. In Sands Point, long term erosion rates of between 0.4 and 1.5 feet per year have been reported. In other areas, such as Kings Point, continued bluff erosion will put an increasing number of structures at risk. Infrastructure includes airports, ports, and rail networks.

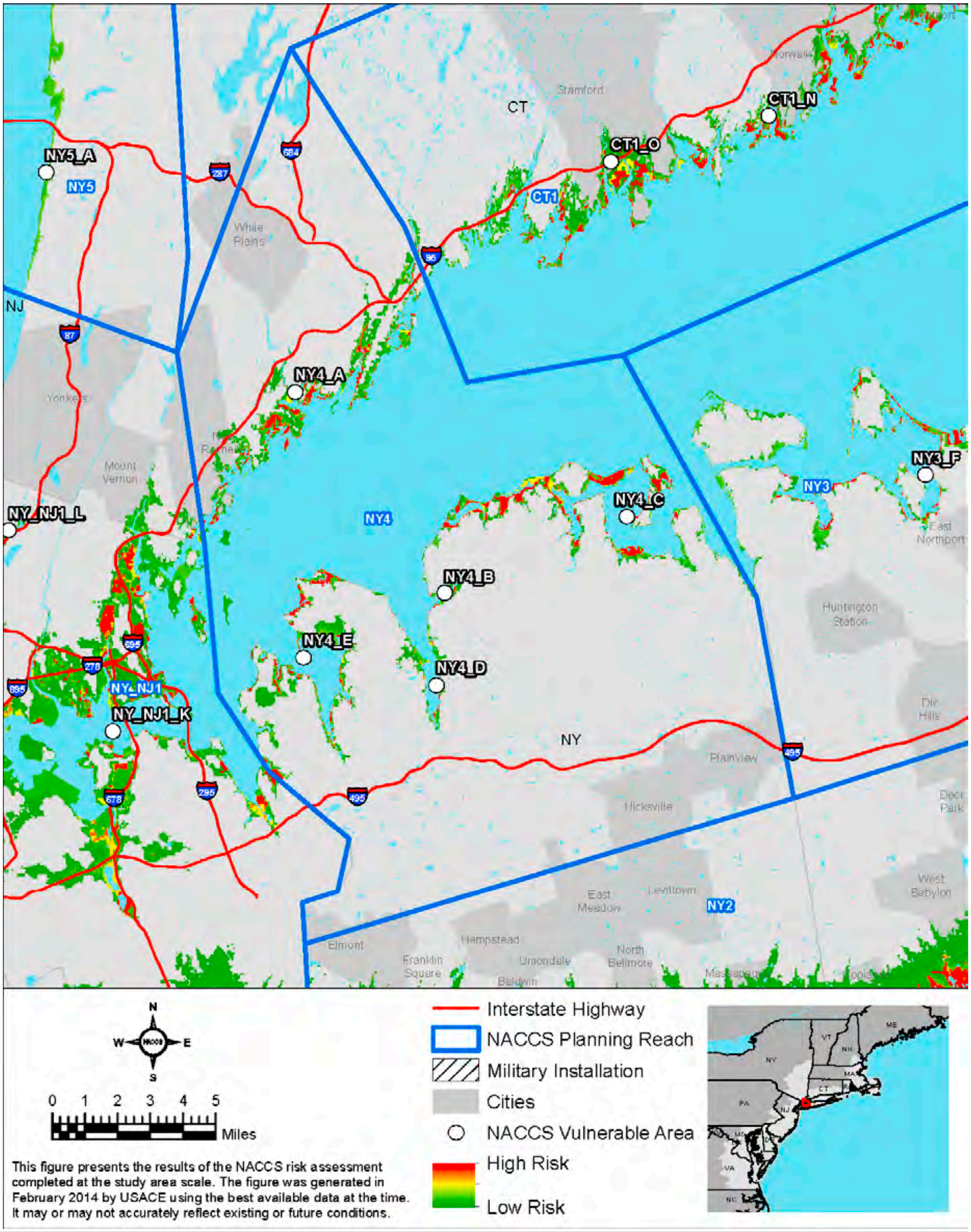

Figure 23. NY4 Reach Risk Areas.

Reach: NY5

The shoreline of New York Reach 5 (Figure 24) along the Hudson River Valley is a bluff with no USACE coastal flood risk management projects, and a very limited floodplain. Six areas of high risk were identified, based on reported inundation levels during the Hurricane Sandy event in the National Hurricane Center (NHC) report (2013) in this reach and are described in this section.

NY5A: Hastings, Irvington, Dobbs Ferry, Tarrytown, Sleepy Hollow

The villages of Hastings, Irvington, Dobbs Ferry, Tarrytown, and Sleepy Hollow are prosperous communities along the Hudson shoreline in Westchester County. The Metro-North commuter railroad Hudson line has stops in each village. Parts of Hastings reported 1.9 feet of inundation from Hurricane Sandy, while the others did not report flood inundation.

NY5B: Ossining and Croton-on-Hudson

Within the designated problem area NY5B, the City of Ossining and the Village of Croton-on-Hudson in Westchester County has an airport, Amtrak stations, a ferry, a prison, and a port. Parts of Ossining reported 2.4 feet of inundation during Hurricane Sandy.

NY5C: Haverstraw, Stony Point, and Piermont

The Towns of Haverstraw and Stony Point are located within Rockland County. These communities contain airports, ports, nursing homes, electrical facilities, and rail bridges. Parts of Stony Point reported between 1.5 and 2.0 feet of inundation from Hurricane Sandy. The Village of Piermont is within Orangetown in Rockland County. The long Erie Railroad Pier was built by the Erie Railroad for use as its principal terminal in the 19th century. Parts of Piermont reported 4.1 feet of inundation from Hurricane Sandy

NY5D: City of Peekskill, Village of Buchanan

The City of Peekskill is a small city, marked by socioeconomic and ethnic diversity, with the attendant infrastructure. It has a strong past in manufacturing. The Village of Buchanan, located within the Township of Cortlandt, is the site of the Indian Point nuclear power facility. Neither Peekskill nor Buchanan reported flood inundation from Hurricane Sandy.

NY5E: West Point

The US Military Academy at West Point, a Federal military reservation, is located within the Town of Highlands, NY, in Orange County. It was established by Thomas Jefferson in 1802, and is the oldest continuously occupied military post in America. Parts of West Point reported 4.2 feet of inundation during Hurricane Sandy.

NY5F: Newburgh

The City of Newburgh is in Orange County. Its fortunes declined in the latter half of the 20th century, and poverty remains a problem in the city. It is ethnically diverse, with a strong African-American and Hispanic population. Parts of Newburgh reported up to 3.0 feet of inundation during Hurricane Sandy.

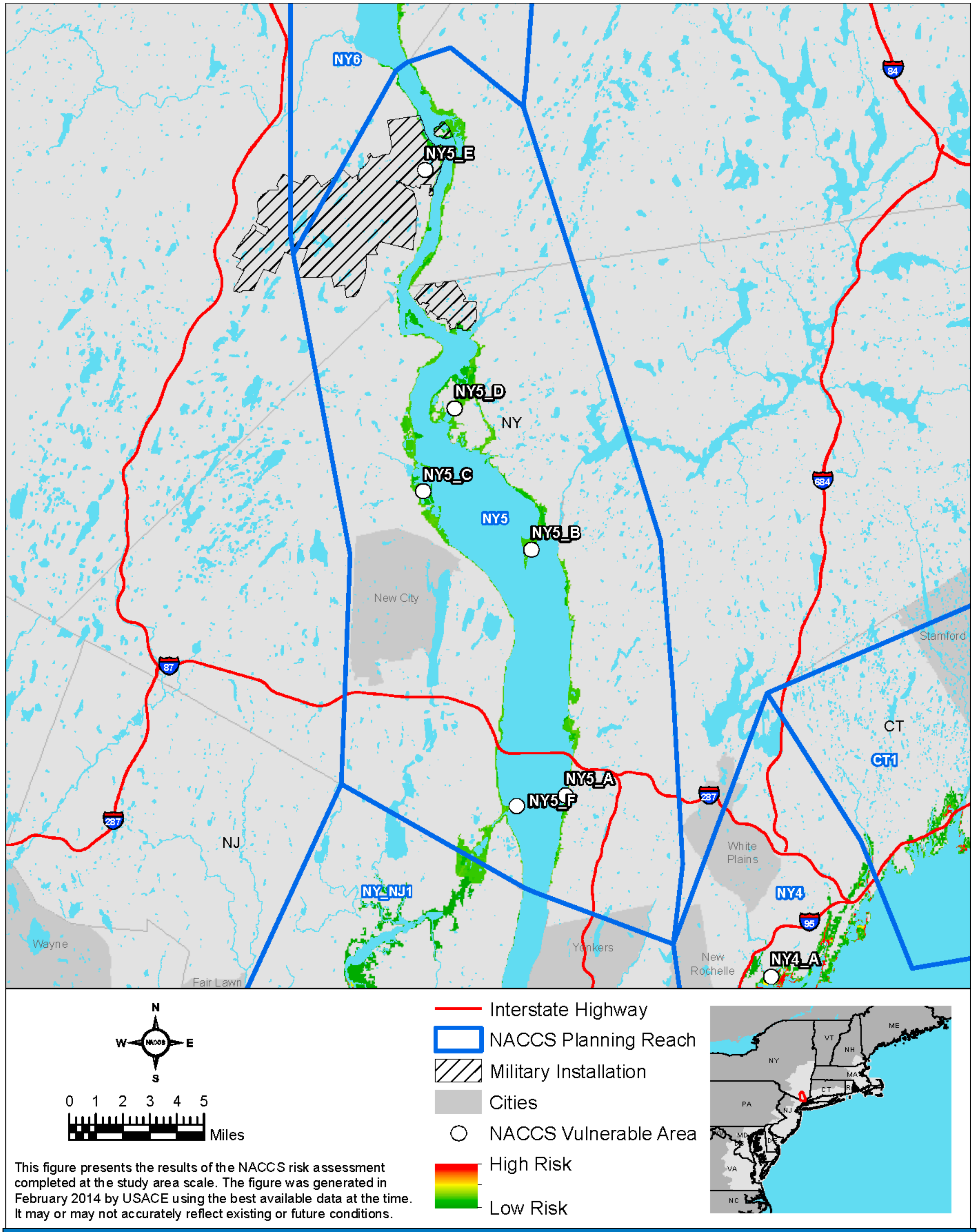

Figure 24. NY5 Reach Risk Areas.

Reach: NY6

The shoreline of New York Reach 6 (Figure 25) along the Hudson River Valley is a bluff with no USACE coastal storm risk management projects, and a very limited floodplain. Six areas of high risk were identified, based on reported inundation levels during the Sandy event in the National Hurricane Center (NHC) report (2013) in this reach and are described in this section.

NY6A: Kingston

The City of Kingston serves at the county seat for Ulster County. It has a rich political and industrial history, briefly serving as New York State's first capital in 1777, and then as a transportation hub in the 19th century with extensive rail and canal networks. Its downtown neighborhood, the Roundout-West Strand Historic District has an extensive history of flooding from Roundout Creek, and is located where the Roundout Creek meets the Hudson River. Parts of Kingston reported up to 4.9 feet of inundation from Hurricane Sandy.

NY6B: Saugerties

The Village of Saugerties, within the Town of Saugerties, Ulster County, is located on the north bank of Esopus Creek as the creek meets the Hudson River. Saugerties was the site of Woodstock '94. Parts of Saugerties reported up to 4.3 feet of inundation from Hurricane Sandy.

NY6C: Poughkeepsie

The City of Poughkeepsie, located on the east bank of the Hudson River, is the county seat for Dutchess County. It is the northern terminus of the Hudson Line for the MetroNorth Commuter Rail into NYC, and is the location of the Mid-Hudson Bridge, which connects Poughkeepsie to Highland on the western bank on the Hudson River. A significant portion of IBM's research and development took part in Poughkeepsie. Parts of Poughkeepsie reported up to 5.1 feet of inundation from Hurricane Sandy.

NY6D: Hudson

The City of Hudson, on the east bank of the Hudson River, is the county seat for Columbia County. Hudson is noted for its rich historic architecture. Parts of Hudson reported up to 2.6 feet of inundation from Hurricane Sandy.

NY6E: Catskill

The Village of Catskill is the county seat of Greene County. It is located on the western bank of the Hudson, where the Catskill River meets the Hudson River. Catskill was the home of Thomas Cole, founder of the Hudson River School of painting. Parts of Catskill reported up to 3.9 feet of inundation from Hurricane Sandy.

NY6F: Coxsackie

The Village of Coxsackie is on the western bank of the Hudson River in Greene County. It is the namesake for the Coxsackievirus, which was first discovered in Coxsackie in 1948. Parts of Coxsackie reported up to 4 feet of inundation from Hurricane Sandy.

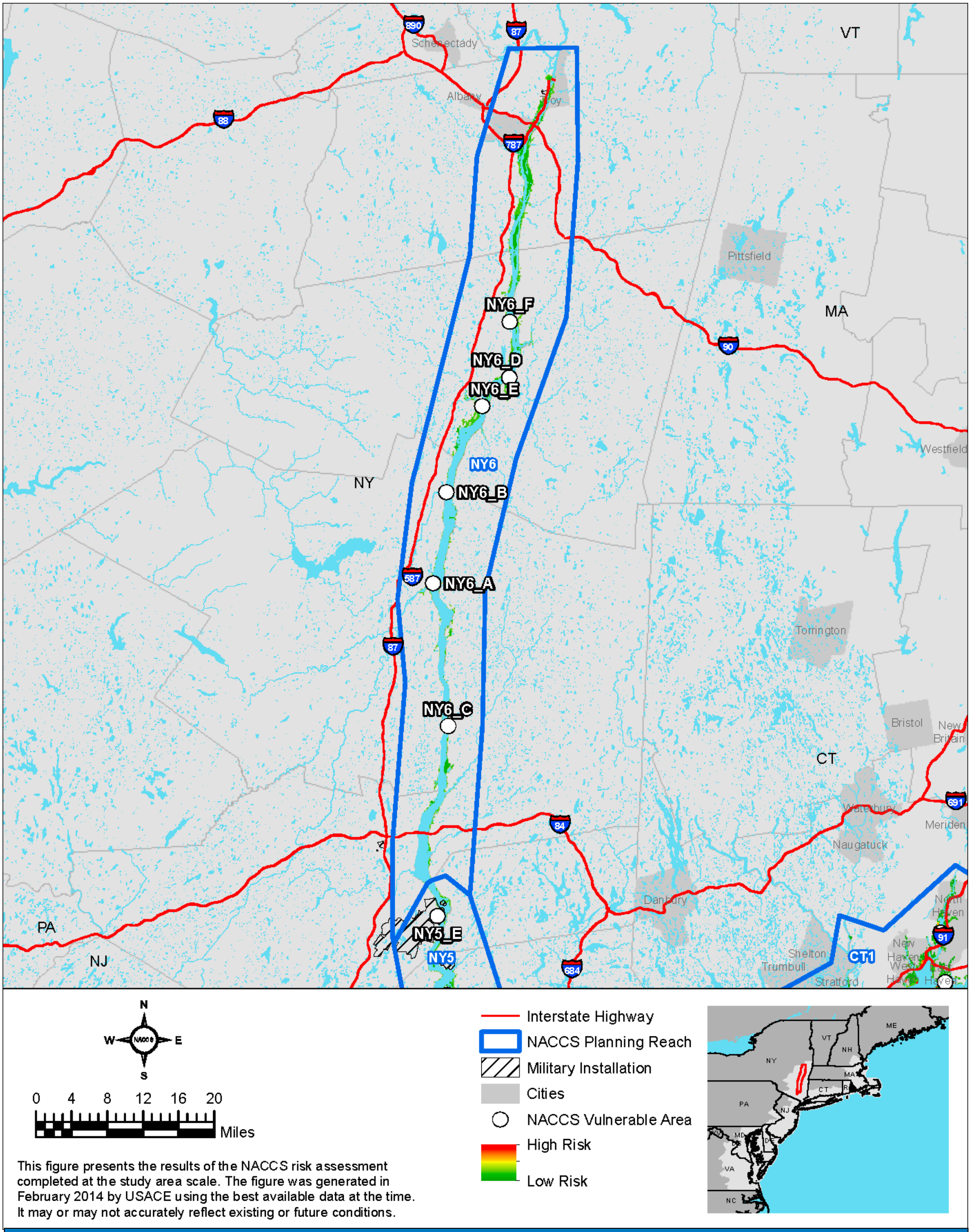

Figure 25. NY6 Reach Risk Areas

Reach: NY-NJ1

The shoreline of New York and New Jersey Reach 1 (Figure 26) is the core of the New York Metropolitan Area. It is urban, with limited USACE coastal storm risk management projects, and moderate floodplain. This reach includes northern New Jersey and the five boroughs of the City of New York: Manhattan, Brooklyn, Queens, the Bronx, and Staten Island. Of the five boroughs, only the Bronx is located on the continental United States mainland. Manhattan and Staten Island are islands, and Brooklyn and Queens are located on the western end of Long Island. The bridges and tunnels that serve as primary evacuation routes between the islands of NYC to the mainland are vitally important, considering that the five boroughs alone are home to more than 8 million people. Across the Hudson River, the New Jersey waterfront contains some of the most densely populated communities within the United States. This reach suffered grave and extensive damages from Hurricane Sandy, with 43 deaths within NYC alone from the storm. Details on the extent of damages from Hurricane Sandy and description of damages can be found in the PlaNYC Report, "A Stronger, More Resilient New York," The report was released by the NYC Strategic Initiative for Rebuilding and Resiliency (SIRR) in June 2013. The report is quoted here to provide an idea of the magnitude of damages in this reach:

"The urban character of New York City magnified the impact of the flooding. More than 443,000 New Yorkers were living in areas that Sandy flooded when the storm struck. In all, 88,700 buildings were in this inundation zone – buildings containing more than 300,000 homes and approximately 23,400 businesses. Much of the city's critical infrastructure also was within flooded areas – including hospitals and nursing homes, key power facilities, many elements of the city's transportation networks, and all of the city's wastewater treatment plants." (NYC SIRR, 2013).

Seventeen areas of high risk were identified and are described in this section. Thirteen of the areas of high exposure are within the State of New York and are included within the reach description (NY_NJ1E to NY_NJ1Q). Unless explicitly stated otherwise, the basic characterization of problem areas within this reach is densely populated in terms of population and infrastructure.

NY_NJ1A: Lower Passaic River

Flooding in the tidal portion of the Lower Passaic River affects municipalities from Newark Bay up to Dundee Dam. Municipalities within the Category 4 floodplain in this problem area include Newark, Harrison, East Newark, Kearny, North Arlington, Belleville, Lyndhurst, Rutherford, East Rutherford, Delawanna, Wallington, and Garfield. Of the listed communities, the communities of Newark, Kearny, and Harrison in the southern portion of the problem area are the most heavily populated and experienced the most reported damages. The storm surge from Hurricane Sandy inundated an extensive area of highly developed industrial, commercial, and residential neighborhoods. There was one documented fatality in this area due to the storm surge during Hurricane Sandy. The highly utilized urban transit systems of the Port Authority Trans-Hudson (PATH), NJ Transit, and Amtrak also operate through this area and these transportation infrastructures were extensively damaged from the storm surge. Newark International Airport is one of nine airports located within this problem area as well. Other key infrastructure includes Amtrak and NJ Transit rail stations and lines, freight rail lines, bus stations, electrical power plants, wastewater treatment plant, and over 40 ports.

There is a USACE Passaic Tidal Flood Risk Management Study, which was originally formulated as a common element of the Passaic River Mainstem Flood Risk Management Project. The tidal coastal storm risk management area consists of 5.5 miles of levees and 5.0 miles of floodwalls to provide a 500 year level of coastal storm risk management to tidal flood prone areas in the cities of Harrison, Kearney, and Newark. There is also a Superfund site at Diamond Alkali with ongoing Remedial Investigation/Feasibility Study by the EPA, which is being coordinated with USACE.

NY_NJ1B: Hackensack River, Hackensack Meadowlands

The Hackensack River Basin, located in Hudson and Bergen Counties, NJ, is tidal from its mouth up to the Oradell Dam, a distance of 22 miles. Tidal flooding occurs along the Hackensack River and its tidal tributaries, specifically in the Hackensack Meadowlands. There are nine tidal tributaries: Berry's Creek, Losen Slofe, Mill Creek, Kingsland Creek, East River Ditch, Cromakill Creek, Penhorn Creek, Saw Mill Creek, and Bellman's Creek. The Hackensack Meadowlands is one of the largest wetland complexes in the New York metropolitan area, at 32 square miles. In Bergen County, communities within the Meadowlands include Carlstadt, East Rutherford, Little Ferry, Lyndhurst, Moonachie, North Arlington, Ridgefield, Rutherford, South Hackensack and Teterboro. Jersey City, Kearny, North Bergen and Secaucus are located within Hudson County. During Hurricane Sandy, a levee was overtopped, causing floods in Moonachie, Carlstadt, and Little Ferry, with up to five feet of water, endangering hundreds of people, who had to be rescued. Notwithstanding the presence of the wetland complexes, the Meadowlands district is developed, with airports, electrical power plants, prisons, wastewater treatment plants, nursing homes, and National Shelter System Facilities.

Under Section 324 of Water Resources Development Act (WRDA) 1992, USACE is authorized to provide design and construction assistance to the New Jersey Meadowlands Commission (NJMC), the regional planning authority for the Hackensack Meadowlands. Under this project, USACE has examined possible flood risk management projects throughout the Meadowlands, including Berry's Creek and the Route 7/Belleville Turnpike area.

NY_NJ1C: Hudson Waterfront of New Jersey (Jersey City to Edgewater)

Problem Area NY_NJ1C is located within the Hudson Waterfront which refers to the stretch of New Jersey between the Bayonne Bridge and the George Washington Bridge. This problem area includes the municipalities of Jersey City, Hoboken, Union City, Weehawken, West New York, Guttenberg, North Bergen, Fairview, Cliffside Park, and Edgewater, and is among the most densely populated in the United States, with great ethnic and socioeconomic diversity. Hoboken and Jersey City, including Liberty State Park, suffered extensive inundation from Hurricane Sandy, and Hoboken is in the midst of developing a master plan for flood risk management. The Holland Tunnel is in Jersey City, and the Lincoln Tunnel is in Union City. Additionally, there are airports, ferries to New York, hospitals, nursing homes, ports, rail stations, and wastewater treatment plants.

NY_NJ1D: City of Bayonne

The City of Bayonne in Hudson County is located on a peninsula bounded by Newark Bay, Kill van Kull, and Upper Bay. Located in the center of the Port of New York and New Jersey, it is a hub of industrial activity, with numerous ports and freight rail lines. In 2010, the Port Authority of New York and New Jersey agreed to acquire land from the Military Ocean Terminal at Bayonne from the City to build additional port facilities. Flood damages to Bayonne from Upper Bay, Kill van Kull, and Upper Bay caused serious disruptions to port activity and the regional, if not national, economy.

NY_NJ1E: Rosebank to St. George on Staten Island (North Shore of Staten Island)

The northern corner of Staten Island overlooking Upper Bay extends from the neighborhoods of Rosebank, Clifton, Stapleton, Tompkinsville, and St. George. These are heavily developed residential neighborhoods. The Staten Island Ferry Terminal, with hourly service to Manhattan, is located at St. George. There is also a fireboat station located in the problem area that may be threatened by flooding from Upper Bay.

NY_NJ1F: South Shore of Staten Island

The 13 miles of coastline on the south shore of Staten Island extend from Fort Wadsworth to Tottenville, along Lower Bay and Raritan Bay. The area has a long history of storm damages and has experienced major storm damages from various recent storm events, including the Northeaster of December 1992, the March 1993 storm, and Hurricane Sandy. These storms caused flood damages, loss of structures, large scale evacuations and several deaths within several communities. Critical infrastructure in this area includes the Oakwood Beach Wastewater Treatment Plant. During Hurricane Sandy, most of the 23 people killed on Staten Island were in this area, mostly drowning in the storm surge. The area is now increasingly vulnerable to severe damages even from moderate storms. There is a USACE Coastal Storm Risk Management Feasibility Study for the south shore of Staten Island. Aside from Oakwood Beach (CAP Section 103), there is no USACE constructed project along the south shore of Staten Island.

NY_NJ1G: New Brighton to Mariners Harbor (North Shore of Staten Island)

Overlooking the Kill Van Kull, the neighborhoods of Mariners Harbor, Port Richmond, Westerleigh, Meiers Corners, Graniteville, Castleton Corners, West Brighton, and New Brighton are a hub of port activity. Aside from commercial activity, the Staten Island Ferry Department of Transportation Maintenance Facility and the United States Coast Guard facility are located here. The Port Richmond Wastewater Treatment Plant is part of the critical infrastructure at risk within this area. It is the most developed part of the Staten Island with the greatest economic and ethnic diversity on the island as well. Flooding from the Kill van Kull seriously disrupts port activity and leads to extensive residential and commercial structure damage.

NY_NJ1H: West Shore of Staten Island

Problem Area NY-NY1H covers the western shoreline of Staten Island along the Arthur Kill from the Goethals Bridge (I-278) to the Outerbridge Crossing (Rt. 440). Rt. 440 turns northward on Staten Island and is known as the West Shore Expressway. The west shore of Staten Island is characterized by light residential development in the neighborhood of Travis and heavy industrial use for oil refining and construction. There is also a Con Edison plant in Travis. The Fresh Kills, and the Fresh Kills Landfill, are located in this problem area, which was flooded extensively during Hurricane Sandy.

NY_NJ1: Southern Brooklyn and Queens – Jamaica Bay and the Rockaway Peninsula

This problem area encompasses southern Brooklyn and Queens in the City of New York, including the neighborhoods of Coney Island, Brighton Beach, Sheepshead Bay, Marine Park, Flatlands, Canarsie, Howard Beach, Far Rockaway, and Breezy Point. The neighborhoods of Coney Island, Brighton Beach, and the Rockaway Peninsula were fully inundated during Hurricane Sandy. In Breezy Point, 350 houses were destroyed by fire, started when rising flood waters sparked a house's electrical system. Rockaway Peninsula lost 1.5 million cubic yards of sand from its beaches and dunes during Sandy. Residents in this area were without electricity and other utilities for weeks post-Hurricane Sandy. The number of structures with flood damage from Hurricane Sandy is in the thousands. In addition to dense residential and commercial development, this problem area also contains John F. Kennedy International Airport, the Metropolitan Transit Authority (MTA) A-train subway line, portions of the

Gateway National Recreational Area, the historic Floyd Bennett Field, Jacob Riis Park, and Jamaica Bay itself, one of the largest remaining wetland complexes in the New York metropolitan area. Other critical infrastructure includes four of NYC's fourteen wastewater treatment plants: Rockaway, Coney Island, 26th Ward, and Jamaica.

The USACE East Rockaway Inlet to Rockaway Inlet (Rockaway) and the Rockaway Inlet to Norton Point (Coney Island) projects have been restored to their original design profile, pursuant to PL 113-2 through the USACE Flood Control and Coastal Emergencies (FCCE) program.

NY_NJ1J: Brooklyn and Queens Western Waterfront

The western waterfront of Brooklyn and Queens overlook Upper Bay and the East River. It includes the neighborhoods of Bay Ridge, Sunset Park, Red Hook, Brooklyn Heights, DUMBO, Brooklyn Navy Yard, Williamsburg, Greenpoint, and Long Island City. Red Hook and Sunset Park suffered the most extensive damages from Hurricane Sandy in this stretch. These neighborhoods are densely populated and still growing; the waterfront was historically industrial, but was rezoned to commercial and residential as part of NYC's bid to host the 2012 Olympic Games. Key infrastructure in this problem area includes five major bridges: the Brooklyn Bridge, the Manhattan Bridge, the Williamsburg Bridge, the Queensboro Bridge, and the Triborough Bridge. Additionally, the Queens Midtown Tunnel connects to Manhattan at Long Island City. Amtrak, NJ Transit, and Long Island Railroad Trains can be found at the Sunnyside Rail Yard. There are nine Metropolitan Transit Authority (MTA) subway tunnels connecting Brooklyn and Queens to Manhattan in this area. There are three Wastewater Treatment Plants is in this sub-reach: Owls Head, Red Hook, and Newtown Creek.

NY_NJ1K: Northern Queens and the Bronx

In Northern Queens and the Bronx, tidal flooding occurs through the Long Island Sound, the Harlem River, and tidal portions of the Bronx River, the Hutchinson River, Flushing Bay and Creek, and Little Neck Bay. Neighborhoods within the maximum extent of vulnerability include, but are not limited to: Kingsbridge, Highbridge, Fordham, Tremont, Morrisiania, Mott Haven, Hunts Point, Soundview, Parkchester, Unionport, Baychester, Co-op City, Eastchester, and City Island in the Bronx. The tidal potion of the Bronx River ends within the Bronx, while the tidal portion of the Hutchinson River extends northward into Westchester County. Within Queens, neighborhoods within the maximum extent of vulnerability include, but are not limited to: Corona, College Point, Flushing, Queens Village, Hollis, Fresh Meadows, Jamaica Estates, Jackson Heights, Astoria, Bayside, Auburndale, Murray Hill, and Whitestone.

During Hurricane Sandy, flooding in this problem area was concentrated in the northeastern Bronx and in the area around Flushing Bay and Creek, including LaGuardia Airport. Other important infrastructure features in the problem area include the Whitestone and Throgs Neck Bridges, the Rikers Island Correctional Facility, the MTA 7-train subway line, and the Long Island Rail Railroad. The Whitestone and Throgs Neck bridges are primary evacuation routes off Queens (Long Island) to the Bronx (the Continental US mainland). Randalls Island serves as a recreational facility for the City, including track and field events for elementary and high schools. Other critical infrastructure include four wastewater treatment plants: Bowery Bay, Hunts Point, Tallman Island, and Wards Island. Flushing Meadows Park and Kissena Park are relatively rare and valuable open space for the communities of Flushing, Corona, and College Point, which are noted for their density, ethnic diversity, and high proportion of working immigrant populations. With the exception of affluent neighborhoods along the shoreline of northeastern Queens (e.g., Bayside, Whitestone), most of the communities within the Bronx and northern Queens can be characterized as diverse, working-class neighborhoods.

NY_NJ1L: Marble Hill and the Spuyten Duyvil

Marble Hill, a neighborhood currently within the Bronx, was once the northernmost neighborhood of Manhattan. In 1895, USACE constructed the Harlem River Ship Chanel, connecting the Hudson and Harlem Rivers, to the south of Marble Hill, turning Marble Hill into an island. In 1914, the Harlem River channel between Marble Hill and the Bronx was filled in, physically connecting the neighborhood to the Bronx although it was politically still part of Manhattan. During Hurricane Sandy, the old Harlem River channel bed flooded, effectively turning Marble Hill back into an island and cutting its residents off from the mainland. Adjacent to Marble Hill, flooding from the Spuyten Duyvil Creek affects Spuyten Duyvil section of Riverdale in the Bronx. The name Spuyten Duyvil is Dutch for "Spouting Devil" and is a reference to the strong and fast tidal currents in the area. Spuyten Duyvil is the location of the Henry Hudson Bridge, which connects the Manhattan to the Bronx. Both Marble Hill and Spuyten Duyvil have Metro-North commuter rail stations, and Marble Hill is also served by the MTA 1-train subway line.

NY_NJ1M: Harlem, East Harlem, and the Upper East Side

This problem area encompasses the east side of upper Manhattan, from 168th Street southward to 77th Street. Tidal flooding occurs through the Harlem River and East River, which are technically tidal straits. The Harlem River in particular has been altered for navigation purposes, including channelization (per the Marble Hill problem area description) and the construction of many bridges to connect Manhattan and the Bronx. Neighborhoods potentially vulnerable to tidal flooding include Harlem, East Harlem (also known as Spanish Harlem or El Barrio), and the Upper East Side, including Yorkville. The Upper East Side is a middle class to upper-middle class neighborhood, while Harlem and East Harlem are working class to middle class neighborhoods. Harlem is an African-American cultural hub, and East Harlem is dominated by Hispanic communities. Both Harlem and East Harlem score highly on NOAA's Index of Social Vulnerability. This problem area is served by the seven MTA subway lines, with three subway tunnels connecting the Manhattan and the Bronx. The Metro-North 125th Street commuter rail station is the last point before service branches off into either the Hudson Valley, up the Harlem River, and into Connecticut.

NY_NJ1N: Mid and Lower Manhattan

This problem area stretches from 125th St and Riverside Drive on the Upper West Side southward, along the southern tip of Manhattan, and up the eastern side of the island up to 34th Street. It includes Governor's Island off southern Manhattan. The tidal surge occurs through Upper Bay, and the East and Hudson Rivers. Vulnerable neighborhoods within this stretch are Battery Park City, the Financial District, the Civic District, Chinatown, Lower East Side, Little Italy, TriBeCa, Alphabet City, East Village, Greenwich Village, SoHo, NoHo, Stuyvesant Town, Chelsea, Hell's Kitchen, the West Side, and the Upper West Side. Of the listed neighborhoods, working class households can be found in Chinatown, the Lower East Side, Little Italy, Alphabet City, Stuyvesant and Hell's Kitchen. The overall trend in this area within the last decade, however, has been increasing and at times rapid gentrification.

Key infrastructure in this problem area include: the Brooklyn, Manhattan, and Williamsburg Bridges; the Brooklyn-Battery Tunnel; the Holland and Lincoln Tunnels; the South Ferry Terminal for the Staten Island Ferry; five MTA subway tunnels, two NJ PATH train tunnels, and the NJ Transit and Amtrak train tunnels out of Pennsylvania Station. The Brooklyn-Battery Tunnel and the Whitehall Station on the MTA

R-train subway line at the tip of southern Manhattan were submerged and extensively damaged during Sandy. Lower Manhattan below 37th Street was without electrical power and other utilities for more than a week post-Hurricane Sandy. Important institutions in NY_NJ1N include, but are not limited to: the New York Stock Exchange on Wall Street, the World Trade Center, the World Financial Center, NYC Hall, Federal and NYS courthouses, and the Lower Manhattan Detention Center.

NY_NJ1O: Hudson River Shoreline of Upper Manhattan

The Hudson River shoreline of Upper Manhattan problem area extends from 125th Street in Morningside Heights to Inwood at the northern tip of Manhattan. The communities of Inwood, Washington Heights, Hamilton Heights and Morningside Heights are densely populated and located at relatively high elevations, but still vulnerable to worst-case storm surge scenarios. Hamilton Heights and Inwood experienced inundation during Hurricane Sandy, through the Hudson River and Sherman Creek, respectively. This area was identified as a problem area because of the presence of 2 prisons, 1 electric power generating plant, 2 major hospitals and transportation infrastructure, including the Henry Hudson Parkway, which is a major highway on the west side of Manhattan, and the North River Wastewaster Treatment Plant. Additionally, entrance roadways and ramps to the George Washington Bridge, which connects Manhattan to New Jersey and the Amtrak rail, are located in this problem area.

NY_NJ1P: East River Shoreline of Mid-Manhattan

Problem area NY_NJ1P extends along the East River shoreline of Manhattan from 34th Street to 77th Street, and includes Roosevelt Island. Flooding from the East River could affect Midtown East and the Upper East Side, and Roosevelt Island. These are densely populated, generally affluent neighborhoods, with a considerable number of hospitals and nursing homes within the problem area. The United Nations Headquarters are located at 42nd Street on the East River. Transportation infrastructure includes three MTA subway tunnels, the Roosevelt Island Tramway between Manhattan and Roosevelt Island, and the Franklin Delano Roosevelt (FDR) Highway along the East River.

NY_NJ1Q: Hudson River Waterfront of Yonkers

Southwest Yonkers, in the City of Yonkers in Westchester County, is potentially vulnerable to tidal surge from the Hudson River. Its population is middle to high density, with a strong ethnic and socioeconomic diversity. The neighborhoods along the Hudson are primarily residential, with some commercial retail on the main roads. The Hudson River line of the Metro-North Railroad and Amtrak are in this problem area.

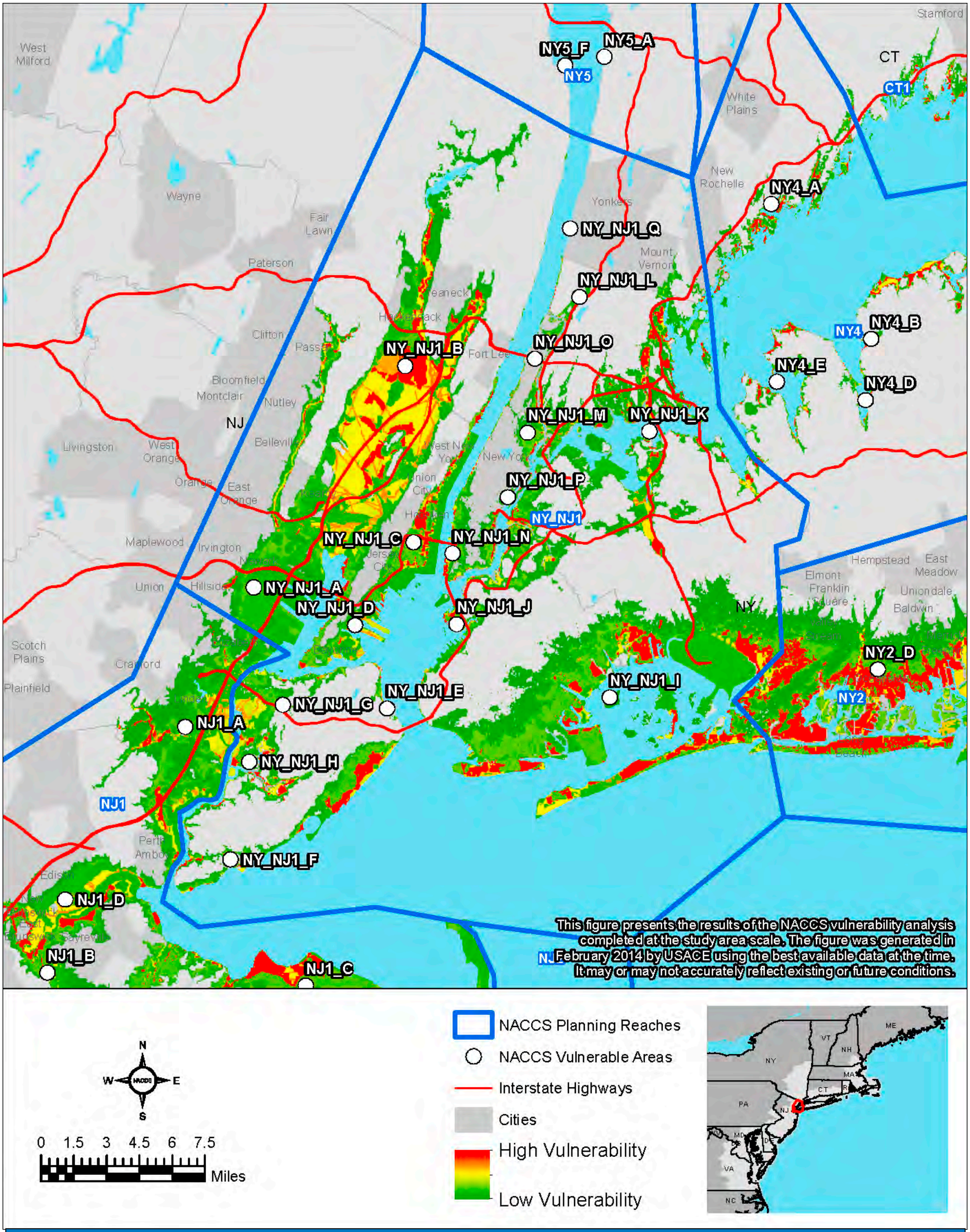

Figure 26. NY_NJ1 Reach Risk Areas

V. Coastal Storm Risk Management Strategies and Measures

V.1. Measures and Applicability by Shoreline Type

The structural and NNBF measures were further categorized based on shoreline type for where they are best suited according to typical application opportunities and constraints and best professional judgment (Dronkers et al 2014; USACE 2014a). Shoreline types were derived from the NOAA Environmental Sensitivity Index Shoreline Classification dataset (NOAA, n.d.). Figure 27 presents the location and extent of each shoreline type in the State of New York. Table 3 summarizes the measures applicability based on shoreline type. It is assumed non-structural measures could be considered in all geographic contexts, subject to further evaluation at a smaller scale.

Additionally, a conceptual analysis of geographic applicability of NNBF measures presented in Table 3 was completed, including beach restoration, beach restoration with breakwaters/groins, living shorelines, reefs, submerged aquatic vegetation, and wetlands. The GIS operations that were used for the NNBF screening analysis are described in the Use of Natural and Nature-Based Features for Coastal Resilience Report (Bridges et. al., 2015). In addition to the NOAA Environmental Sensitivity Index Shoreline Classification dataset (NOAA, n.d.), other criteria that was considered was habitat type, impervious cover, water quality, and topography/bathymetry. Consistent with the theme of the Framework, further evaluation of the results would be required at a smaller scale and with finer data sets. Figure 28 presents the location and extent of NNBF measures based on additional screening criteria. Additional information associated with the methodology and results of the analysis is presented in the Planning Analyses Appendix

The lengths of shoreline type on an individual reach basis are provided in Figure 29 through Figure 35.

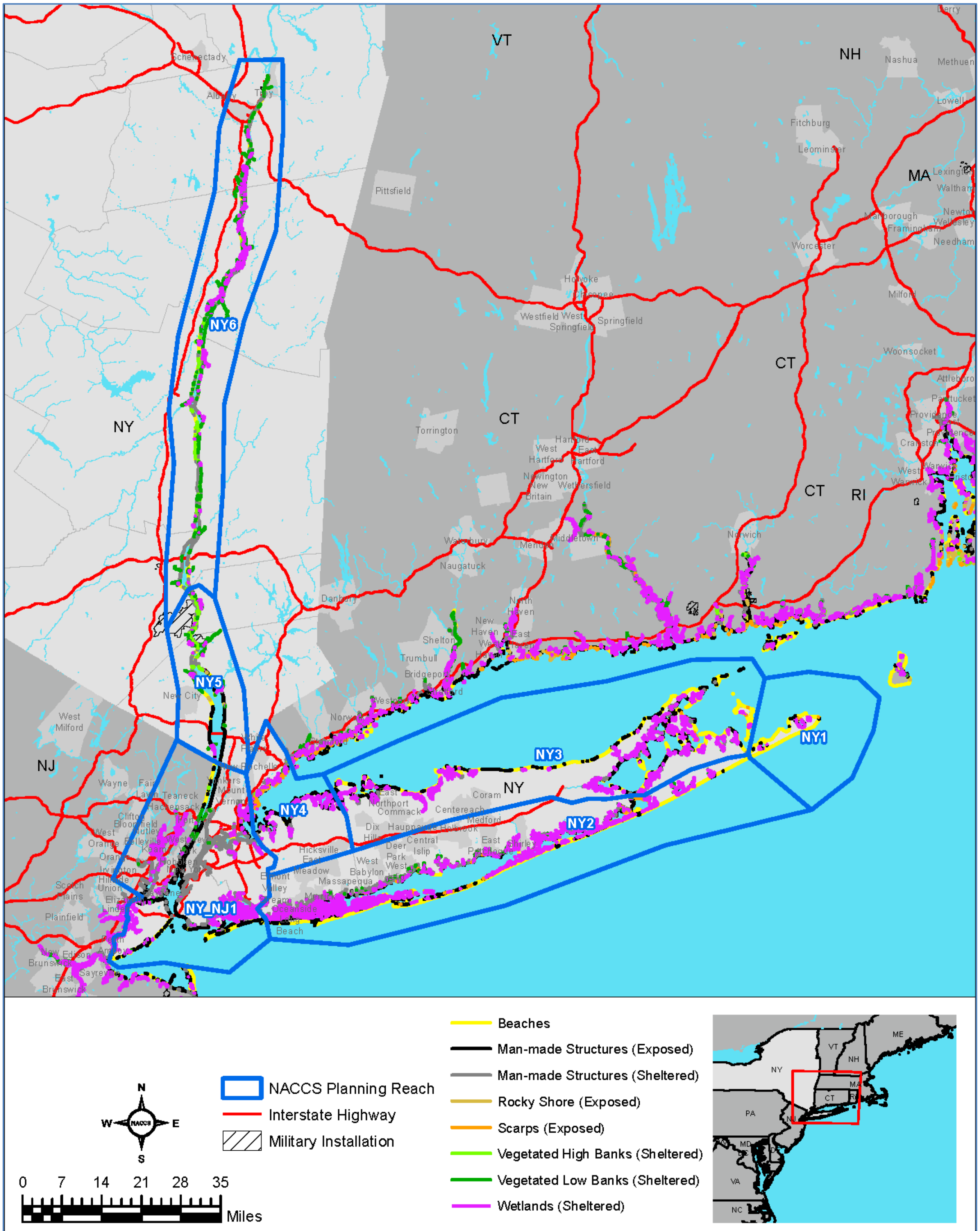

Figure 27. Shoreline Types for the State of New York

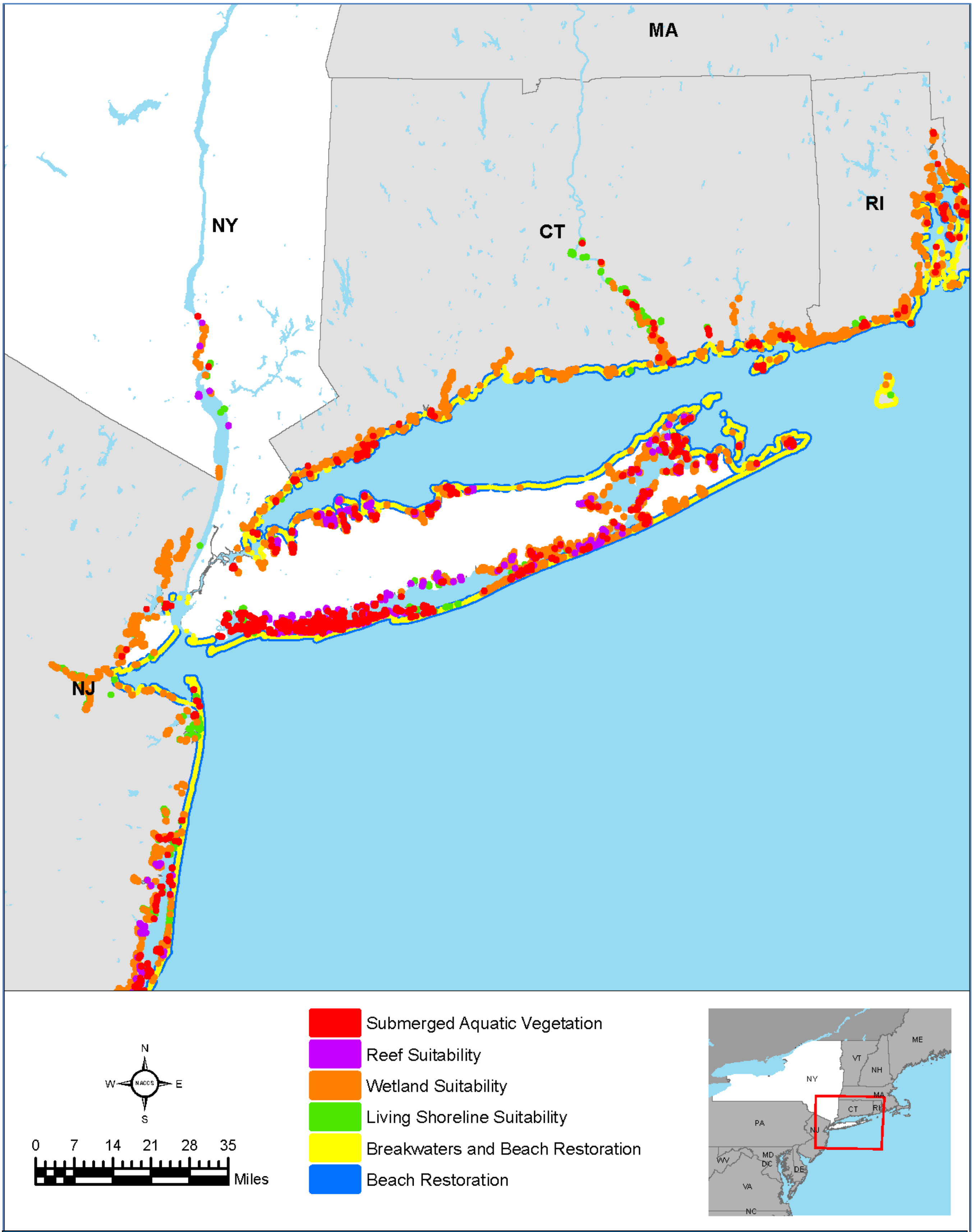

Figure 28. NNBF Measures Screening for the State of New York.

Table 3. Structural and NNBF Measure Applicability by NOAA-ESI Shoreline Type

Measures	Rocky shores (Exposed)	Rocky shores (Sheltered)	Beaches (Exposed)	Manmade structures (Exposed)	Manmade structures (Sheltered)	Scarps (Exposed)	Scarps (Sheltered)	Vegetated low banks (Sheltered)	Wetlands/Marshes/ Swamps (Sheltered)
Structural									
Storm Surge Barrier[1]									
Barrier Island Preservation and Beach Restoration (beach fill, dune creation)[2]			x						
Beach Restoration and Breakwaters[2]			x						
Beach Restoration and Groins[2]			x						
Shoreline Stabilization						x	x	x	
Deployable Floodwalls					x				
Floodwalls and Levees		x			x			x	
Drainage Improvements	x	x	x	X	x	x	x	x	x
Natural and Nature-Based Features									
Living Shoreline						x	x	x	x
Wetlands							x		x
Reefs	x	x				x			x
Submerged Aquatic Vegetation[3]									x
Overwash Fans[4]									
Drainage Improvements	x	x	x	X	x	x	x	x	x

[1] *The applicability of storm surge barriers cannot be determined based on shoreline type. It depends on other factors such as coastal geography.*

[2] *Beaches and dunes are also considered Natural and Nature-Based Features*

[3] *Submerged Aquatic Vegetation is not associated with any particular shoreline type. Initially assumed to apply to wetland shorelines.*

[4] *Overwash fans may apply to the back side of barrier islands which are not explicitly identified in the NOAA-ESI shoreline database.*

Table 4. Shoreline Types by Length (feet) by Reach

Risk Area	Beaches	Manmade Structures (Exposed)	Manmade Structures (Sheltered)	Rocky Shore (Exposed)	Scarps (Exposed)	Vegetated High Banks (Sheltered)	Vegetated Low Banks (Sheltered)	Wetlands (Sheltered)	Total
NY_NJ1_A	440	12,252	67,058				237	370	80,120
NY_NJ1_B	579	3,670	106,676				4,116	438,423	553,464
NY_NJ1_C	1,550	83,619	25,648				5,775	8,850	125,442
NY_NJ1_D	3,983	63,294	63,641				302	21,842	153,062
NY_NJ1_E	971	32,188	13,668						46,827
NY_NJ1_F	67,042	38,298	3,881				2,894	28,630	140,745
NY_NJ1_G	579	35,003	1,217				311	11,256	48,366
NY_NJ1_H	4,386	14,652	6,458				659	258,382	284,537
NY_NJ1_I	159,008	117,671	183,116				1,440	893,297	1,354,532
NY_NJ1_J	1,077	56,402	285,628					372	343,479
NY_NJ1_K	21,111	53,739	325,080	1,928	3,874	1,732	3,227	170,929	581,620
NY_NJ1_L		10,111	2,078			811			13,000
NY_NJ1_M	463		28,866						29,329
NY_NJ1_N		109,507	30,047				6,207		145,761
NY_NJ1_O		16,145	25,406				7,382		48,933
NY_NJ1_P			43,406						43,406
NY_NJ1_Q	383	20,463							20,846
NY1_A	2	2	7						11
NY1_B	8,489	13,449			346			3,114	25,398
NY1_C	4,174								4,174
NY1_D	14,169	121						4,480	18,770
NY1_E	6,525							522	7,047
NY2_A	13,998	7,683	9,604				17,998	133,223	182,506
NY2_B	332,114	225,356	394,888		33,204		37,003	1,175,508	2,198,073
NY2_C	42,323	20,082						177,361	239,766
NY2_D	115,122	179,124	526,881		2,578		10,694	1,371,326	2,205,725
NY3_A	154,192	72,508	58,291				967	268,671	554,629
NY3_B	30,405	18,141	15,934				995	75,573	141,048
NY3_C	5,831	394	680					8,853	15,758
NY3_D	104,244	11,008	20,310					361,914	497,476
NY3_E	14,529	1,369	825					180,034	196,757
NY3_F	99,786	37,109	30,516				1,213	85,037	253,661
NY3_G	16,094	12,464	27,085				411	144,757	200,811
NY3_H	1,353	1,242							2,595
NY4_A	45,108	74,365	129,843	12,115	33,429	13,762	7,256	104,564	420,442
NY4_B	4,920	3,652	9,218					2,537	20,327
NY4_C	40,509	49,957	11,595					168,739	270,800
NY4_D	11,585	9,322	14,349					33,153	68,409

Table 4. Shoreline Types by Length (feet) by Reach

Risk Area	Beaches	Manmade Structures (Exposed)	Manmade Structures (Sheltered)	Rocky Shore (Exposed)	Scarps (Exposed)	Vegetated High Banks (Sheltered)	Vegetated Low Banks (Sheltered)	Wetlands (Sheltered)	Total
NY4_E	31,356	48,077	17,830				57	53,038	150,358
NY5_A	3,392	38,155		473			5,196		47,216
NY5_B	11,767	31,189	3,537	257			25,123	20,538	92,411
NY5_C	14,067	6,267	25,465			2,281	29,335	31,438	108,853
NY5_D	21,130	1,975	35,031	1,120		13,243	34,087	11,279	117,865
NY5_E	3,065		14,739			3,265			21,069
NY5_F		13,028					5,006	3,686	21,720
NY6_A	400		3,244				1,100	4,118	8,862
NY6_B	323		1,796				3,250	2,935	8,304
NY6_C			2,531				4,251		6,782
NY6_D			2,804					462	3,266
NY6_E			2,712				2,214		4,926
NY6_F	312		4,047				589	303	5,251
Total	**1,412,854**	**1,542,051**	**2,575,629**	**15,893**	**73,431**	**35,094**	**219,295**	**6,259,514**	**12,134,524**

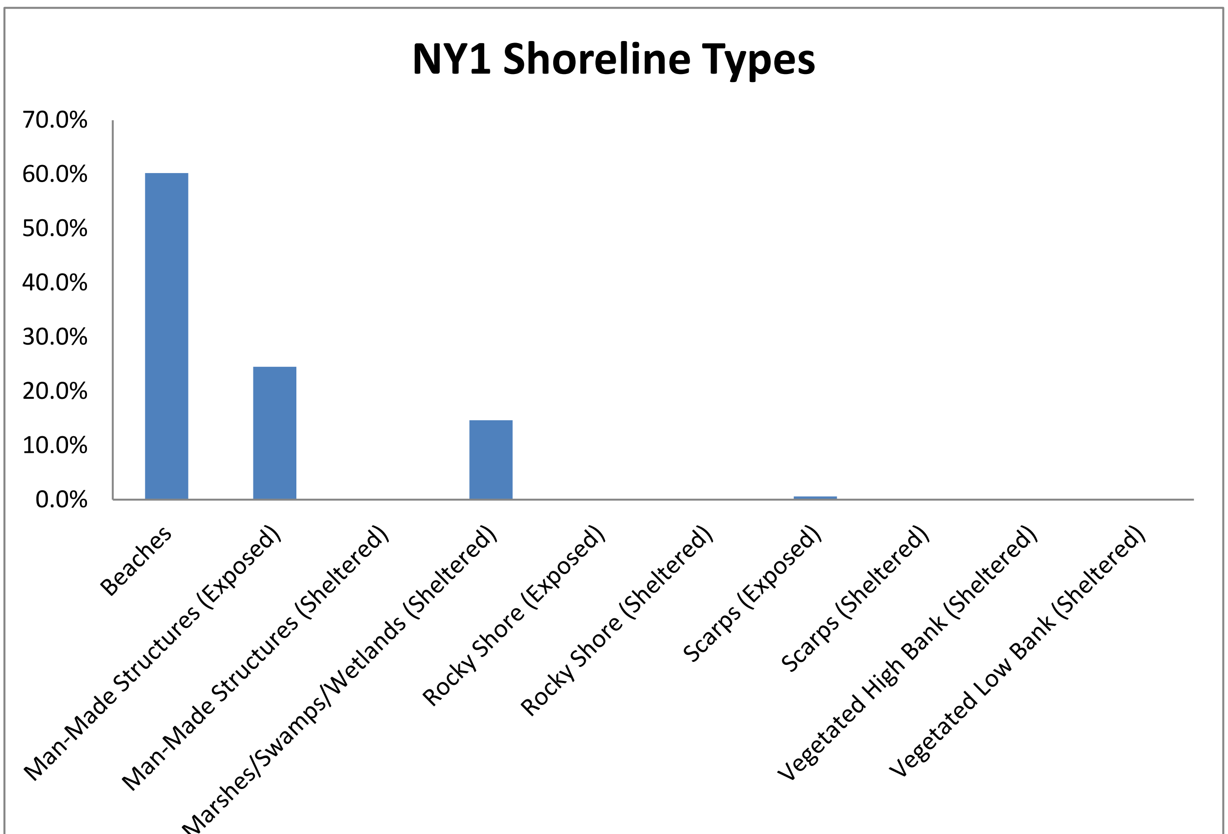

Figure 29. NY1 Shoreline Types

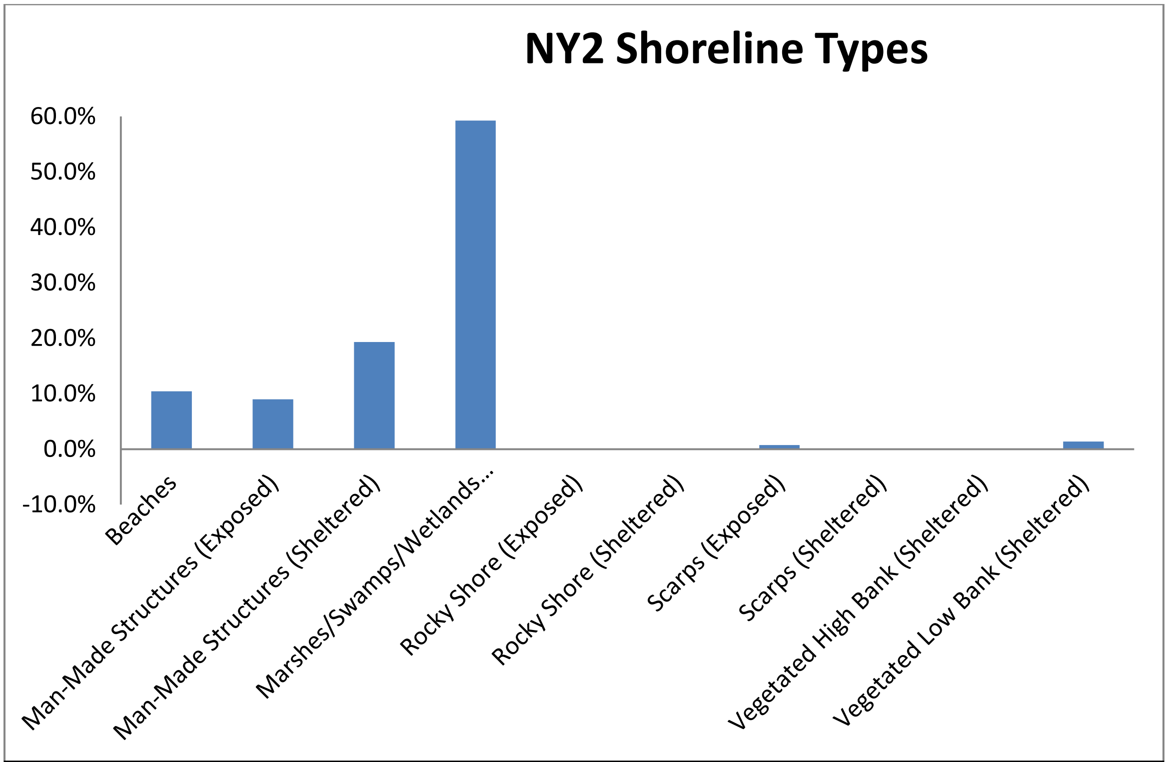

Figure 30. NY2 Shoreline Types

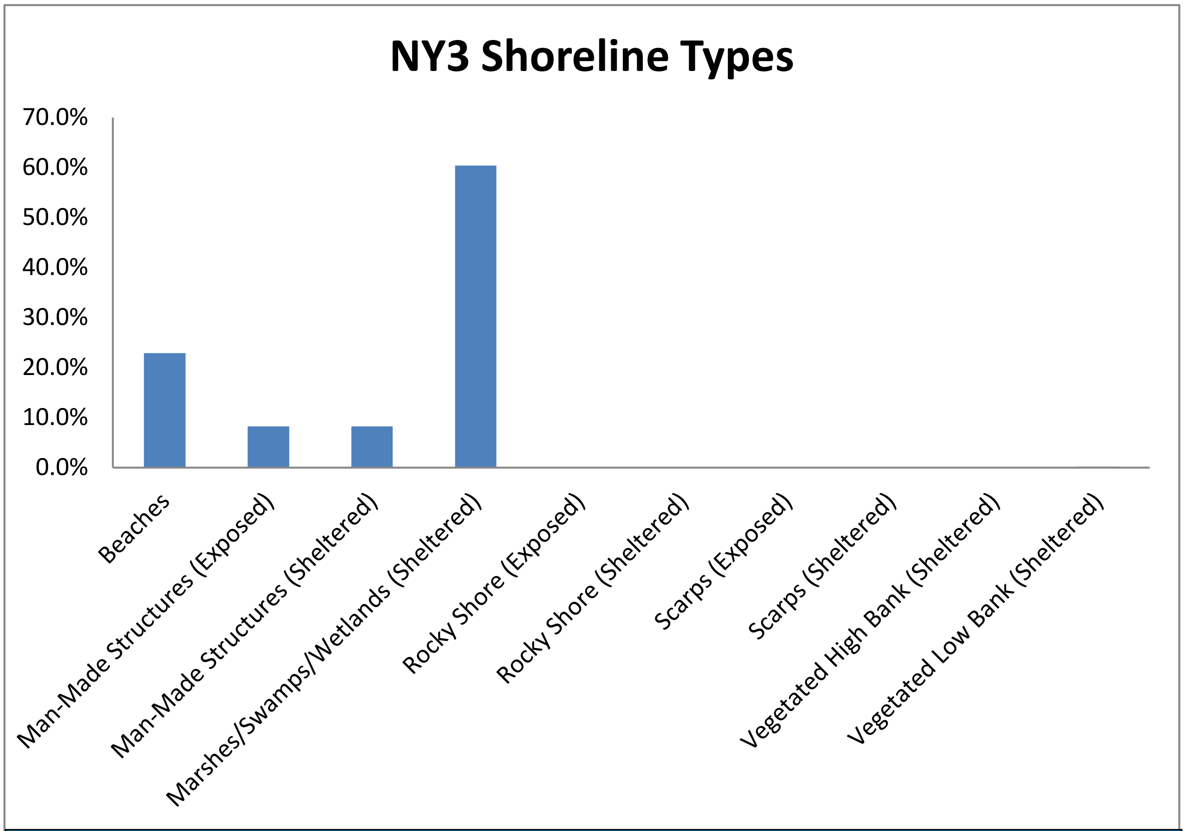

Figure 31. NY3 Shoreline Types

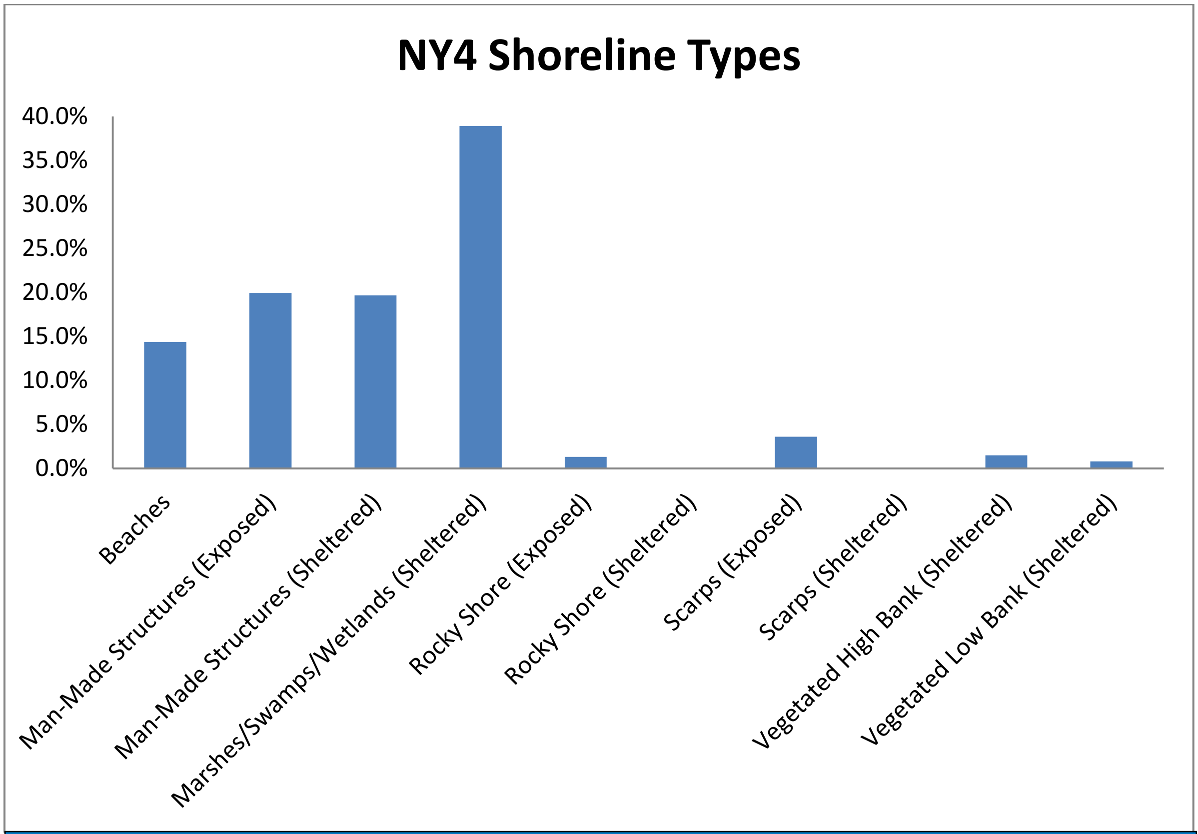

Figure 32. NY4 Shoreline Types

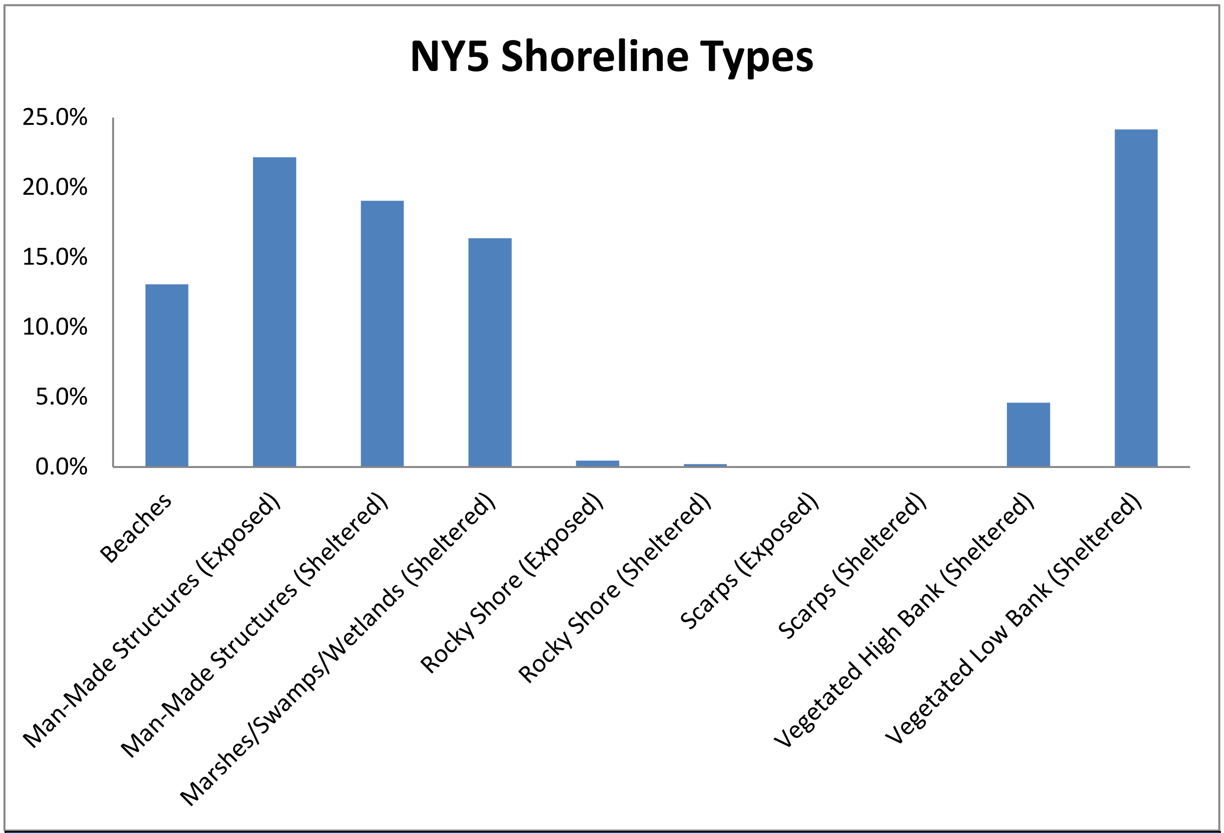

Figure 33. NY5 Shoreline Types

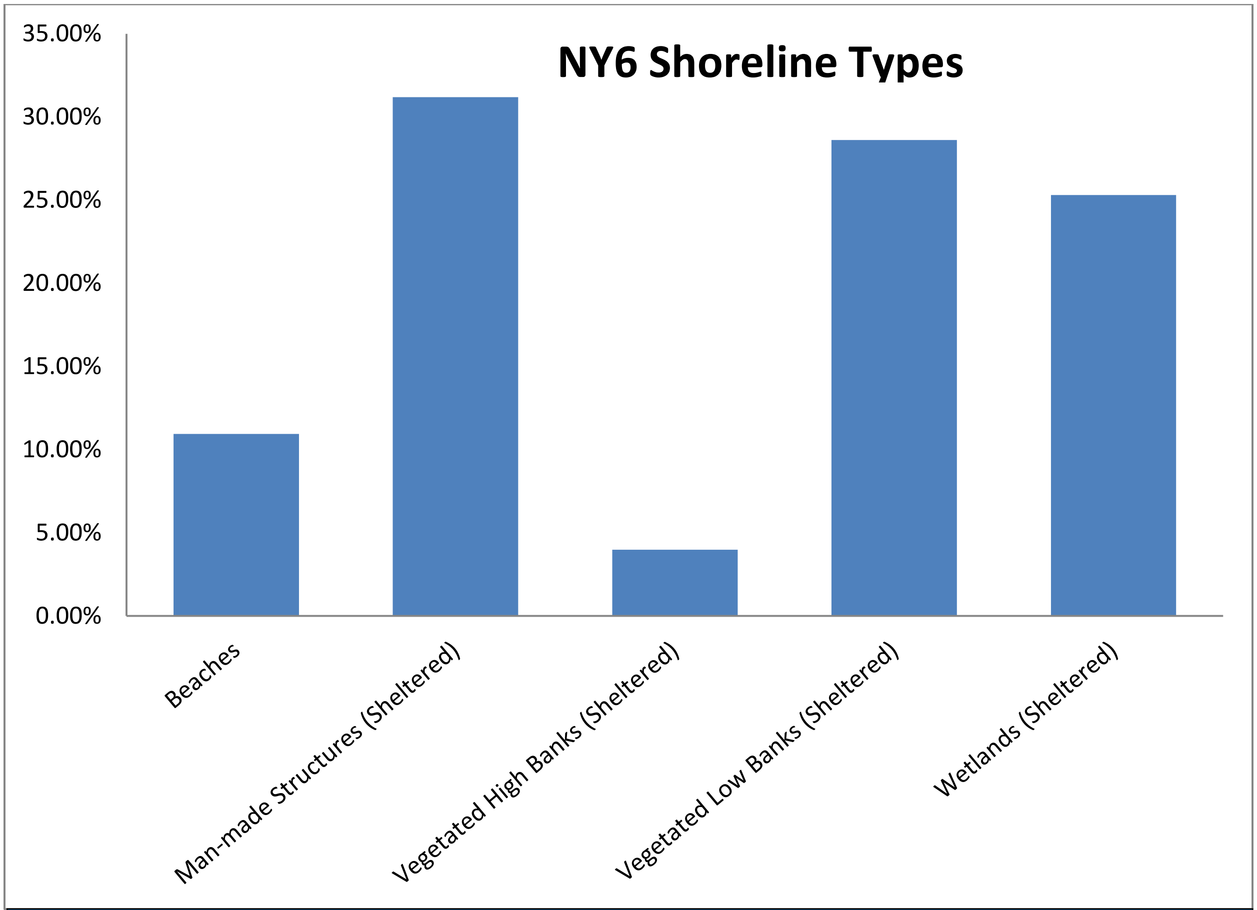

Figure 34. NY6 Shoreline Types

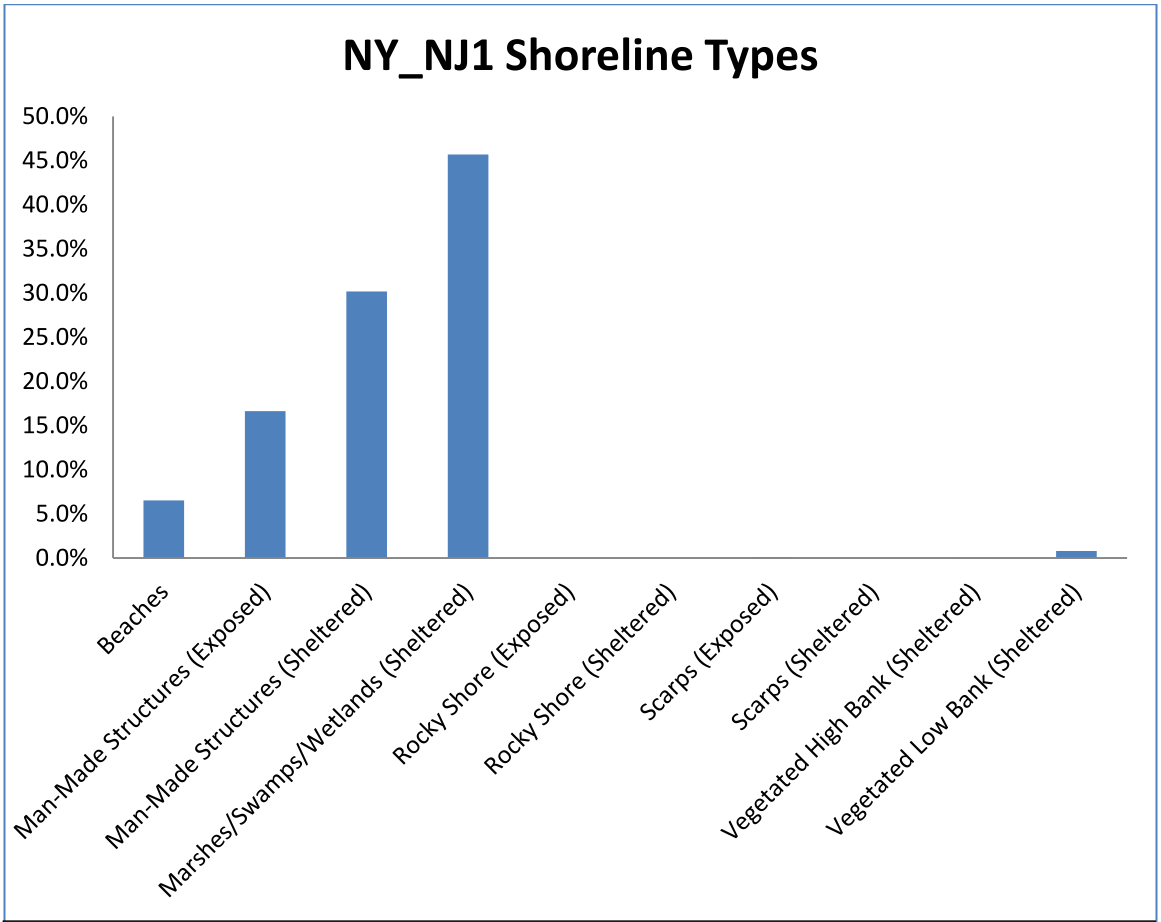

Figure 35. NY_NJ1 Shoreline Types

V.2. Cost Considerations

Conceptual design and parametric cost estimates were developed for the various coastal storm risk management measures together with quantities and parametric costs (typically per linear foot of shoreline) based on a combination of available cost information for existing projects and representative unit costs for all construction items (e.g., excavation, fill, rock, plantings) based on historical observations. Additional information on the various measures is included in the Planning Analyses Appendix.

VI. Tier 1 Assessment Results

Table 5 presents the results of the State of New York risk areas and the comparison of management measures. The reference to the level of risk reduction in the table relates to the flooding attribute of the storm damage reduction and resilience storm damage reduction function presented in Table 1 of the overview section. The level of risk reduction (High or Low) is based on a 1 percent chance flood plus three feet (High) or 10 percent chance flood (Low) level. For each shoreline type within the risk area presented in Table 5, the numerical sequence of the measures for each shoreline type within the respective risk area relates to the change in risk and the parametric unit cost estimates for the applicable measures. Nonstructural measures could be considered in all geographic contexts, subject to further evaluation at a smaller scale. As a result, Table 5 only presents the change in risk and the parametric unit cost estimates for structural measures, including NNBF.

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
NY1_B	Beaches	H	3	2	1									
NY1_B	Scarps (Exposed)	L				3					1		2	
NY1_B	Wetlands (Sheltered)	L									1	3	4	2
NY1_C	Beaches	H	3	2	1									
NY1_D	Beaches	H	3	2	1									
NY1_D	Wetlands (Sheltered)	L									1	3	4	2

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
NY1_E	Beaches	H	3	2	1									
NY1_E	Wetlands (Sheltered)	L									1	3	4	2
NY2_A	Beaches	H	3	2	1									
NY2_A	Manmade Structures (Sheltered)	H					3	2	1					
NY2_A	Vegetated Low Banks (Sheltered)	H						2	1					
NY2_A	Vegetated Low Banks (Sheltered	L				2					1			
NY2_A	Wetlands (Sheltered)	L									1	3	4	2
NY2_B	Beaches	H	3	2	1									
NY2_B	Manmade Structures (Sheltered)	H					3	2	1					
NY2_B	Scarps (Exposed)	L				3					1		2	
NY2_B	Vegetated Low Banks (Sheltered)	H						2	1					
NY2_B	Vegetated Low Banks (Sheltered	L				2					1			
NY2_B	Wetlands (Sheltered)	L									1	3	4	2
NY2_C	Beaches	H	3	2	1									

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
NY2_C	Wetlands (Sheltered)	L									1	3	4	2
NY2_D	Beaches	H	3	2	1									
NY2_D	Manmade Structures (Sheltered)	H					3	2	1					
NY2_D	Scarps (Exposed)	L				3					1		2	
NY2_D	Vegetated Low Banks (Sheltered)	H						2	1					
NY2_D	Vegetated Low Banks (Sheltered	L				2					1			
NY2_D	Wetlands (Sheltered)	L									1	3	4	2
NY3_A	Beaches	H	3	2	1									
NY3_A	Manmade Structures (Sheltered)	H					3	2	1					
NY3_A	Vegetated Low Banks (Sheltered)	H						2	1					
NY3_A	Vegetated Low Banks (Sheltered	L				2					1			
NY3_A	Wetlands (Sheltered)	L									1	3	4	2
NY3_B	Beaches	H	3	2	1									
NY3_B	Manmade	H					3	2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	Structures (Sheltered)													
NY3_B	Vegetated Low Banks (Sheltered)	H						2	1					
NY3_B	Vegetated Low Banks (Sheltered	L				2					1			
NY3_B	Wetlands (Sheltered)	L									1	3	4	2
NY3_C	Beaches	H	3	2	1									
NY3_C	Manmade Structures (Sheltered)	H					3	2	1					
NY3_C	Wetlands (Sheltered)	L									1	3	4	2
NY3_D	Beaches	H	3	2	1									
NY3_D	Manmade Structures (Sheltered)	H					3	2	1					
NY3_D	Wetlands (Sheltered)	L									1	3	4	2
NY3_E	Beaches	H	3	2	1									
NY3_E	Manmade Structures (Sheltered)	H					3	2	1					
NY3_E	Wetlands (Sheltered)	L									1	3	4	2
NY3_F	Beaches	H	3	2	1									
NY3_F	Manmade	H					3	2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	Structures (Sheltered)													
NY3_F	Vegetated Low Banks (Sheltered)	H						2	1					
NY3_F	Vegetated Low Banks (Sheltered	L				2					1			
NY3_F	Wetlands (Sheltered)	L									1	3	4	2
NY3_G	Beaches	H	3	2	1									
NY3_G	Manmade Structures (Sheltered)	H					3	2	1					
NY3_G	Vegetated Low Banks (Sheltered)	H						2	1					
NY3_G	Vegetated Low Banks (Sheltered	L				2					1			
NY3_G	Wetlands (Sheltered)	L									1	3	4	2
NY3_H	Beaches	H	3	2	1									
NY4_A	Beaches	H	3	2	1									
NY4_A	Manmade Structures (Sheltered)	H					3	2	1					
NY4_A	Rocky Shore (Exposed)	L											1	
NY4_A	Scarps (Exposed)	L				3					1		2	

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
NY4_A	Vegetated Low Banks (Sheltered)	H						2	1					
NY4_A	Vegetated Low Banks (Sheltered	L				2					1			
NY4_A	Wetlands (Sheltered)	L									1	3	4	2
NY4_B	Beaches	H	3	2	1									
NY4_B	Manmade Structures (Sheltered)	H					3	2	1					
NY4_B	Wetlands (Sheltered)	L									1	3	4	2
NY4_C	Beaches	H	3	2	1									
NY4_C	Manmade Structures (Sheltered)	H					3	2	1					
NY4_C	Wetlands (Sheltered)	L									1	3	4	2
NY4_D	Beaches	H	3	2	1									
NY4_D	Manmade Structures (Sheltered)	H					3	2	1					
NY4_D	Wetlands (Sheltered)	L									1	3	4	2
NY4_E	Beaches	H	3	2	1									
NY4_E	Manmade Structures (Sheltered)	H					3	2	1					
NY4_E	Vegetated	H						2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	Low Banks (Sheltered)													
NY4_E	Vegetated Low Banks (Sheltered	L				2					1			
NY4_E	Wetlands (Sheltered)	L									1	3	4	2
NY5_A	Beaches	H	3	2	1									
NY5_A	Rocky Shore (Exposed)	L											1	
NY5_A	Vegetated Low Banks (Sheltered)	H						2	1					
NY5_A	Vegetated Low Banks (Sheltered	L				2					1			
NY5_B	Beaches	H	3	2	1									
NY5_B	Manmade Structures (Sheltered)	H					3	2	1					
NY5_B	Rocky Shore (Exposed)	L											1	
NY5_B	Vegetated Low Banks (Sheltered)	H						2	1					
NY5_B	Vegetated Low Banks (Sheltered	L				2					1			
NY5_B	Wetlands (Sheltered)	L									1	3	4	2

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
NY5_C	Beaches	H	3	2	1									
NY5_C	Manmade Structures (Sheltered)	H					3	2	1					
NY5_C	Vegetated Low Banks (Sheltered)	H						2	1					
NY5_C	Vegetated Low Banks (Sheltered	L				2					1			
NY5_C	Wetlands (Sheltered)	L									1	3	4	2
NY5_D	Beaches	H	3	2	1									
NY5_D	Manmade Structures (Sheltered)	H					3	2	1					
NY5_D	Rocky Shore (Exposed)	L											1	
NY5_D	Vegetated Low Banks (Sheltered)	H						2	1					
NY5_D	Vegetated Low Banks (Sheltered	L				2					1			
NY5_D	Wetlands (Sheltered)	L									1	3	4	2
NY5_E	Beaches	H	3	2	1									
NY5_E	Manmade Structures (Sheltered)	H					3	2	1					
NY5_F	Vegetated	H						2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	Low Banks (Sheltered)													
NY5_F	Vegetated Low Banks (Sheltered	L				2					1			
NY5_F	Wetlands (Sheltered)	L									1	3	4	2
NY6_A	Beaches	H	3	2	1									
NY6_A	Manmade Structures (Sheltered)	H					3	2	1					
NY6_A	Vegetated Low Banks (Sheltered)	H						2	1					
NY6_A	Vegetated Low Banks (Sheltered	L				2					1			
NY6_A	Wetlands (Sheltered)	L									1	3	4	2
NY6_B	Beaches	H	3	2	1									
NY6_B	Manmade Structures (Sheltered)	H					3	2	1					
NY6_B	Vegetated Low Banks (Sheltered)	H						2	1					
NY6_B	Vegetated Low Banks (Sheltered	L				2					1			
NY6_B	Wetlands (Sheltered)	L									1	3	4	2
NY6_C	Manmade	H					3	2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	Structures (Sheltered)													
NY6_C	Vegetated Low Banks (Sheltered)	H						2	1					
NY6_C	Vegetated Low Banks (Sheltered	L				2					1			
NY6_D	Manmade Structures (Sheltered)	H					3	2	1					
NY6_D	Wetlands (Sheltered)	L									1	3	4	2
NY6_E	Manmade Structures (Sheltered)	H					3	2	1					
NY6_E	Vegetated Low Banks (Sheltered)	H						2	1					
NY6_E	Vegetated Low Banks (Sheltered	L				2					1			
NY6_F	Beaches	H	3	2	1									
NY6_F	Manmade Structures (Sheltered)	H					3	2	1					
NY6_F	Vegetated Low Banks (Sheltered)	H						2	1					
NY6_F	Vegetated Low Banks (Sheltered	L				2					1			
NY6_F	Wetlands	L									1	3	4	2

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	(Sheltered)													
NY_NJ1_A	Beaches	H	3	2	1									
NY_NJ1_A	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_A	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_A	Vegetated Low Banks (Sheltered)	L				2					1			
NY_NJ1_A	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_B	Beaches	H	3	2	1									
NY_NJ1_B	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_B	Vegetated Low Banks (Sheltered	H						2	1					
NY_NJ1_B	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_B	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_C	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_C	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_C	Manmade Structures	H					3	2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	(Sheltered)													
NY_NJ1_C	Beaches	H	3	2	1									
NY_NJ1_C	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_C	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_C	Vegetated Low Banks (Sheltered)	L				2					1			
NY_NJ1_C	Wetlands (Sheltered)										1	3	4	2
NY_NJ1_D	Beaches	H	1	2	3									
NY_NJ1_D	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_D	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_D	Vegetated Low Banks (Sheltered)	L				2					1			
NY_NJ1_D	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_E	Beaches	H	3	2	1									
NY_NJ1_E	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_F	Beaches	H	3	2	1									
NY_NJ1_F	Manmade Structures	H					3	2	1					

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	(Sheltered)													
NY_NJ1_F	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_F	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_F	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_G	Beaches	H	3	2	1									
NY_NJ1_G	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_G	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_G	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_G	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_H	Beaches	H	3	2	1									
NY_NJ1_H	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_H	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_H	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_H	Wetlands	L									1	3	4	2

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	(Sheltered)													
NY_NJ1_I	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_I	Beaches	H	3	2	1									
NY_NJ1_I	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_I	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_I	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_J	Beaches	H	3	2	1									
NY_NJ1_J	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_J	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_K	Beaches	H	3	2	1									
NY_NJ1_K	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_K	Rocky Shore (Exposed)	L											1	
NY_NJ1_K	Scarps (Exposed)	L				3					1		2	
NY_NJ1_K	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_K	Vegetated	L				2					1			

Table 5. Comparison of Measures within NACCS Risk Areas in the State of New York

Risk Areas	NACCS Shoreline Type	Level of Risk Reduction	Beach Restoration with Breakwaters	Beach Restoration with Groins	Beach Restoration with Dunes	Shoreline Stabilization	Deployable Floodwall	Floodwall	Levee	Overwash Fans	Living Shoreline	Wetlands	Reefs	SAV Restoration
	Low Banks (Sheltered													
NY_NJ1_K	Wetlands (Sheltered)	L									1	3	4	2
NY_NJ1_L	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_M	Beaches	H	3	2	1									
NY_NJ1_M	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_N	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_N	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_N	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_O	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_O	Vegetated Low Banks (Sheltered)	H						2	1					
NY_NJ1_O	Vegetated Low Banks (Sheltered	L				2					1			
NY_NJ1_P	Manmade Structures (Sheltered)	H					3	2	1					
NY_NJ1_Q	Beaches	H	3	2	1									

VII. Tier 2 Assessment of Conceptual Measures

The NACCS Regional Analysis for the State of New York Tier 1 analysis identified areas of risk based on flood inundation mapping, exposure and vulnerability to the flood hazard, and various management measures applicable to the shorelines within the risk areas by state using the aggregated measure matrices presented in Table 2 of the State Appendix Overview. To apply the principles associated with the NACCS CSRM Framework, the NACCS Tier 2 analysis considers the three strategies to address coastal flood risk in which the various management measures apply for the Southern Brooklyn and Queens – Jamaica Bay and the Rockaway Peninsula, including: 1) protection/risk reduction including on structural measures to reduce damages from future storm events. This strategy would likely be included in developed areas along the coast; 2) accommodation includes adaptive measures which can adapt based on the rate of sea level change over time. This strategy would include NNBF measures along with traditional nonstructural measures, such as elevation, floodproofing, and ringwalls; and 3) managed retreat including the acquisition and buyouts to convert land to open space.

The single risk area for local scale analysis is the Southern Brooklyn and Queens – Jamaica Bay and the Rockaway Peninsula of New York ("Tier 2") analysis. This analysis was performed in coordination with the NYSDEC and the NYC to further evaluate flood risk as part of the CSRM Framework. Defined as, NY_NJ1, Southern Brooklyn and Queens – Jamaica Bay and the Rockaway Peninsula (Table 5) includes a wide range of problems, needs, and opportunities and was selected for the sample assessment. This area was selected for additional analysis due to the lack of existing Federal projects as well as the overall need for enhanced coastal resilience to surrounding communities due to significantly developed waterfront areas. In order to describe the NACCS risk assessment and the identification of measures for all exposure areas identified in the study area, in a concise manner, this single risk area in New York at risk to coastal flooding was selected and discussed in the Main Report.

CSRM measures were considered within the three strategies for the Southern Brooklyn and Queens – Jamaica Bay and Rockaway Peninsula of New York area of high risk. The identification of measures are based upon several natural and physical characteristics including shoreline type (Table 3) land use/development, topography, sea level change inundation, extreme water levels and existing CSRM projects and aerial photography. As demonstrated in Table 5, this high risk area was subdivided into 15 sub-regions. Each sub-region offers a unique set of CSRM measures which may act as an example for similar geomorphic settings in the State of New York by state and local agencies, and non-profit organizations.

The evaluation of measures as part of the Coastal Storm Risk Management Framework is a relative evaluation of the general assumption of a change in vulnerability from the application of the management measure, based on the geographic association of the measure to the various shoreline types included in the risk areas. The process is iterative and consists of a tiered analysis. The first tier includes a broad level analysis at a regional scale. The process utilizes national or regional datasets. At this scale and corresponding level of detail in the datasets, the first tier analysis includes the broad evaluation of vulnerability as defined as the product of exposure and probability of flooding. This level of analysis should be considered a preliminary approximation, which requires much more detail before any decisions can be made for implementation.

A second tier of analysis constitutes a slightly finer analysis. This level of analysis incorporates the availability of existing coastal storm risk management projects as well as other planned activities. In addition, the second tier considers the combination of measures to reduce vulnerability. Considering combinations of measures would promote sustainable communities by buying down risk while also increasing the redundancy of measures in the comprehensive system. For example, a NNBF in combination with a structural component may provide a greater level of risk reduction, while also incorporating ecosystem services for the community. The purpose of this analysis is to describe the necessary requirements associated with comprehensive risk management, which includes a combination of various strategies and management measures, to achieve risk reduction and increased resilience.

An illustrative example of the application of the Comprehensive Coastal Storm Risk Management Framework process, including the second tier analysis, to the Jamaica Bay and Rockaway Peninsula risk area (NY_NJ1) is presented in the following paragraphs. Additional examples of this second tier analysis for each state are included in this Appendix.

The NY_NJ1 risk area encompasses southern Brooklyn and Queens in the City of New York, including the neighborhoods of Coney Island, Brighton Beach, Sheepshead Bay, Marine Park, Flatlands, Canarsie, Howard Beach, Far Rockaway, and Breezy Point. The neighborhoods of Coney Island, Brighton Beach, and the Rockaway Peninsula were fully inundated during Hurricane Sandy. In Breezy Point, 350 houses were destroyed by a fire that started when rising flood waters sparked a house's electrical system. Rockaway Peninsula lost 1.5 million cubic yards of sand from its beaches and dunes during Sandy. Residents in this area were without electricity and other utilities for weeks post-Sandy. The number of structures with flood damage from Hurricane Sandy is in the tens of thousands. In addition to dense residential and commercial development, this risk area also contains John F. Kennedy International Airport, the Metropolitan Transit Authority (MTA) A-train subway line, portions of the Gateway National Recreational Area, the historic Floyd Bennett Field, Jacob Riis Park, and Jamaica Bay itself, one of the largest remaining wetland complexes in the New York Metropolitan Area.

The USACE East Rockaway Inlet to Rockaway Inlet (Rockaway) and the Atlantic Coast of NYC, Rockaway Inlet to Norton Point (Coney Island) projects have been restored to their original design profile, pursuant to PL 113-2, through the USACE Flood Control and Coastal Emergencies program.

Storm damage within the example area is caused by storm surge flooding and wave impacts on beachfront properties especially along the Rockaway peninsula. Widespread flooding in Jamaica Bay is primarily associated with storm surge through Rockaway inlet while storm surges into Coney Island Creek is the primary source of damages to the Coney Island, Gravesend and west Brighton communities.

As part of the second tier analysis, the NY_NJ1 risk area was further subdivided into subareas to generally identify those areas appropriate for the various risk management measures and not necessarily by shoreline type as part of the first tier analyses. The purpose of this finer iterative evaluation is to reevaluate the first tier analysis at a smaller scale while considering existing coastal storm risk management projects and planned projects. For this particular example general strategies and specific project proposals included in the NYC Special Initiative for Rebuilding and Resiliency (SIRR), NY Rising Community Reconstruction Plans, NYS Plans, and ongoing USACE studies and projects, were incorporated into the evaluation. Additionally, by dividing the risk area further into subareas, a general evaluation of the combination of those measures included in the first tier analysis could be completed.

The second tier analysis resulted in an additional 15 subareas within the NY_NJ1 risk area. Three general flood risk management strategies, avoid, accommodate, and preserve, as well as regional versus local measures were considered, including a storm surge gate at the Rockaway Inlet and those management measures applicable to the shorelines identified in the risk area using the measures matrix. In addition, the analysis considered ongoing USACE projects located in the risk area, including East Rockaway Inlet to Rockaway Inlet (Rockaway) (First Interim Report) and the Atlantic Coast of NYC, Rockaway Inlet to Norton Point, NY (Coney Island) (Second Interim Report).

Two protection strategies were considered, one consisting of local protection measures such as dune and beach fill along the ocean shorelines, and revetments, seawalls, levees and floodwalls along interior bay shorelines. This strategy was developed considering existing constructed projects such as USACE's Coney Island beach fill project, as well as others that will be constructed in the near term such as beach fill and groins along Sea Gate's ocean shoreline as part of USACE's overall Coney Island project, USACE's Rockaway project, and NYSDEC natural infrastructure project at Spring Creek in Howard Beach.

A second, regional, protection strategy was developed by combining more robust ocean shoreline protection strategies with a storm surge barrier across Rockaway Inlet, and a number of NNBF measures within Jamaica Bay that would mitigate the effects of frequent flooding locally. These NNBF measures are consistent with proposed and featured projects presented in the NY Rising Community Reconstruction plans as well as other ongoing USACE efforts such as the Jamaica Bay Ecosystem Restoration Feasibility Study. These NNBF projects, which include wetland restoration, maritime forests, oyster reefs/breakwaters, natural re-contouring of existing grades, natural berm construction, etc. were also considered as part of an adaptation strategy together with non-structural measures such as elevating and flood proofing structures. Finally, a managed retreat strategy consisting of the acquisition and relocation of structures in areas subject to very frequent flooding (greater than a 10 percent flood) was also evaluated. Together, the measures evaluated cover the full range of flood risk management strategies and illustrate an integrated approach to risk reduction and increased resilience by combining structural, NNBF and non-structural measures. Table 6 presents the results of the Tier 2 analysis.

The Tier 2 analysis evaluates the relative costs associated with management measures included in the three primary strategies for coastal storm risk management for this particular area. For each of the areas identified, management measures were selected based on general knowledge and data available, including shoreline type, topography, extent of development from online aerial photography, and flood inundation mapping. The risk reduction associated with the management measures corresponds to the qualitative evaluation of measures presented in Table 6, such as high for a 1 percent flood plus three feet and low for a 10 percent flood (this is the refined measures table that was presented in the main report and the State appendix overview). The cost index was derived from parametric unit cost estimates divided by the highest parametric unit cost of all the management measure in the area. The higher the cost index the greater the relative costs. This enables the users to compare the measures associated with the risk management strategy in order to evaluate affordability and ultimately leading to an acceptable level of risk tolerance. The combination of measures leading to a selection of a plan as described in the NACCS Framework would further quantify risk reduction, and evaluate and compare the change in the risk based on the total cost of the plan. This would be completed at a smaller scale, Tier 3, which would be able to incorporate refined exposure and vulnerability, and evaluation of other risk management measures, as well as refined costs. The third tier analysis will not be completed as part of the Comprehensive Storm Risk Management Framework.

Table 6. Tier 2 Analysis Example Area Relative Cost/Management Measure Matrix for the NY_NJ1 Risk Area

Subarea	Risk Management Strategies									
	Preserve				Accommodate				Avoid	
	Structural Measures (1% flood elevation plus 3 feet)		Regional/ Gates Structural Measures (0.2% flood elevation plus 3 feet)		NNBF (10% flood elevation)		Non-Structural Measures (1% flood elevation plus 3 feet)		Acquisition (10% flood elevation)	
	Description	Cost Index	Description	Cost Index	Description	Cost Index	Description	Cost Index	Description	Cost Index
Coney Island – Sea Gate	"Strengthen" to 1 % flood design level	0.45	"Strengthen" to 0.2 % flood design level	1.00	N/A	N/A	N/A	N/A	N/A	N/A
Coney Island & Brighton Beach	"Strengthen" to 1 % flood design level	0.35	"Strengthen" to 0.2 % flood design level	1.00	N/A	N/A	N/A	N/A	N/A	N/A
Manhattan Beach	Groins + Beach Restoration	0.48	Coastal dike/ floodwall	0.72	N/A	N/A	Floodproofing	0.42	Acquisition and Relocation	1.00
Rockaway West	Beach Restoration	0.19	Beach restoration + buried seawall	0.40	N/A	N/A	Floodproofing	0.42	Acquisition and Relocation	1.00
Rockaway East –Ocean	N/A	N/A	Beach restoration + buried seawall	1.00	N/A	N/A	N/A	N/A	N/A	N/A
Coney Island Creek	Revetment	0.04	Tidal barrier and wetlands (SIRR)	0.08	NNBF	0.01	Floodproofing	0.42	Acquisition and Relocation	1.00
Jamaica Bay –Brooklyn Shoreline	Levee/ Floodwall	0.24	NNBF	0.01	NNBF	0.01	Floodproofing	0.42	Acquisition and Relocation	1.00
Howard Beach	2018 Existing Conditions plus Levee/ Floodwall	0.86	NNBF	0.07	NNBF	0.07	Floodproofing	0.42	Acquisition and Relocation	1.00
JFK Airport	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Rockaway East –Bay	Levee/ Floodwall	0.72	NNBF	0.03	NNBF	0.03	Floodproofing	0.42	Acquisition and Relocation	1.00
Rockaway West – Bay 1	Levee/ Floodwall	1.00	N/A	N/A	N/A	N/A	Floodproofing	0.09	Acquisition and Relocation	0.22
Floyd Bennett Field – National Park Service	N/A	N/A	NNBF	1.00	NNBF	1.00	N/A	N/A	N/A	N/A
Marsh Islands	N/A	N/A	NNBF	1.00	NNBF	1.00	N/A	N/A	N/A	N/A
Broad Channel	Levee/ Floodwall	1.00	N/A	N/A	NNBF	0.01	Floodproofing	0.06	Acquisition and Relocation	0.15

VIII. Focus Area Analysis Summary

Two Focus Area Analyses (FAA) have been developed for the State of New York, including the New York-New Jersey Harbor and Tributaries FAA and the Nassau County Back Bays FAA. The purpose of the FAA is to determine if there is an interest in conducting further study to identify structural, non-structural, NNBF, and policy/programmatic CSRM strategies and opportunities. The complete FAAs are provided in an attachment to this State of New York Chapter. A summary discussion of the content of this analysis for each FAA is provided in this section.

New York-New Jersey Harbor and Tributaries

The purpose of the New York - New Jersey Harbor and Tributaries (NYNJHT) Focus Area Analysis is to:

- Examine the New York – New Jersey Harbor and Tributaries to identify problems, needs, and opportunities for improvements relating to CSRM, flood risk management and related purposes.
- Identify a non-Federal sponsor(s) willing to cost-share potential future investigations.

The study area encompasses New York – New Jersey Harbor and its tributaries area that was subject to flooding caused by storm surge, and damages as a result of Hurricane Sandy. This area is commonly aligned with the USACE Hudson-Raritan Estuary (HRE) Feasibility Study Comprehensive Restoration Plan (CRP); general regions of the study area are employed in this study to identify geographically relevant problems, opportunities, and potential CSRM measures.

The study area was defined to include Jamaica Bay; Lower New York Bay; Lower Raritan River; Arthur Kill and Kill van Kull; Newark Bay, Hackensack River, Passaic River; Hudson River; Harlem River, East River, Western Long Island Sound; and Upper New York Bay. The HRE CRP Volume I introduction section presents greater geographic and geomorphic detail of these regions. Additional details can be found in the FAA Report included as an attachment to this chapter. The study area covers more than 940 square miles. A map of the study area is included as Figure 36.

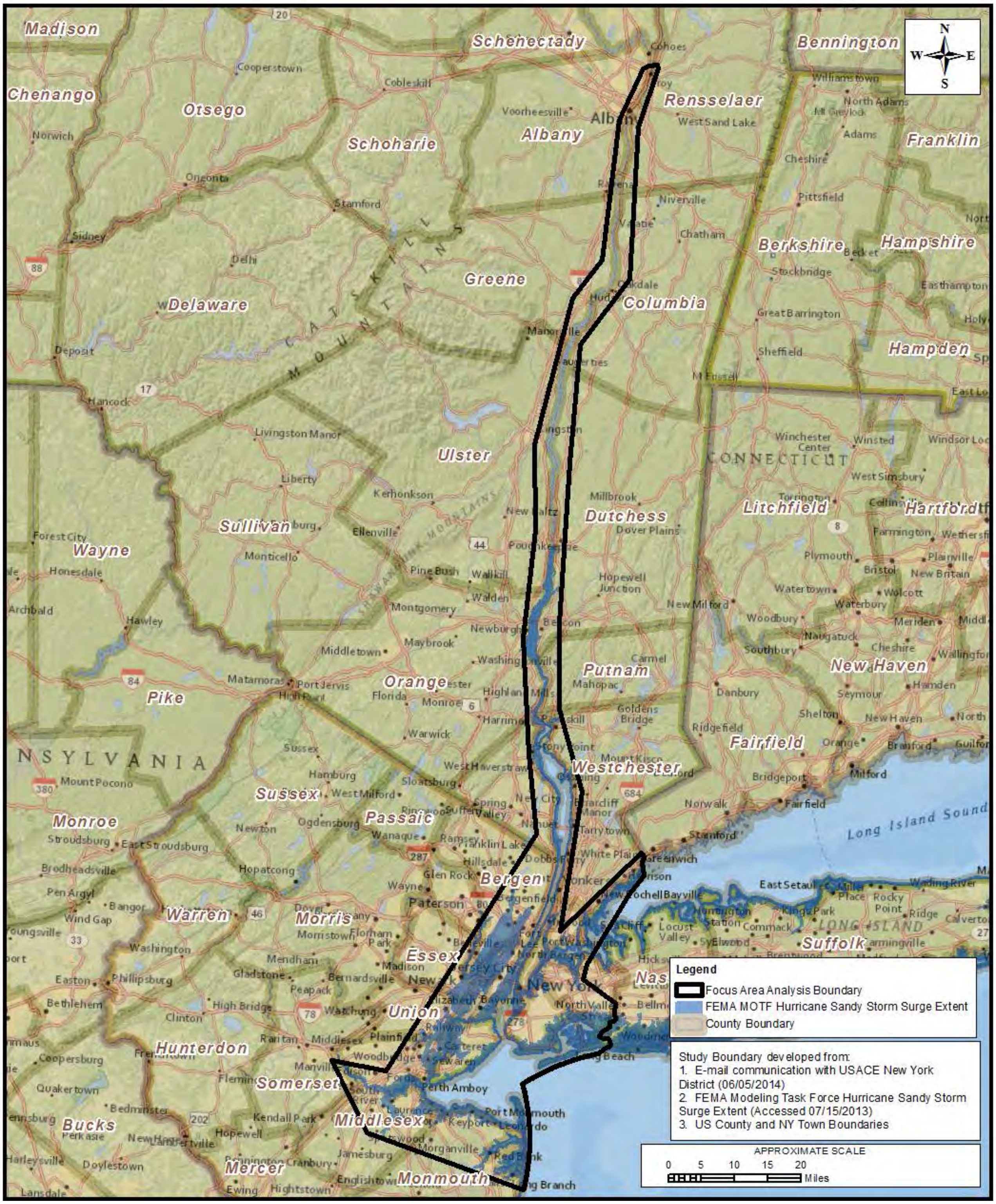

Figure 36. New York – New Jersey Harbor and Tributaries Focus Area Analysis Boundary

Nassau County Back Bays

The purpose of the Nassau County Back Bays Focus Area Analysis is to:

- Examine the Nassau County Back Bays area to identify problems, needs, and opportunities for improvements relating to CSRM, flood risk management and related purposes.
- Identify potential non-Federal sponsor(s) willing to cost-share potential future investigations.

The study area encompasses the Nassau County Back Bays area that was subject to flooding caused by storm surge, and damages as a result of Hurricane Sandy. The study area is bound to the north by Lakeview Avenue, Seaman Avenue, and East Sunrise Highway and to the south by the Atlantic Coast. The eastern and western boundaries of the study area are defined by the Suffolk County line to the east and Queens County line to the west. The inland extent of storm surge caused by Hurricane Sandy as defined by the Federal Emergency Management Agency (FEMA) Modeling Task Force (MOTF) within the southern shoreline of Nassau County is entirely included in the study area. Additional details can be found in the Focus Area Analysis Report included as an attachment to this chapter. The study area covers approximately 98 square miles of Nassau County. A map of the study area is included as Figure 37.

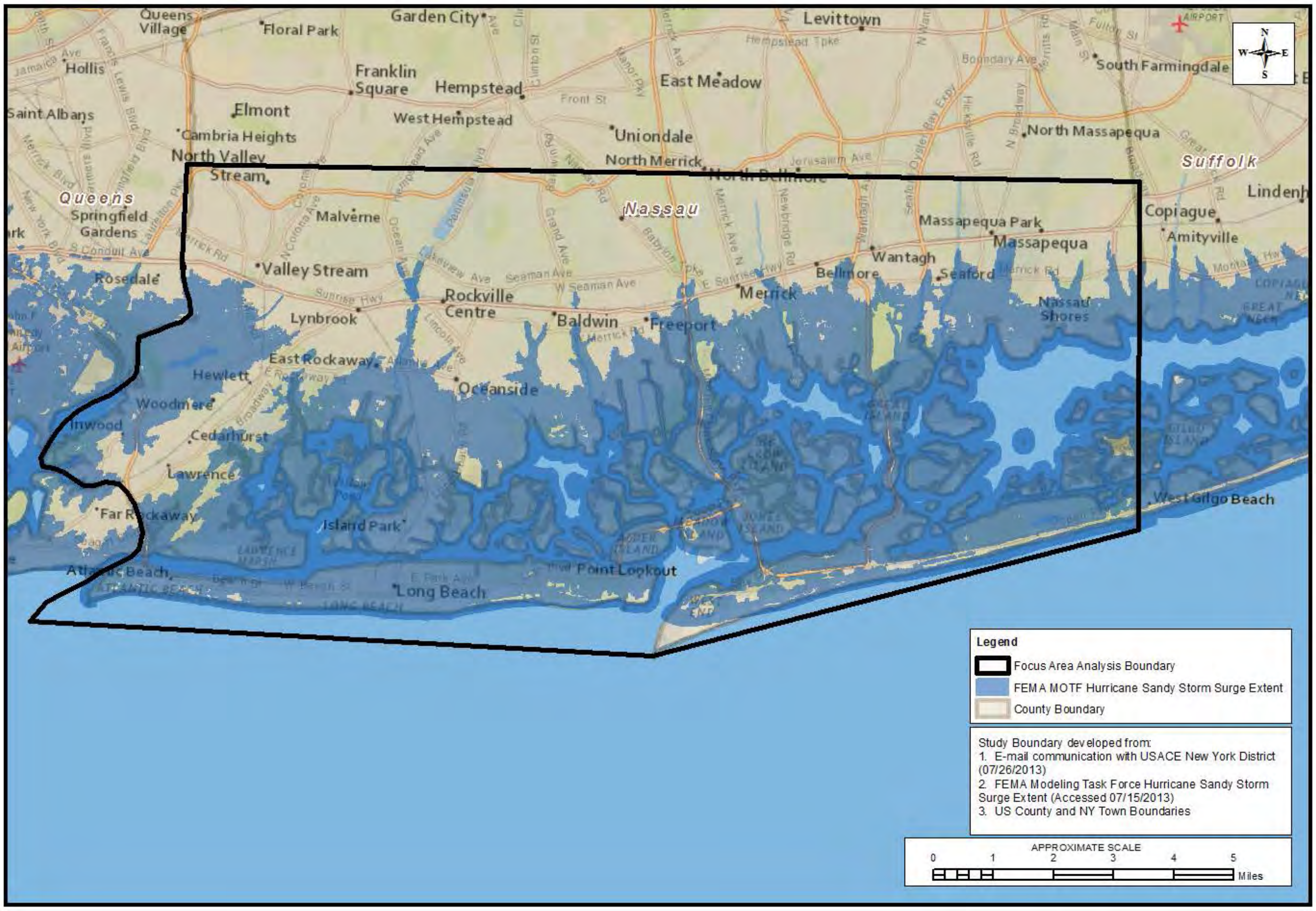

Figure 37. Nassau County Back Bays Focus Area Analysis Boundary.

Visioning and Partnering Meeting Summary

A series of visioning meetings were held throughout the region in support of the North Atlantic Coast Comprehensive Study (NACCS). The purpose of the visioning meetings was to continue dialogue with the states and other stakeholders to develop a shared vision for resilience in response to risk and exposure, building upon the previous discussions and information that have been compiled to date. USACE New York District conducted a visioning meeting for the Nassau County Back Bays Focus Area on February 4, 2014. Additionally, partnering meetings were held in two locations in New York (NYC - January 27, 2014 and the Upper Hudson Valley - March 17, 2014) to continue dialog with Federal, state, and local stakeholders in smaller settings where visioning was not as necessary due to existing comprehensive regional plans.

For the Nassau County Back Bays Visioning Session, USACE New York District presented an overview of the NACCS, as well as an update on USACE Sandy Recovery efforts in Nassau County. A brief overview of the NY Rising Community Reconstruction Program was also presented by a representative of this program. Following the presentations, meeting participants were involved in facilitated, small group discussion related to vulnerabilities, potential solutions and any institutional or other barriers to reducing risk and increasing resilience.

A summary of the most prominent common themes identified during the visioning and partnering meetings is included below.

- Coastal populations and infrastructure are vulnerable.
- Methods of coastal storm risk management strategies must be redundant, robust, and adaptable to the future uncertainty of coastal flood risk.
- Flooding from storm surge and intense precipitation events/stormwater runoff threatens coastal communities.
- Interagency coordination and collaboration are quintessential to progress in making informed decisions.
- Low-lying shorelines, such as inland bays or back bays, are significantly susceptible to flooding.
- A common vision and coastal risk framework are needed to make decisions for future conditions
- Addressing coastal storm risk is a shared responsibility borne by Federal, state, regional, local and other stakeholders
- Emphasis on data collection, hazards and impacts prediction, support modeling, and the advancement of tools are needed to provide a complete, holistic picture

Additional feedback received from the Nassau County Back Bays visioning meeting included the following.

- Stakeholders expressed that they were overloaded with information and data requests
- The missions and requests from different agencies overlapped
- Damages from Hurricane Sandy severely impacted the communities in this area and the recovery process is still very much ongoing

IX. Agency Coordination and Collaboration

IX.1. Coordination

As part of PL 113-2, Federal agencies received appropriations for various purposes within the agencies' mission areas in response to Hurricane Sandy. As part of the NACCS authorizing language, the NACCS was conducted in coordination with other Federal agencies, and state, local, and tribal officials to ensure consistency with other plans to be developed, as appropriate. Extensive collaboration occurred as part of the NACCS, which is presented in the Agency Coordination and Collaboration Report.

Interagency points of contact and subject matter experts were asked in early 2013 to assist in preparing the scope for the NACCS and to be engaged in data gathering and development of analyses as part of the NACCS. This coordination complements the NACCS website located at http://www.nad.usace.army.mil/CompStudy.aspx and webinars for a number of coastal resilience topics. Several lettersto the New York State Department of Environmental Conservation (NYSDEC) commencing in mid -2013 requested feedback with respect to the preliminary problem identification, the post-Sandy Most-Likely Future Conditions, vulnerability mapping, and problems, needs and opportunities for future planning initiatives. NYSDEC also conducted a review of a previous draft of this Appendix for the State of New York in April of 2014.

USACE received three separate response letters from NYSDEC addressing comments on: the draft Project Management Plan and the draft Scope of Work; the Agency Review Draft; and the problems, needs, and opportunities for future planning initiatives. Several meetings were held with NYSDEC to discuss the original USACE correspondences. In response to the April 16, 2014 USACE request letter regarding problems, needs, and opportunities, NYSDEC responded by letter April 29, 2014 (Attachment B of Appendix D). The letter states that there is significant interest in the USACE development of more specific solutions for CSRM and resilience in the New York New Jersey Harbor and Tributaries (NYNJHT) Focus Area Analysis study area, which is in line with New York's 2100 Commission report, which recognized the importance of infrastructure improvements and resilience for NYC, with particular emphasis on the economically important New York Harbor region.

Subsequently, on January 27, 2014, representatives of the NYSDEC and the NYC Office of Long Term Planning and Sustainability met with members of the U.S. Army Corps of Engineers North Atlantic Division and New York District to discuss the NYNJHT region. This meeting and subsequent discussions affirmed the necessity for a feasibility study of the NYNJHT region and potential pathways to make this occur. New York reiterated that in order to be successful, the NACCS must set the stage for one or more feasibility studies focused directly on the NYNJHT region, to be accomplished at full Federal expense. The State of New York feels an effective feasibility study should include the following elements: (1) consideration of a wide range of engineering alternatives to address the full range of human, private property, and public infrastructure risks; (2) a description of the level of risk that would justify expedited project implementation; (3) a recognition that the New York-New Jersey Harbor is a shared waterway; (4) a recognition that bi-state cooperation is desirable; (5) an outline of the necessary and sufficient contents of any feasibility study stemming from the NYNJHT region.

IX.2. Related Activities, Projects and Grants

Specific Federal, state, and private non-profit organization efforts that have been prepared in response to PL 113-2 are discussed below specifically for the State of New Jersey. Additional information regarding Federal, state, and private non-profit organization projects and plans applicable to all of the States in the NACCS Study Area are discussed in Appendix D: State and District of Columbia Analyses, while additional information regarding the alignment of interagency plans and strategies is discussed in the Agency Collaboration and Coordination Report.

Federal Efforts

The Department of the Interior (DOI) received $360 million in appropriations for mitigation actions to restore and rebuild national parks, national wildlife refuges, and other Federal public assets through resilient coastal habitat and infrastructure. In August 2013, the Department of the Interior (DOI) announced that USFWS and the National Fish and Wildlife Foundation (NFWF) would assist in administering the Hurricane Sandy Coastal Resiliency Competitive Grant Program which will support projects that reduce communities' vulnerability to the growing risks from coastal storms, sea level change, flooding, erosion and associated threats through strengthening natural ecosystems that also benefit fish and wildlife. The Hurricane Sandy Coastal Resiliency Competitive Grants Program will provide approximately $100 million in grants for 46 proposals to those states that were affected by Hurricane Sandy. States affected is defined as those states with disaster declarations as a result of the storm event. The grants range from $100,000 to $5 million and requests for proposal were due by January 31, 2014. More information on the program can be found at www.nfwf.org/HurricaneSandy, and the full list of projects can be found at http://www.nfwf.org/hurricanesandy/Documents/2014-grants-list-v2.pdf. Figure 38 presents proposed projects (including DOI grant projects that were not selected to receive grant funding because those that were not selected to receive grant funding represent an opportunity to potentially receive funding in the future) and other ongoing Federal actions using PL 113-2 funding.

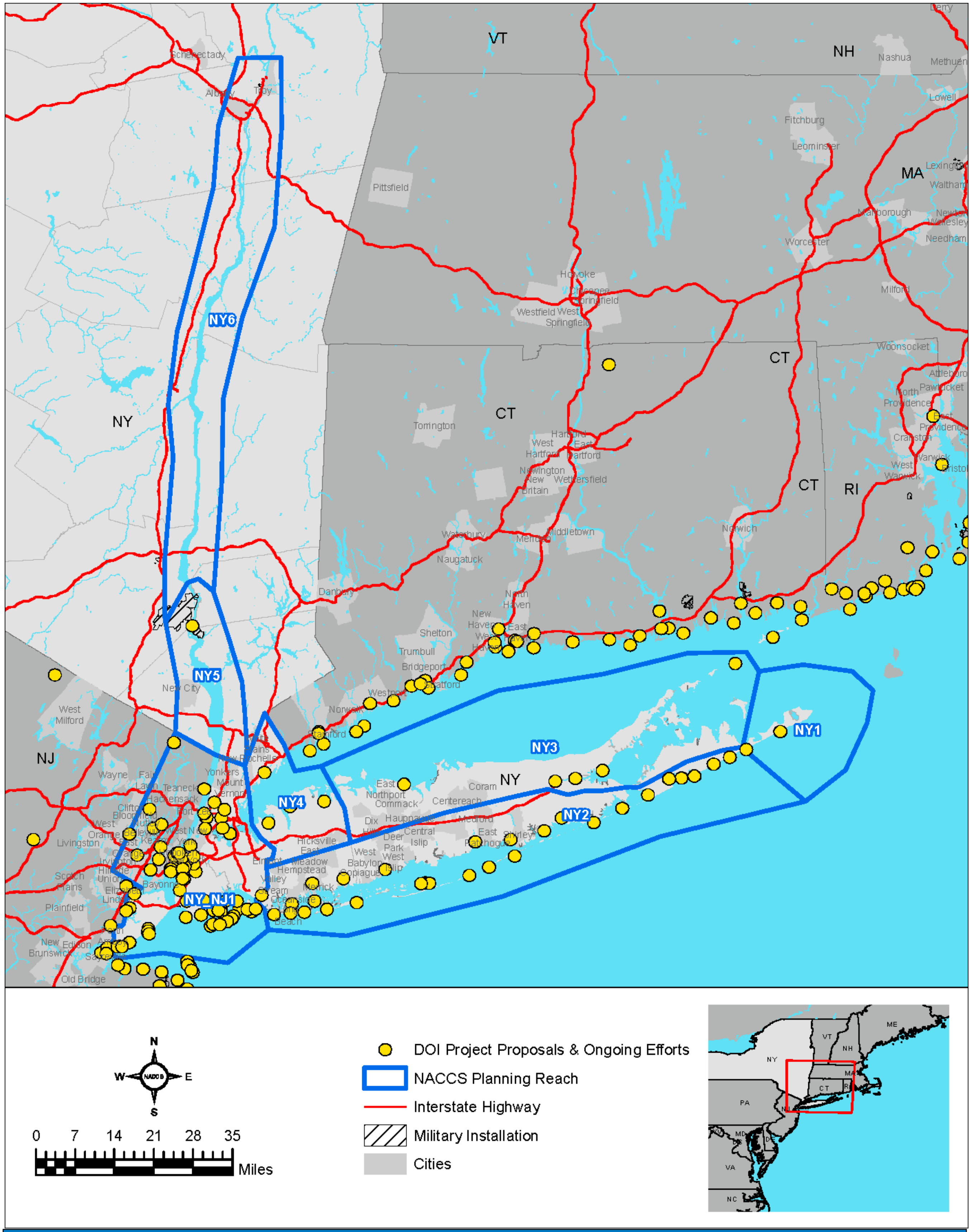

Figure 38. DOI Project Proposals and Ongoing Efforts for the State of New York.

In addition to the Hurricane Sandy Rebuilding Task Force discussed in the Overview section of this State Appendix, the U.S. Housing and Urban Development (HUD) has allocated approximately $12 billion for recovery actions including Rebuild by Design to rebuild areas affected by Hurricane Sandy through the Community Development Block Grant Program (CDBG), with an additional $2.5 billion identified for future allocation upon approval of the amendments to the State and City Disaster Recovery Plans. In the State of New York (including NYC), $7.45 billion of CDBG funds were made available for areas affected by Hurricane Sandy, with an additional $1.6 billion identified for future allocation upon approval of the amendment to the State and City Disaster Recovery Plans. More information is available at www.*hud*.gov/*sandy.*

HUD led Rebuild by Design, an initiative following the Hurricane Sandy Rebuilding Task Force. The purpose of the initiative was to consider innovative and implementable solutions to address risk of future climate events. By creating a competition, the effort brings together experts from various fields to develop opportunities for resilience and innovation as part of the rebuilding process in areas with extensive impacts from Hurricane Sandy in Connecticut, New Jersey, and New York. Three geographical categories were identified: City, Shore, and Region. Ten projects were selected by HUD Secretary Shaun Donovan to proceed into a design phase. Six of the ten proposals address the hazards of coastal storms in New York including: 1) “The BIG U (East River Park) – Manhattan”; 2) “Living with the Bay (Slow Streams) – Nassau County, Long Island”; 3) “Living Breakwaters – Tottenville, Staten Island”; 4) “Lifelines, Hunts Point, South Bronx”; 5) “Commercial Corridor Resiliency - The Rockaways & Red Hook (NYC), Asbury Park, NJ; and 6) Blue Dunes – Offshore Islands, NY Harbor”. On June 2, 2014 HUD announced 6 winning proposals, four of which will address the hazards of coastal storms in New York (#1 to #4, as previously identified). More information on the initiative and the various designs that were submitted for consideration for the competition is available at http://www.rebuildbydesign.org/.

Other Federal projects and efforts conducted within the agencies’ mission areas in response to Hurricane Sandy not associated with PL 113-2 are discussed in this section.

Following Hurricane Sandy landfall, President Obama issued an initial disaster declaration for several New York counties. Federal partners were directed to enact the National Disaster Recovery Framework to conduct a comprehensive and collaborative response to the disaster (FEMA-4085-DR-NY). This included six Recovery Support Functions (RSF) overseen by FEMA. Each RSF has the responsibility to coordinate and develop a Mission Scoping Assessment and a Recovery Support Strategy in one of six areas: Natural and Cultural Resources (including coastal resources such as beach, dunes, wetlands and estuaries), Infrastructure Systems, Health and Social Services, Housing, Economic, and Community Planning and capacity Building. More information is available at: http://www.fema.gov/disaster/4085.

Under the National Response Plan, the U.S. Department of Homeland Security established a Joint Field Office (JFO) as one of the principal NRP organizational elements designed to implement a new single, comprehensive approach to domestic incident management. The JFO is a temporary Federal multiagency coordination center established locally at a central location to coordinate Federal, State, local, tribal, nongovernmental and private-sector organizations with primary responsibility for activities associated with threat response and incident support. Hurricane Sandy JFOs were established in New York, New Jersey, and Connecticut.

FEMA also developed FEMA - 942: “Mitigation Assessment Team Report: Hurricane Sandy in New Jersey and New York” (FEMA, 2013). This report documents observations made during field visits to evaluate key building damage caused by Hurricane Sandy. The report presents recommendations with regards to key engineering concepts, codes and standards, mitigation measures and considerations that can be used in the planning and recovery process to help minimize future damage to structures and their related utility systems. Additional info can be found at http://www.fema.gov/media-library/assets/documents/85922.

Suffolk County has applied for $25 million in Federal funds under the Department of Agriculture's Sandy Emergency Watershed Protection Program (funded by PL 113-2) to finance a coastal storm risk management project for the communities of Mastic and Shirley. The project would allow Suffolk County to acquire 60 parcels of private land, with the consent of property owners, in vulnerable, flood-prone Mastic and Shirley areas devastated by Hurricane Sandy. The land would then be returned to its natural state improving resilience by preserving and enhancing vulnerable wetland habitat which serves as a critical natural defense against coastal storms.

State and New York City Efforts

Numerous studies and reports regarding the NYS coastline have been produced. Of the myriad reports, three are referenced in this section for the purposes of the NACCS. They are the New York State Coastal Management Program (1982), the NYS2100 Report (2013) on New York State Infrastructure Resilience, and the PlaNYC: A Stronger, More Resilient New York (2013) by the City of New York Special Initiative for Rebuilding and Resiliency (SIRR). These three reports were chosen for their comprehensive scope, encapsulating many smaller initiatives, and for their direct pertinence to the issue of coastal flood risk management measures being investigated by non-Federal entities.

The New York State Coastal Management Program (approved 1982, updated 2006) serves as a framework to government decisions on New York's coasts, by coordinating Federal, state, and municipal actions to ensure consistency of land use, and by advocating policies to promote beneficial use of coastal resources, to prevent the impairment of coastal resources, and to manage major activities substantially affecting numerous resources (2006:1).[3] The Coastal Management Program Report identifies 44 policies, consistent with the program objectives, to be implemented or followed by entities wishing to pursue actions within the coastal zone.

In the month following Hurricane Sandy, New York State Governor Andrew Cuomo convened the NYS 2100 Commission to examine infrastructure vulnerability within the state and recommend actions to improve the resilience of the infrastructure systems.[4] The nine major public policy recommendations from the NYS 2100 report (2013:12-13) are:

1. Protect, upgrade, and strengthen existing systems
2. Rebuild smarter: ensure replacement with better options and alternatives
3. Encourage the use of green and natural infrastructure
4. Create shared equipment and resource reserves
5. Promote integrated planning and develop criteria for integrated decision-making for capital investments
6. Enhance institutional coordination
7. Improve data, mapping, visualization, communication systems

[3] http://coastalmanagement.noaa.gov/mystate/ny.html
[4] http://www.governor.ny.gov/NYS2100Commission

8. Create new incentive programs to encourage resilient behaviors and reduce vulnerabilities
9. Expand education, job training and workforce development opportunities.

In April of 2013, Governor Cuomo announced the NY Rising Community Reconstruction (NYRCR) Program, establishing more than $650 million for a planning and implementation process that provides rebuilding and resilience assistance to communities severely damaged by Hurricane Sandy, as well as Hurricane Irene and Tropical Storm Lee. Drawing on lessons learned from past recovery efforts, the NYRCR Program is a unique combination of bottom-up community participation and State-provided technical expertise.

The NYRCR Plan is an important step toward rebuilding a more resilient community. Forty-five NYRCR Communities, each comprising one more of the 102 localities, were created and led by a NYRCR Planning Committee composed of local residents, business owners, and civic leaders. Throughout the planning process, Planning Committees were supported by staff from the Governor's Office of Storm Recovery, planners from the NYS Department of State and NYS Department of Transportation, and consultants from world-class planning firms that specialize in engineering, flood mitigation solutions, natural and nature based features, and more. Each Planning Committee assessed storm damages and current risk, identified the community needs and opportunities, and developed recovery and resilient strategies.

Each NYRCR Plan identifies projects and implementation actions to help fulfill recovery and resilience strategies. Each locality is eligible for between $3M and $25M of Community Development Block Grant (CDBG) dollars to implement elements of their plans. The NY Rising Community Reconstruction team is also working to help communities identify other Federal, state, local, nonprofit, and private resources to supplement this funding. Some projects and actions identified in the plans are longer-term, and need to be further developed before their implementation may begin. The completed NYRCR Plans are:

Catskills/Hudson Valley Region

Stony Point

Ulster County Communities

Long Island Region

- Baldwin
- Barnum Island, Oceanside, Village of Island Park, Harbor Isle
- Bay Park, Village of East Rockaway
- Bellmore and Merrick
- City of Long Beach
- Fire Island
- Lido Beach and Point Lookout
- The Massapequas
- Mastic Beach and Smith Point of Shirley
- Oakdale and West Sayville
- Seaford and Wantagh
- South Valley Stream
- Village of Amityville and Copiague
- Village of Atlantic Beach, Atlantic Beach Estates, East Atlantic Beach
- Village of Babylon, West Babylon

- Village of Bayville
- The Five Towns (Village of Cedarhurst, Hewlett, Village of Lawrence, Woodmere, Village of Hewlett Neck, Village of Hewlett Harbor, Meadowmere, and Inwood)
- Freeport
- Village of Lindenhurst
- West Gilgo to Captree
- West Islip

NYC Region

- Breezy Point
- Brighton Beach, Coney Island, Manhattan Beach, and Sea Gate
- Broad Channel
- Gerritsen Beach and Sheepshead Bay
- Lower Manhattan
- Howard Beach
- Red Hook
- Rockaway East
- Rockaway West
- East and South Shores Staten Island

More detailed information about NY Rising and the Community Reconstruction Plans can be found at http://www.stormreocvery.ny.gov/nyrcr.

The City of New York formed the Special Initiative for Rebuilding and Resiliency (SIRR) to identify recovery measures compiled in the report, *A Stronger, More Resilient New York,* released in June 2013.[5] The SIRR was charged by the Mayor of New York City to analyze the impacts of Hurricane Sandy on the City's buildings, infrastructure, and people; to assess the risks faced by the City from future coastal flood risk, especially in the face of climate change, and to identify strategies to promote a resilient city, and proposals to rebuild portions of the city that were most strongly impacted by Hurricane Sandy. The PlaNYC Report identifies policy changes, and potential structural and non-structural measures, to address coastal flood risk within the Brooklyn-Queens waterfront, the east and south shores of Staten Island, southern Brooklyn and Queens, the Bronx, and southern Manhattan. Based on coordination with the City, it is understood that implementation of larger scale structural and non-structural efforts would be contingent upon Federal involvement, and that any USACE studies resulting from the current effort would incorporate analysis of the measures proposed in the PlaNYC report.

Coordination with the NACCS

From a letter dated September 4, 2013 requesting feedback with respect to the preliminary problem identification and vulnerability mapping, the New York District received information and comments from NYSDEC on October 2, 2013 and from NYC on October 4, 2013. The primary comments from NYSDEC addressed:

1. Recommendation to extend analysis of risk areas northward on Hudson River to include full extent of tidal influence, up to Troy Dam

[5] http://www.nyc.gov/html/sirr/html/home/home.shtml

2. Analysis does not account for the combination of heavy rainfall event (Hurricane Irene) and a surge event (Hurricane Sandy), which would be the worse case scenario for the Hudson estuary
3. Evaulation of vulnerable environmental resources should be extended beyond seagreass to include all types of submerged aquatic vegetation (SAV).
4. It was difficult to comment on the accuracy of the vulnerability mapping without knowing what the mapped spots were intended to represent.

Private Non-Profit Organization Efforts

Structures of Coastal Resilience (SCR) is a Rockefeller Foundation-supported project dedicated to studying and proposing resilient designs for urban coastal environments in the North Atlantic region. SCR brings together a distinguished group of engineers, scientists, architects, landscape architects, and scholars from Princeton, Harvard, the City College of New York, and University of Pennsylvania. The engineering and science team at Princeton is working on the coastal storm and climate change probabilistic hazards assessment and each of the four design teams is developing both general strategies and features for coastal storm risk management in the four study regions: Narragansett Bay, RI; Jamaica Bay, NY; Atlantic City, NJ; and Norfolk, VA. The City College of New York team favors an approach to resilience which considers salt marsh loss as a paradigmatic example of environmental vulnerability and the need to maintain a resilient marsh ecosystem to provide coastal storm risk management services to adjacent communities through wind fetch reduction and wave attenuation.

In the wake of Hurricane Sandy, NYC asked The Nature Conservancy to prepare a conceptual study on how a mix of natural and built defenses could be implemented in a dense urban area. The Nature Conservancy prepared the report, called “Integrating Natural Infrastructure into Urban Coastal Resilience” by request from the NYC SIRR to evaluate the role of nature and natural infrastructure in managing risk to coastal communities in NYC from some of the impacts of climate change. The community of Howard Beach, Queens, an area that was hard hit during Hurricane Sandy, was selected as a representative neighborhood for conceptually addressing the use of natural systems as part of a resilience strategy in the face of a changing climate and future storm events.

The highlights of the study found: (1) natural features can be successfully used in a dense urban setting, in combination with “built” defenses, to provide efficient and cost-effective risk management from sea level change, storm surges and coastal flooding; (2) innovative financing options are available to bring these hybrid approaches to reality; and (3) community participation is a necessary ingredient for any future work aimed at developing solutions for particular communities.

The analysis looked at natural defenses like re-vegetated shorelines, mussel beds and restored wetlands, and also at more traditional, built defenses like removable sea walls and sea gates at the entrance to some of Howard Beach’s canals. The experts studied a variety of scenarios to determine what would be most effective, what costs and financing might look like, and how this might all look long-term.

The study found that the hybrid approaches, combining natural and built options, could work effectively in dense urban areas to provide climate risk management as well as other benefits for communities. The Nature Conservancy found that once you start mixing natural and built defenses, you start seeing great returns on residential properties. Although it may seem like the only way to manage risk to a dense urban area is with built infrastructure, the study demonstrates that there is a significant, cost-efficient role for nature to play. Additional information on the Nature Conservancy’s study on Howard Beach can be found at http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newyork/natural-infrastructure-study-at-howard-beach.xml.

Prior to Hurricane Sandy, The Nature Conservancy had developed their coastal resilience tool to help coastal communities and decision-makers in Connecticut, Long Island and NYC help manage risk from flooding and storm surges. Following Hurricane Sandy, The Nature Conservancy updated the coastal resilience tool, which now allows communities explore different flooding scenarios, analyze the potential impacts on communities, natural resources and critical infrastructure like roads and schools and develop solutions to address these realities. The coastal resilience tool can be found at http://coastalresilience.org/.

In June 2014, Climate Central launched its enhanced Surging Seas Risk Finder for New York, which includes extensive downloadable data. The Risk Finder is a public web tool that provides local projections, maps and assessments of exposure to sea level change and coastal flooding tabulated for every zip code and municipality along with planning, legislative and other districts. Exposure assessments cover over 100 demographic, economic, infrastructure and environmental variables using data drawn mainly from Federal sources, including NOAA, USGS, FEMA, DOT, DOE, DOI, EPA, FCC and the Census. The web tool was recently highlighted at the launch of The White House's Climate Data Initiative. More information can be found at http://sealevel.climatecentral.org/.

Table 7 presents the list of specific Federal, state, and private non-profit organization projects and plans proposed for the State of New York.

Table 7. Post Hurricane Sandy New York Federal and State Projects and Plans.

Agency	State	Proposal	Cost
USFWS/DOI	NY	Salt Marsh Restoration and Enhancement at Seatuck, Wertheim and Lido Beach National Wildlife Refuges, Long Island, New York	$11,093,000
USDA/NRCS	NY	NRCS will provide $7.5 million to restore this urban wetland. The project includes creating wetland pools that will reduce the speed of water flow and hold flood and storm water. Approximately 80 percent of streets in and around the project area regularly flood because they do not have storm sewers, and the improvements announced today will provide outlets for storm sewers to be constructed in the future. The restoration will provide habitat for animals and will promote native habitats that range from open water to upland forest.	$7,500,000

Rockefeller Foundation	NY	NYC is home to more than 520 miles of coastline and more than 8 million residents -- nearly 400,000 of whom live in buildings that are physically vulnerable to coastal flooding and sea level change. Faced with an aging building stock, an expanding 1 percent floodplain, and rising costs of insurance, NYC's coastal communities need to be better prepared. The city's efforts to protect its neighborhoods could lead to replicable, cost-effective models for the rest of the world.	
HUD	NYC	Grantees will be required to identify unmet needs for housing, economic development and infrastructure and may use this allocation to address those unmet needs. Grantees will be required to incorporate a risk assessment in their planning efforts to ensure long term resilience.	$3,219,820,000
HUD	NY	Grantees will be required to identify unmet needs for housing, economic development and infrastructure and may use this allocation to address those unmet needs. Grantees will be required to incorporate a risk assessment in their planning efforts to ensure long term resilience.	$3,810,960,000
NY MTA	NY	MTA will use the funds to complete hundreds of projects in the following categories: •Rail Support and Equipment Facilities Repair: $535 million for critical repairs primarily to three damaged under-river tunnels—Greenpoint, Montague, and Steinway. •Electrical and Power Distribution Repair: $138.9 million to restore damaged substations and power infrastructure for the Long Island Rail Road (LIRR) and Metro-North Railroad. •Signal and Communication Repair: $88.1 million to repair essential communications and signal equipment for Metro-North (system-wide) and LIRR's Long Beach Branch and Westside storage yard. Transitway Line Restoration: $91.5 million to restore damaged rights of way on the Metro-North Harlem, Hudson, and New Haven Lines; and for design services to make long-term repairs to damaged assets. •Rail Stations, Stops, and Terminals: $32 million to repair to stations, employee facilities, and fare collection equipment for both rail and bus facilities.	$886,000,000

NOAA	NY/NJ	Contract topometric-bathymetric lidar data collection of the shoreline in the highest impact areas (primarily NY/NJ)	
NOAA	NY/NJ	Contract topometric-bathymetric lidar data collection of the shoreline in the highest impact areas (primarily NY/NJ)	
NYCDEP	NYC	A DOI/NFWF grant to develop a self-sustaining oyster population in Jamaica Bay, New York. Project will improve water quality and increase oyster larvae recruitment.	$1,375,000
NYCDPR	NYC	A DOI/NFWF grant to restore ecosystem function and habitat in Starlight Park on the Bronx River in NYC. Project will re-naturalize the shoreline, restore habitat function, and remove contaminated soil.	$16,400,000
CT Fund for the Environment	NY	A DOI/NFWF grant to Enhance Sunken Meadow State Park's 135 acres of salt marsh and remove runoff in Long Island, New York. Project will strengthen ecosystem resilience and promote green infrastructure benefits.	$2,557,500
The Nature Conservancy – New York	NY	A DOI/NFWF grant to mitigate flooding and restore fish passage in the Ausable Watershed, but replacing three flood-prone culverts. Project will also reduce community costs.	$808,454
NYCDPR	NYC	A DOI/NFWF grant to strengthen Coney Island's resilience through installation of 14 green streets in NYC, New York. Project will mitigate flooding, filter over two million gallons of stormwater run-off, and serve as a model to other communities.	$1,323,333
NYCDPR	NYC	A DOI/NFWF grant to improve Harlem River's water quality and resilience through stream daylighting of the Tibbetts Brook, a tributary to the Harlem River. Project will reduce over 88 million gallons of stormwater runoff and decrease sewer overflow events by 15% annually.	$2,366,000
NYCDPR	NYC	A DOI/NFWF grant to restore Spring Creek Park's 11 acres of salt marsh and 16 acres of coastal upland in Queens, New York. Project will reduce flood impacts, capture run-off, and contribute recreational space	$11,237,500
NYCDPR	NYC	A DOI/NFWF grant to restore Sunset Cove's five acres of wetland and seven acres of upland habitat in Queens, New York. Project will enhance water quality, provide shellfish habitat, and increase public recreation access.	$7,090,000

Suffolk County	NY	A DOI/NFWF grant to restore 400 wetland acres and build capacity to rehabilitate 1,500 acres in Suffolk County, New York. Project will strengthen wetland resilience and provide capacity-building opportunities.	$1,998,740
The Seneca Nation of Indians	NY	A DOI/NFWF grant to restore riparian buffer and reconnect ten land-locked areas to the Allegany Reservoir in Cattaraugus County, New York. Project will strengthen the reservoir's resilience.	$576,477
Shinnecock Indian Nation	NY	A DOI/NFWF grant to restore the Shinnecock Reservation's eelgrass, oyster, marsh, and beach habitats in Southampton, New York. Project will reduce erosion, increase habitat, and strengthen shoreline resilience.	$4,064,000

IX.3. Sources of Information

A review of Federal, State, municipal, and academic literature was conducted and various reports covering topics related to coastal resilience and risk reduction in New York were considered in the development of this state narrative and are listed in Table 8.

Table 8. Federal and State of New York Sources of Information.

Resource	Reference/Source	Synopsis
PlaNYC: A Greener, Greater New York	http://www.nyc.gov/html/planyc2030/html/theplan/the-plan.shtml	Released in 2007, PlaNYC was an unprecedented effort undertaken by Mayor Bloomberg to prepare the city for one million more residents, strengthen our economy, combat climate change, and enhance the quality of life for all New Yorkers. The Plan brought together over 25 City agencies to work toward the vision of a greener, greater New York. Updated 2011 and again in 2013 with the Special Initiative for Rebuilding and Resiliency post-Hurricane Sandy (2013)
PlaNYC: A Stronger, More Resilient New York. Special Initiative for Rebuilding and Resiliency (SIRR)	http://www.nyc.gov/html/sirr/html/home/home.shtml	The SIRR was charged by the Mayor of New York to analyze the impacts of Hurricane Sandy on the city's buildings, infrastructure, and people; to assess the risks faced by the city from future coastal flood risk, especially in the face of climate change, and to identify strategies to promote a resilient city, and proposals to rebuild portions of the city that were most strongly impacted by Hurricane Sandy. The SIRR identifies policy changes, and potential structural and non-structural measures, to address coastal flood risk within the Brooklyn-Queens waterfront, the east and south shores of Staten Island, southern Brooklyn and Queens, and southern Manhattan.

Resource	Reference/Source	Synopsis
Environmental Review of Climate Change Adaption after Sandy	http://www.newyorklawjournal.com/PubArticleNY.jsp?id=1202583745794&Environmental_Review_of_Climate_Change_Adaptation_After_Sandy&slreturn=20130206133956	J. Kevin Healy, a member of Bryan Cave, writes that the devastation caused by Sandy may have stunned most New Yorkers, but it came as no surprise to the climatologists, urban planners and government officials who have been focusing with an ever-increasing level of concern on the implications of a changing climate on the long-term well-being of NYC. As city and state efforts to protect infrastructure move forward, government officials must address how the strategies they devise fit within the mandates established by SEQRA and the programs established under the Coastal Zone Management Act of 1972.
NYS 2100 Commission	http://www.governor.ny.gov/NYS2100Commission	Examines and evaluates key vulnerabilities in the State's critical infrastructure systems, and to recommends actions that should be taken to strengthen and improve the resilience of those systems.
NYS DOS. 2010. New York State Coastal Management Program 309 Assessment and Strategies-July 1, 2011 through June 30, 2016	http://coastalmanagement.noaa.gov/mystate/ny.html	New York's CZMA Section 309 Draft Assessment and Strategy examines opportunities and evaluates the nine subject coastal enhancement areas: public access, coastal hazards, ocean and Great Lakes resources, wetlands, cumulative and secondary impacts, marine debris, special area management plans, energy and government facility siting, and aquaculture. This assessment describes the current status of each Priority Enhancement Area and associated accomplishments (since the 2006 report); and a strategy section identifies strategies for improvements to several enhancement areas for which the Department plans significant effort and achievement over the next five years.
Deadliest, Costliest and Most Intense U.S. Tropical Cyclones from 1851-2010, NOAA	http://www.nhc.noaa.gov/pdf/nws-nhc-6.pdf	This document lists the deadliest tropical cyclones in the United States during 1851-2010 and the costliest tropical cyclones in the United States during 1900-2010. The compilation ranks damage, as expressed by monetary losses, in three ways: 1) contemporaneous estimates; 2) contemporaneous estimates adjusted by inflation to 2010 dollars; and 3) contemporaneous estimates adjusted for inflation and the growth of population and personal wealth (Pielke et al., 2008) to 2010 dollars. In addition, the most intense hurricanes to make landfall in the United States during the 160-year period are listed. Also presented are some additional statistics on United States hurricanes and tropical cyclones in general.

Resource	Reference/Source	Synopsis
Bathtub Analogy and Chesapeake Bay Sinking	http://green.blogs.nytimes.com/2013/01/22/sea-level-and-the-limits-of-the-bathtub-analogy/	The main topic of this article is sea level change, and the concern of sinking land and its potential impacts to various regions worldwide. It was discussed that the kinds of long-term increases in sea level that scientists are talking about could wind up displacing a substantial fraction of the human population. About 1.3 billion people, or 21 percent of the population, live within 82 feet of sea level.
Land Trust Alliance (collection of agency tools)	http://www.landtrustalliance.org/ccn/tools	Coastal Conservation Networking provides land trusts working in coastal areas with resources to help address unique challenges associated with climate change, including the protection of wetlands, buffers, and other natural ecosystems that will increase resilience to climate change impacts, such as sea level change. Coastal Conservation Networking is a partnership of the following organizations: EPA, NOAA, USFWS, and Land Trust Alliance
Coastal Resilience Index (a community assessment)	http://www.masgc.org/pdf/masgp/08-014.pdf	The purpose of this self-assessment is to provide community leaders with a simple and inexpensive method of predicting if their community will reach and maintain an acceptable level of functioning after a disaster
NOAA Coastal Resilience Decision Support Framework	http://www.csc.noaa.gov/digitalcoast/tools/coastalresilience	This website, 1. provides multiple climate scenarios of projected sea level change and storm surge conditions, allowing users to zoom to specific locations in each geography, 2. establishes relationships among ecological, social, and economic indicators to provide a comprehensive platform for local and regional decision making and 3. recognizes common management objectives and proposes solutions for achieving ecosystem protection and community resilience
NOAA Critical Facilities	http://www.csc.noaa.gov/criticalfacilities/	The intent of this tool is to provide an initial assessment of a community's critical facilities and road miles within the FEMA 1 percent flood zone. This tool was initially created to assist the Mississippi/Alabama Sea Grant in conducting their "Coastal Resiliency Index: A Community Self-Assessment" workshops and has been expanded based on available flood data.
TNC Tool for Coastal Planning	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/connecticut/explore/coastal-resilience-tool.xml	The Coastal Resilience Tool lets communities explore different flooding scenarios, analyze the potential impacts on communities, natural resources and critical infrastructure like roads and schools and develop solutions to address these realities.

Resource	Reference/Source	Synopsis
Storm Surge Research Group - Stonybrook, New York and Sandy Summary (Prof Malcolm Bowman)	http://stormy.msrc.sunysb.edu/	This website displays observed, astronomical and predicted sea level variations at key NOAA tide stations on the northeastern coastline with an emphasis on New York Harbor. Our storm surge prediction model (SBSS Version 1) consists of the Stony Brook 12-km MM5 mesoscale weather prediction model coupled to the ADCIRC ocean circulation model. The model predicts winds, pressure, tides, storm surge and currents with a 50-hr time horizon. The MM5 model is run twice daily and the output is used as input for ADCIRC. The water level predictions and observations are updated at 3am and 3pm daily. The predictions are 5hrs behind real time due to the model's run time.
Interactive Sea Level Rise Map	http://www.newscientist.com/article/mg21729034.900-new-map-pinpoints-cities-to-avoid-as-sea-levels-rise.html	Perrette has modeled all of these effects and calculated local sea level changes in 2100 for the entire planet. While the global average rise is predicted to be between 30 and 106 centimeters, he says tropical seas will rise 10 or 20 per cent more, while polar seas will see a below-average rise. Coasts around the Indian Ocean will be hard hit, as will Japan, south-east Australia and Argentina (Earth System Dynamics, doi.org/kbf). New York's position may be less perilous than previously thought. A weakening of the Atlantic Gulf Stream will cause water to slop westwards, triggering a rapid rise on the eastern seaboard, but this will be counteracted by Greenland's weaker gravitational pull. The city is not out of the woods, though, warns Aimée Slangen of Utrecht University in the Netherlands, whose own model suggests that Antarctica could lose a lot of ice, which would produce an above-average rise throughout the northern hemisphere.
Norfolk, New York, Boston - Climate Change	http://www.nationaljournal.com/magazine/the-scary-truth-about-how-much-climate-change-is-costing-you-20130207	A 2012 study by the U.S. Geological Survey determined that sea levels along the East Coast will rise three to four times faster than the global average. The study named Norfolk, NYC, and Boston as the three metro areas most vulnerable to the devastating effects of rising sea levels—ranging from the dramatic increase in storm surge, as winds scoop up water from the sea and dump more of it farther from the coast than ever before, to the steady erosion of roads, buildings, and arable soil as seawater creeps inland.
New York Rising (Chapter 6)	http://d2srrmjar534jf.cloudfront.net/6/9c/4/3898/2013SOSBook.pdf	New York Recommendations to improve protect coastal communities and improve their resilience to coastal storm damage

Resource	Reference/Source	Synopsis
NYC Post-Sandy Future Article	http://www.gothamgazette.com/index.php/city/4149-storm-surge-an-interview-with-climate-change-expert-klaus-jacob-about-nycs-post-sandy-future	Geophysicist Klaus Jacob describes his struggles to get Washington and Albany, as well as the City of new York, to pay attention to the peril of rising sea levels; how some proposed solutions like flood gates would likely cause more trouble than they are worth; and how he thinks the city's shrinking footprint will lead to more densely populated neighborhoods on higher ground and the loss of coastline.
Climate Change Adaptation in New York City: Building a Risk Management Response	http://www.nyas.org/publications/annals/Detail.aspx?cid=ab9d0f9f-1cb1-4f21-b0c8-7607daa5dfcc	Climate change has the potential to affect everyday life in NYC. Environmental conditions as experienced today will shift, exposes the city and its residents to new hazards and heightened risks; we will be challenged by increasing temperatures, changes in precipitation patterns, rising sea levels, and more intense and frequent extreme events. While mitigation actions that reduce greenhouse gas emissions will help to decrease the magnitude and impact of future changes, they will not prevent climate change from occurring altogether. Funded through a grant from the Rockefeller Foundation and modeled on the Intergovernmental Panel on Climate Change, the NYC Panel on Climate Change (NPCC) was convened by Mayor Michael Bloomberg in August 2008 as part of PlaNYC, the City's long-term sustainability plan. The NPCC consists of scientists who study climate change and its impact, as well as legal, insurance, and risk management experts. This Annals volume presents the NPCC report, including NYC–specific climate change projections, tools to help entities identify climate vulnerabilities and develop adaptation strategies, and recommendations on how to foster an effective climate resilience program.
Draft Recovery Support Strategy - NY	Under Review	A coordinated Federal response, led by FEMA, to develop and publish a recovery framework post-Sandy.

Resource	Reference/Source	Synopsis
Developing coastal adaptation to climate change in the New York City infrastructure-shed: process, approach, tools, and strategies	http://pubs.giss.nasa.gov/abs/ro06110e.html	While current rates of sea level change and associated coastal flooding in the NYC region appear to be manageable by stakeholders responsible for communications, energy, transportation, and water infrastructure, projections for sea level change and associated flooding in the future, especially those associated with rapid icemelt of the Greenland and West Antarctic Icesheets, may be outside the range of current capacity because extreme events might cause flooding beyond today's planning and preparedness regimes. This paper describes the comprehensive process, approach, and tools for adaptation developed by the NYC Panel on Climate Change (NPCC) in conjunction with the region's stakeholders who manage its critical infrastructure, much of which lies near the coast. It presents the adaptation framework and the sea level rise and storm projections related to coastal risks developed through the stakeholder process. Climate change adaptation planning in NYC is characterized by a multi-jurisdictional stakeholder scientist process, state-of-the-art scientific projections and mapping, and development of adaptation strategies based on a risk-management approach.
NYC Storm Surge Risk, Princeton University	ftp://texmex.mit.edu/pub/emanuel/PAPERS/Ning_etal_2010.pdf	Hurricane storm surge presents a major hazard for the United States. We apply a model-based risk assessment methodology to investigate hurricane storm surge risk for NYC. We couple a statistical/deterministic hurricane model with the hydrodynamic model SLOSH (sea, lake, and overland surges from hurricanes) to generate a large number of synthetic surge events; the SLOSH model simulations are compared to advanced circulation model simulations. Statistical analysis is carried out on the empirical data. It is observed that the probability distribution of hurricane surge heights at the Battery, NYC, exhibited a heavy tail, which essentially determines the risk of NYC being struck by a catastrophic coastal flood event. The peaks-over-threshold method with the generalized Pareto distribution is applied to estimate the upper tail of the surge heights. The resulting return periods of surge heights are consistent with those of other studies for the New York area. This storm surge risk assessment methodology may be applied to other coastal areas and can be extended to consider the effect of future climate change.
Seeing Sandy's Impacts with Remote Sensors, NYSDEC	Upon request	PowerPoint presentation
CDBG action plan developed	http://www.nyshcr.org/Programs/NYS-CDBG/	The Office of Community Renewal administers the Community Development Block Grant (CDBG)

Resource	Reference/Source	Synopsis
by the NYS Department of Homes and Community Renewal		program for the State of New York. The NYS CDBG program provides financial assistance to eligible cities, towns, and villages with populations fewer than 50,000 and counties with an area population under 200,000, in order to develop viable communities by providing decent, affordable housing, and suitable living environments, as well as expanding economic opportunities, principally for persons of low and moderate income. The state must ensure that no less than 70% of its CDBG funds are used for activities that benefit low- and moderate-income persons. The program objectives are achieved by supporting activities or projects that: benefit low- and moderate-income families; create job opportunities for low- and moderate-income persons; prevent or eliminate slums and blight; or address a community development need that poses a serious and imminent threat to the community's health or welfare. Project selection shall take into consideration the recommendation of the relevant regional economic development council or the Commissioner's determination that the proposed project aligns with the regional strategic priorities of the respective region.
Metadata files on air quality monitoring which occurred post-Superstorm Sandy, NYSDEC	http://www.dec.ny.gov/public/87659.html	Air Monitoring for Hurricane Sandy Note: Effective May 16, 2013, all monitoring related to Hurricane Sandy has been discontinued.
Narrow Bay, Floodplain Protection and Hazard Mitigation Plan, Suffolk County NY & Property Owner list	http://suffolkcountyny.gov/Portals/0/planning/Publications/NarrowBay_reportopt.pdf	Two documents recommending a hazard mitigation plan to implement a voluntary buyout program of vacant land and storm damaged homes in the Village of Mastic Beach on Long Island. This plan was prepared by the Suffolk County Planning Department fifteen years ago, using FEMA funding. Although it is dated, Suffolk County has brought it to our attention for possible action post-Hurricane Sandy. A total of 30 property owners are interested in selling their properties for open space purposes to reduce future flood damages in the area.
Urban Waterfront Adaptive Strategies, NYC	www.nyc.gov/uwas	Urban Waterfront Adaptive Strategies is a resource to help guide planners and policy makers in NYC and beyond in identifying and evaluating potential coastal protection strategies.
New York State Sea Level Rise Task Force, Report to the Legislature	http://www.dec.ny.gov/energy/67778.html	The legislature directed the Task Force to “evaluate ways of protecting New York’s remaining coastal ecosystems and natural habitats, and increasing coastal community resilience in the face of sea level change, applying the best available science as to

Resource	Reference/Source	Synopsis
(2010)		sea level change and its anticipated impacts." The Task Force has studied and deliberated, with public participation, the complex issues involved with sea level change in New York State; however, a thorough analysis of the costs and benefits associated with sea level change and potential adaptation strategies was beyond the scope of this effort. The findings and recommendations in this report are an important first step in increasing the resilience of our coastal communities but should be further analyzed to evaluate their site-specific applicability and effect on economic development, greenhouse gas mitigation efforts, the environment and other factors.
Performance Evaluation of the New Orleans and SE Louisiana Hurricane Protection System, IPET, USACE	Is the final report of a series concerning the in-depth analysis of the New Orleans and Southeast Louisiana Hurricane Protection System (HPS) conducted by the Interagency Performance Evaluation Task Force (IPET). The analyses conducted by the IPET and the information presented in this report are designed to answer five principal questions that comprised the IPET mission: 1. The System: What were the pre-Katrina characteristics of the HPS components; how did they compare to the original design intent? 2. The Storm: What was the surge and wave environment created by Katrina and the forces incident on the levees and floodwalls? 3. The Performance: How did the levees and floodwalls perform, what insights can be gained for the effective repair of the system, and what is the residual capability of the undamaged portions? What was the performance of the interior drainage system and pump stations and their role in flooding and dewatering of the area? 4. The Consequences: What were the societal-related consequences of the flooding from Katrina (including economic, life and safety, environmental, and historical and cultural losses)? 5. The Risk: What were the risk and reliability of the HPS prior to Katrina,	The prototype risk assessment for New Orleans identified the areas most vulnerable to future flooding and with the highest residual risk. Residual risk is the vulnerability that remains after all risk reduction measures are considered. Risk assessment provides a new and more comprehensive method to understand the inherent vulnerability of areas protected by complex protection systems and subjected to uncertain natural hazards. It provides a direct view into the sources of vulnerability, providing a valuable tool for public officials at all levels to focus resources and attention on the most serious problems and to seek solutions that reduce risk through both strengthening physical structures and reducing exposure of people and property to losses by non-structural means. Given a relatively uniform level of reliability of the protection system, the relative risk values are largely related to elevation (below sea level) and the value of property or number of people who occupy those areas. The emergency response preparedness and efficiency of evacuation prior to a storm is a key component to reducing risk to life and human safety. This is especially important for those who need assistance to evacuate.

Resource	Reference/Source	Synopsis
	and what will they be following the planned repairs and improvements (June 2007)?	
The New Orleans Hurricane Protection System: What Went Wrong and Why, ASCE	The members of the ASCE Hurricane Katrina External Review Panel have conducted an in-depth review of the comprehensive work of the United States Army Corps of Engineers (USACE) Interagency Performance Evaluation Taskforce (IPET). We are indebted to the dedicated efforts of more than 150 engineers and scientists, who have, in the year and a half following Hurricane Katrina, evaluated the causes of the New Orleans area hurricane protection system failures. As a result of this excellent work, we now better understand what went wrong and why. The ASCE Hurricane Katrina External Review Panel has an obligation to share its findings and insights, which go beyond the scope of the IPET review, so that others may learn from this tragedy and prevent similar disasters from happening again, not only in New Orleans, but in other communities throughout the United States that are also vulnerable to hurricanes and flooding. http://www.asce.org/uploadedFiles/Publications/ASCE_News/2009/04_April/ERPreport.pdf	The American Society of Civil Engineers, Hurricane Katrina External Review Panel has identified 10 critical actions they believe are critical to help minimize the risks of another "Katrina" in the future. These include 1. Keep safety at the forefront of public priorities, 2. Quantify the risks, 3. Communicate the risks to the public and decide how much risk is acceptable, 4. Rethink the whole system, including land use in New Orleans, 5. Correct the deficiencies, 6. Put someone in charge, 7. Improve interagency coordination, 8. Upgrade engineering design procedures, 9. Bring in independent experts, and 10. Place safety first
The New Orleans Hurricane Protection System: Assessing Pre-Katrina Vulnerability and Improving Mitigation and Preparedness, NAE/NRC	Jeffrey Jacobs, a Scholar with the Water Science and Technology Board of the National Research Council served as the study director for the National Academy of Engineering and National Research Council's Committee on New Orleans Regional Hurricane Protection Projects. The Council is the operating arm of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine of The National Academies. The Academies operate under an 1863 charter from Congress to provide independent advice to the Federal government on	There were several lessons learned as a result of Hurricane Katrina discussed within the document. There were as follow: 1. There are many inherent hydrologic vulnerabilities of living in the greater New Orleans metropolitan region, especially in areas below sea level. Post-Katrina repairs and strengthening have reduced some of these vulnerabilities. Nevertheless, because of the possibility of levee/floodwall overtopping—or more importantly, levee/ floodwall failure—the risks of inundation and flooding never can be fully eliminated by protective structures no matter how large or sturdy those structures may be. 2. The pre-Katrina footprint of the New Orleans hurricane protection system consisted of roughly 350 miles of protective structures including levees, I-walls, and T-walls. There was undue optimism about the ability of this

Resource	Reference/Source	Synopsis
	scientific and technical matters. Their committee was convened in December 2005 at the request of then-Assistant Secretary of the Army for Civil Works, Mr. J.P. Woodley, to provide an independent review of the work of the Interagency Performance Evaluation Task Force, or IPET. The IPET group was assembled by the U.S. Army Corps of Engineers to evaluate the performance of the New Orleans hurricane protection system during Hurricane Katrina and to provide advice in repairing the system. During its 3.5-year tenure our committee issued five reports, all of which reviewed draft reports issued by the IPET. Their committee's fifth and final report was issued in April 2009 and it reviewed the IPET draft final report and commented on important "lessons learned" during Hurricane Katrina and its aftermath. The document was a summary of those lesson learned as identified in their final report.	extensive network of protective structures to provide reliable flood protection. Future construction of protective structures for the region should proceed with these lessons firmly in mind and in the context of a more comprehensive and resilient hurricane protection plan. 3. The planning and design for upgrading the current hurricane protection system should discourage settlement in areas that are most vulnerable to flooding due to hurricane storm surge. The voluntary relocation of people and neighborhoods out of particularly vulnerable areas—with adequate resources designed to improve their safety in less vulnerable areas—should be considered as a viable public policy option.4.When voluntary relocations are not viable, floodproofing measures will be an essential complement to protective structures—such as levees and floodwalls—in improving public safety in the New Orleans region from hurricanes and induced storm surge. This committee especially endorses the practice of elevating the first floor of buildings to at least the 1 percent flood level, and preferably to a more conservative elevation. The more conservative elevation reflects a subsequent finding in this report regarding the inadequacy of the 1 percent flood as a standard for a large urban center such as New Orleans. Critical public and private infrastructure—electric power, water, gas, telecommunications, and flood water collection and pumping facilities—should be strengthened through reliable construction, ensuring reliable interdependencies among critical infrastructure systems.5.The disaster response plan for New Orleans, although extensive and instrumental in successfully evacuating a very large portion of the New Orleans metropolitan area population, was inadequate for the Katrina event. Thus, there is a need for more extensive and systematic evacuation studies, plans, and communication of evacuation plans. A comprehensive evacuation program should include not only well designed and tested evacuation plans, protocols, and criteria for evacuation warnings, but also alternatives such as improved local and regional shelters that could make evacuations less imposing. It also should consider longer-term strategies that can enhance the efficiency of evacuations, such as locating facilities for the ill and elderly away from more vulnerable areas that maybe subject to frequent evacuations.

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ATTACHMENT A1

Focus Area Analyses Report

ATTACHMENT A

1. **New York – New Jersey Harbor and Tributaries, NY, Focus Area Report**

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Appendices

1. Study Authority

The focus area analysis presented in this report is being conducted as a part of the North Atlantic Coast Comprehensive Study (NACCS) authorized under the Disaster Relief Appropriations Act of 2013 (Public Law [PL] 113-2), Title X, Chapter 4 approved 29 January 2013.

Specific language within PL 113-2 states, *"…as a part of the study, the Secretary shall identify those activities warranting additional analysis by the Corps."* This report identifies coastal storm risk management and flood risk management activities warranting additional analysis that could be pursued in New York – New Jersey Harbor and Tributaries (NYNJHT) study area. PL 84-71 is a plausible method for further investigation.

2. Study Purpose

The purpose of this focus area report is to capture and present information regarding the possible cost-shared, future phases of study to provide structural and/or non-structural coastal storm risk management, flood risk management, ecosystem restoration, and other related purposes for the NYNJHT study area.

The focus area report will:

- Examine the New York – New Jersey Harbor and Tributaries area to identify problems, needs, and opportunities for improvements relating to coastal storm risk management and related purposes.
- Identify a non-Federal sponsor(s) willing to cost-share the potential future investigation.

3. Location of Study Area / Congressional District

The study area is commonly aligned with the USACE Hudson – Raritan Estuary (HRE) Feasibility Study Comprehensive Restoration Plan (CRP) and the New York – New Jersey Harbor and Estuary Program (HEP). The general sub-regions of the HRE study area are employed in this study to identify geographically relevant problems, opportunities, and potential coastal storm risk management measures. The HRE sub-regions were delineated on a watershed basis.

The study area was defined to include Jamaica Bay; Lower New York Bay; Lower Raritan River; Arthur Kill and Kill Van Kull; Newark Bay, Hackensack River, Passaic River; Hudson River; Harlem River, East River, Western Long Island Sound; and Upper New York Bay. The introduction of the HRE CRP, Volume I, presents greater geographic and geomorphic detail of these regions. Additional details can be found in the individual state appendices of the NACCS. The study area covers more than 1380 square miles. A map of the study area is included as **Figure 1**.

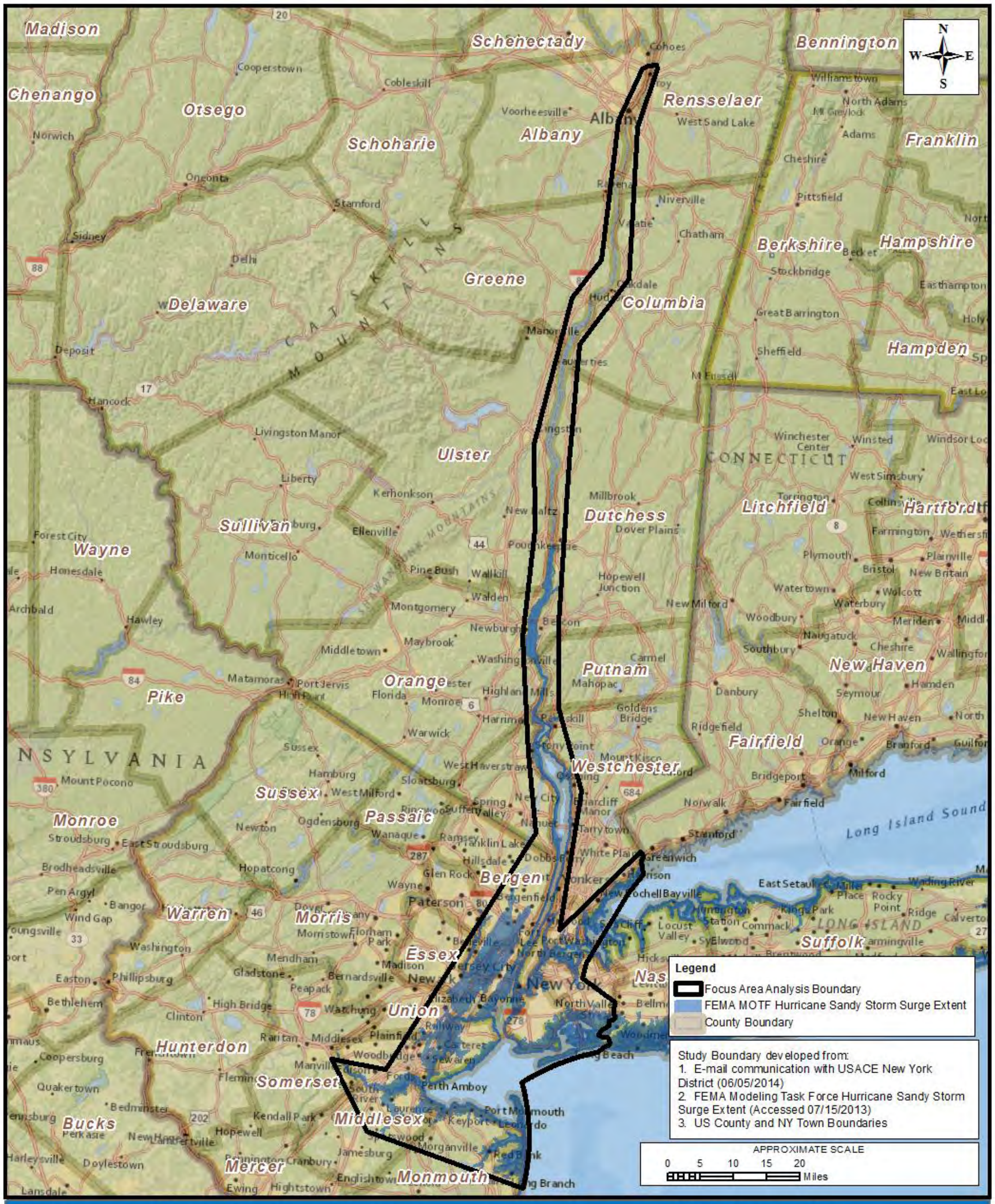

Figure 1. New York – New Jersey Harbor and Tributaries Focus Area Analysis Boundary

The spatial depiction of the Hurricane Sandy storm surge extent, developed by the Federal Emergency Management Agency (FEMA) Modeling Task Force, was also used to define impacted regions and refine the study area. The storm surge extent is only available for a portion of the study area. The study area comprises parts of 22 counties in New Jersey and New York, including Bergen, Passaic, Essex, Hudson, Union, Somerset, and Middlesex Counties in New Jersey; and Rensselaer, Albany, Columbia, Greene, Dutchess, Ulster, Putnam, Orange, Westchester, Rockland, Bronx, New York, Queens, Kings, and Richmond Counties in New York. For the purposes of this study, the Hudson River region extends upstream to the location of the Federal Lock and Dam in Troy, NY.

Congressional interest in the study area lies with New Jersey Senators Robert Menendez and Jeffrey Chiesa and New York Senators Kirsten Gillibrand and Charles Schumer. The study area contains all or portions of the following Congressional Districts:

Table 1. Congressional Districts and Representatives

Congressional District	State	Representative
5th	NJ	Representative Scott Garrett
6th	NJ	Representative Frank Pallone Jr.
7th	NJ	Representative Leonard Lance
8th	NJ	Representative Albio Sires
10th	NJ	Representative Donald M. Payne Jr.
11th	NJ	Representative Rodney P. Frelinghuysen
12th	NJ	Representative Rush D. Holt
3rd	NY	Representative Steve Israel
4th	NY	Representative Carolyn McCarthy
5th	NY	Representative Gregory W. Meeks
6th	NY	Representative Grace Meng
7th	NY	Representative Nydia M. Velázquez
8th	NY	Representative Hakeem S. Jeffries
9th	NY	Representative Yvette D. Clarke
10th	NY	Representative Jerrold Nadler
11th	NY	Representative Michael G. Grimm
12th	NY	Representative Carolyn B. Maloney
13th	NY	Representative Charles B. Rangel
14th	NY	Representative Joseph Crowley
15th	NY	Representative José E. Serrano
16th	NY	Representative Eliot L. Engel
17th	NY	Representative Nita M. Lowey
18th	NY	Representative Sean Patrick Maloney
19th	NY	Representative Chris Gibson
20th	NY	Representative Paul Tonko

4. Prior Studies and Existing Projects

This focus area report will identify problems and opportunities within the study area as they relate to coastal storm risk management and related purposes. The occurrence of flooding within the study area has been well documented, and a number of prior studies and projects in the study area were reviewed for relevancy to this study. Detailed descriptions and fact sheets for USACE coastal studies and projects within the jurisdiction of USACE New York District in New Jersey and New York are available on the USACE New York District Civil Works website.[1]

Types of USACE civil works projects include those related to navigation, coastal storm and flood risk management, ecosystem restoration, and water resource management. Community resilience is also an increasingly relevant topic included for consideration in ongoing and proposed studies and projects. The intent of including community resilience is to consider past, present, and future exposure to hazards, such as coastal flooding, and to influence and improve the capacity to withstand and recover from adverse situations.

For the purposes of brevity, references to studies and projects that were considered spin-offs or sub-studies under a comprehensive or overall study were condensed into the larger project (i.e., Hudson-Raritan Ecosystem Restoration Feasibility Study). Navigational studies or projects within the NYNJHT study area were presented in a similar fashion.

There may be additional USACE studies or projects within the mapped study area that are not specifically outlined in the following tables. These studies or projects have been authorized, are ready for construction, or are constructed (i.e., Raritan Bay and Sandy Hook Bay: Keansburg, East Keansburg, and Laurence Harbor). In cases where older studies overlapped with existing studies, guidance was considered but was not documented outright (i.e., Hudson River Habitat Restoration). Only studies or reports that were provided or readily available are documented herein.

Table 2 is a summary of various studies and projects undertaken by USACE. Projects or studies listed in the Disaster Relief Appropriations Act, 2013 Interim Reports (IR) #1 and #2, and the FEMA Recovery Support Summary (RSS) Reports from the New York (DR-4085) and New Jersey (DR-4086) Joint Field Offices (JFO) are listed first.

Table 3 is a summary of additional studies and projects undertaken by USACE or listed in the USACE Fiscal Year (FY) 2014 Proposed Civil Works Projects within the study area.

Table 4 presents a summary of various studies and projects undertaken by state or regional agencies. For brevity, certain entities were abbreviated. Please refer to the acronym list at the beginning of this report for complete names.

Table 5 summarizes various studies and projects undertaken by local municipalities or jurisdictions. Countywide or multi-jurisdictional all-hazards mitigation plans (HMP) were also included if readily available. The following counties are in the process of developing an HMP, or have not made it publicly available, or have not completed implementation of a HMP: Essex, Middlesex, Union Counties in New Jersey; and Putnam County and Westchester County in New York.

[1] http://www.nan.usace.army.mil/Missions/CivilWorks.aspx

Table 2. Summary of Prior USACE Studies and Existing Projects

Listed in Interim Report #1, Interim Report #2, FEMA DR-4085-NY RSS, FEMA DR-4086-NJ RSS

Study / Report	Focus Area	Structural or Non-Structural	Disaster Relief Appropriations Interim Report	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
South Shore of Staten Island	Lower New York Bay	S/N	IR #2	Ongoing	Flood risk management structures, land acquisition Feasibility Study, 2014		X		X		X
Oakwood Beach Levee (Continuing Authorities Program [CAP] 103)	Lower New York Bay	S	IR #1	Ongoing	Flood risk management structures Constructed, 2000 Repair damages due to Sandy, 2013		X				X
East Rockaway Inlet to Rockaway Inlet (Rockaway Beach) and Jamaica Bay	Lower New York Bay/Jamaica Bay	S	IR #1 IR #2	Ongoing/ ST	Beach replenishment Reformulation, 2003 Restore to design profile due to Sandy, 2013		X	X			X
Atlantic Coast of New York City, Rockaway Inlet to Norton Point (Coney Island)	Lower New York Bay/Jamaica Bay	S	IR #2	Ongoing/ ST	Beach replenishment Partially constructed, 1995 Reevaluation, 2005 Restore to design		X				X

Study / Report	Focus Area	Structural or Non-Structural	Disaster Relief Appropriations Interim Report	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
					profile due to Sandy, 2013						
Plumb Beach (CAP 204)	Jamaica Bay	S	IR #2	Ongoing/ ST	Beach replenishment, groins, and breakwater Constructed, 2012-2013		X				X
Jamaica Bay, Marine Park, and Plumb Beach Feasibility Study	Jamaica Bay	S/N	IR#2	Ongoing/ ST	Reevaluation, 2013		X		X		X
South River, Raritan Basin	Lower Raritan River	S/N	IR #2	LT	Flood risk management, interior drainage facilities, ecosystem restoration Authorized but Unconstructed, 2013		x	X	X		X
Rahway River Basin and South Branch Rahway River	Arthur Kill and Kill Van Kull	S	IR #2	LT	Stormwater management by detention Feasibility Study, 2013		X	X			X

Study / Report	Focus Area	Structural or Non-Structural	Disaster Relief Appropriations Interim Report	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Joseph G. Minish Passaic River Waterfront Park and Historic Area	Newark Bay, Hackensack River, Passaic River	S/N	IR #2	Ongoing/ ST	Bulkhead Authorized but Unconstructed, 2013		X				X
Passaic River Main Stem and Tidal Protection Area (Passaic River and Newark Bay upstream to the Dundee Dam); Basin Flood Management	Newark Bay, Hackensack River, Passaic River	S/N	IR #2	LT	Limited Reevaluation, 2013 Authorized but Unconstructed		X	X	X		X
Shrewsbury River and Tributaries, NJ	Lower New York Bay	S/N	IR #2	Ongoing	Feasibility alternatives analysis under post-Sandy update		X				X
Highlands, Raritan Bay and Sandy Hook Bay, NJ	Lower New York Bay	S	IR #2	Ongoing	Feasibility alternatives analysis under post-Sandy update		X				X
Leonardo, Raritan Bay and Sandy Hook Bay, NJ	Lower New York Bay	N	IR #	Ongoing	Feasibility alternatives analysis under post-Sandy update		X				X

Table 3. Summary of Additional USACE Prior Studies and Existing Projects

Study / Report	Focus Area	Structural or Non-Structural	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Arthur Kill Channel, Howland Hook Marine Terminal, Bronx River, Buttermilk Channel, East River and South Brother Island Channel, Great Kills Harbor, East Rockaway Inlet, Hudson River Channel, Jamaica Bay Federal Navigational Channel, New York and New Jersey Harbor Maintenance and Deepening, New York and New Jersey Channels, Ambrose Channel, Port Jersey Channel, Newark Bay, Hackensack and Passaic Rivers, Newtown Creek, Raritan River, Westchester Creek	Multiple study regions	S	Various timeframes	Various activities: dredging, channel deepening, maintenance, caretaker status	X					
Hudson-Raritan Estuary - Overall Feasibility Study, Comprehensive Restoration Plan (Gowanus Bay and Canal, Liberty State Park, Hackensack Meadowlands, Lower Passaic River, Soundview Park, Flushing Bay and Creek)	Multiple study regions	S/NS	Various timeframes	Restoration and management plan Feasibility Study, 2013				X		X
New York City Watershed: Water Supply, Storage	Multiple study regions	S/N	Various timeframes	Various activities, 2012: 10 In-Progress Projects 37 Constructed Projects				X	X	X

Study / Report	Focus Area	Structural or Non-Structural	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Jamaica Bay, Beneficial Use of Dredged Material and Marsh Islands (CAP 204/207)	Jamaica Bay	S	Ongoing	Constructed, 2012 Ongoing maintenance, 2013				X		X
Spring Creek Park (CAP 1135)	Jamaica Bay	N	Ongoing/ ST	Feasibility Study, 2013				X		
Gerritsen Creek (CAP 1135)	Jamaica Bay	N	Ongoing	Constructed, 2012				X		
Manhattan Beach and Sheepshead Bay	Jamaica Bay	S	LT	Seawall Reconnaissance Study, 2013		X				X
Mill Brook, Highland Park (Middlesex County, NJ)	Lower Raritan River	S	LT	Channel and culvert Preliminary Engineering Design, 1998		X	X			
Millstone River Basin	Lower Raritan River	S/N	Ongoing/ LT	Reconnaissance Study, 2000 Feasibility Study, 2002		X	X	X		X
Raritan River Green Brook Sub Basin	Arthur Kill, Kill Van Kull	S/N	ST	Flood risk management structures, stream bank stabilization Planning, Design,			X			X

Study / Report	Focus Area	Structural or Non-Structural	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
				and Analysis, 2013						
Woodbridge River Basin	Arthur Kill, Kill Van Kull	S	LT	Flood risk management alternatives Not economically justified, 2007		X	X	X		X
Elizabeth River (CAP 14)	Arthur Kill, Kill Van Kull	S	ST	Stream bank stabilization Planning, Design, and Analysis, 2006			X	X		X
Lower Saddle River	Newark Bay, Hackensack River, Passaic River	S/N	Ongoing	Channel modifications, stream bank stabilization Limited Reevaluation, 2013			X	X		X
Ramapo River, Mahwah River, Masonicus Brook at Mahwah, NJ and Suffern, NY	Newark Bay, Hackensack River, Passaic River	S/N	Ongoing/ ST	Environmental restoration, bank stabilization PMP Reevaluation, 2011		X	X	X		X

Study / Report	Focus Area	Structural or Non-Structural	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Peckman River Basin	Newark Bay, Hackensack River, Passaic River	S/N	Ongoing/ LT	Reconnaissance Study, 2001 FCSA, 2002 FY 2008 funding		X	X	X		X
Saw Mill River at Elmsford and Greenburgh, New York	Hudson River	S	ST	Flood Damage Reduction Project General Re-Evaluation and Design, PMP, 2002		X	X			X
Dutchess County Watersheds	Hudson River	S/N	LT	Reconnaissance Study, 2009 Feasibility Study		X	X	X		X
Sparkill Creek, Northvale (Bergen County, NJ and Rockland County, NY)	Hudson River	N	LT	Reconnaissance Study, 2004 Feasibility Study			X			X
Kings Park (Rockland County)	Hudson River	N	Ongoing	Pond restoration Reconnaissance Study, 2012				X	X	
McClellan Pier	Hudson River	S	LT	Bulkhead Initial Appraisal Report (IAR), 2013			X			X
Rikers Island	Harlem River, East River, Western	S	LT	Revetment Preliminary Engineering as part of Planning, Design,		X	X			

Study / Report	Focus Area	Structural or Non-Structural	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
	Long Island Sound			and Analysis (PDA), 1995						
Bronx River Basin, Westchester and Bronx Counties	Harlem River, East River, Western Long Island Sound	S/N	Ongoing/ ST	Watershed Report, 2010 Rescoping Charette, 2012 Feasibility Study, 2014			X	X	X	X
Westchester County Streams	Harlem River, East River, Western Long Island Sound	S/N	Ongoing/ LT	Reconnaissance Study, 2008 Byram River Feasibility Cost Sharing Agreement, 2012			X	X	X	X
Blind Brook Watershed	Harlem River, East River, Western Long Island Sound	S/N	Ongoing/ ST	Flood risk management alternatives, sluice gate improvements Watershed Management Plan, 2009		X	X			X
Mamaroneck and Sheldrake Rivers Basin	Harlem River, East River, Western Long Island	S/N	Ongoing/ LT	General Re-Evaluation Report, 2013 Flood Risk Management Study,		X	X			X

Study / Report	Focus Area	Structural or Non-Structural	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Summary/Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
	Sound			2015						
Yonkers Avenue, Tuckahoe (Westchester County)	Harlem River, East River, Western Long Island Sound	S	Ongoing	Stream bank stabilization Constructed, 2012			X			X

Table 4. Summary of Prior State and Regional Studies and Existing Projects

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
New York State 2100 Commission (NYS2100), Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure	New York	S/N	NYS 2100 , Rockefeller Foundation	Various timeframes	2013	Specific recommendations and strategy for infrastructure resilience	X	X	X	X	X	X
New York State Standard Multi-Hazard Mitigation Plan	New York	S/N	NYSDOS NYSDEC FEMA	Ongoing	2011	FEMA approved state multi-hazard mitigation plan, overarching strategies		X	X		X	X
New York State Coastal Management Program, Section 309 Combined Assessment and Strategies	New York	S/N	NYSDOS NOAA	Ongoing/ ST	2011	Coastal enhancement areas, ecosystem based management, strategies for enhancement areas	X	X	X	X	X	X
The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 1: Mid-Atlantic, New York	New York	S	New York Sea Grant Extension Program, EPA	Various	2010	Forecast of shore protection measures, planning for sea level rise (SLR).		X	X			X
State of New York Action Plan For Community Development Block Grant (CDBG) Program Disaster	New York	S/N	NYSHCR HUD	Ongoing	2013	Damage quantification, prioritization, needs						X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Recovery						assessment of NY CDBG funds, infrastructure bank						
State of New Jersey 2012 State Hazard Mitigation Plan	New Jersey	S/N	NJOEM FEMA	Ongoing	2012	FEMA approved state multi-hazard mitigation plan, overarching strategies		X	X		X	X
NJ Coastal Management Program, Section 309 Assessment and Strategies	New Jersey	S/N	NJDEP CMP NOAA	Ongoing/ ST	2011	Coastal enhancement areas, ecosystem based management, strategies for enhancement areas	X	X	X	X	X	X
The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 1: Mid-Atlantic, New Jersey	New Jersey	S	Middle Atlantic Center for Geography and Environmental Studies, EPA	Various	2010	Forecast of shore protection measures, planning for SLR.		X	X		X	X
New Jersey Department of Community Affairs (NJDCA), Community Development Block Grant Disaster Recovery Action Plan	New Jersey	S/N	NJDCA HUD	Ongoing	2013	Damage quantification, NJ CDBG funds to impacted counties						X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Case Study: Assessment of the Vulnerability of Port Authority of NY and NJ Facilities to the Impacts of Climate Change	New Jersey/New York	S/N	PANYNJ	Ongoing	2011	ASCE article, infrastructure risk assessment and adaptation strategies		X	X			X
Report 11-18 Responding to Climate Change in New York State, Synthesis Report (ClimAID)	New Jersey/New York	S/N	NYSERDA PANYNJ	Ongoing	2011	Knowledge gaps, sector-specific recommendations, economic analysis of climate change	X	X	X	X	X	X
Jamaica Bay Watershed Protection Plan	Jamaica Bay	S/N	NYCDEP	Ongoing	2012	Update of watershed management strategies			X	X		
Bridge Creek Wetland Restoration Project	Lower New York Bay, Staten Island	N	NOAA NYSDEC	Ongoing	2006	Restoration plan				X		X
Raritan Basin Watershed Management Plan and Associated Technical Reports	Lower Raritan River	S/N	NJ Water Supply Authority, NJDEP	Ongoing	2010	Restoration management plan for impaired water resources			X	X	X	X
Oakwood Beach Feasibility Study	Lower New York Bay, Staten Island	S/N	NYSDEC NYSDOS-OGS	Ongoing	2013	Recommendations to USACE on nature based measures to minimize flooding impact		X	X	X		X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Rahway River Watershed Flood Risk Management Needs Assessment	Arthur Kill and Kill Van Kull	S/N	Mayor's Council NJDEP	Ongoing	2011	Identified specific community-based needs to minimize flooding impacts		X	X			X
New Jersey Meadowlands Commission Master Plan, Hackensack Meadowlands Floodplain Management Plan	Newark Bay, Hackensack River, Passaic River	S/N	NJMC	Ongoing	2012	Primary planning document, providing history, area plans, preservation		X	X	X	X	X
Report to the Governor: Recommendations of the Passaic River Basin Flood Advisory Commission	Newark Bay, Hackensack River, Passaic River	S/N	NJDEP PRBFAC	Ongoing	2011	Recommendation s to minimize flooding impact		X	X	X	X	X
Climate Resilience Evaluation and Awareness Tool (CREAT) Exercise with North Hudson Sewerage Authority and New York-New Jersey Harbor Estuary Program	Upper New York Bay	N	NHSA EPA	Ongoing	2011	Documentation of workshop using CREAT for NHSA, future planning exercises		X	X		X	X
Bronx River Alliance Ecological Restoration and Management Plan, Greenway Plan	Harlem River, East River, Western Long Island Sound	S/N	WCS-NOAA NYCDPR NYSDOS	Ongoing	2012	Planning opportunities, general management plan				X		X
Hudson River Estuary Program Progress Report, Restoration Plan, and Associated Reports	Hudson River, additional study regions	S/N	NYSDEC	Ongoing	2013	Management strategies, tidal ecosystem restoration				X		X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
The City of New York Natural Hazard Mitigation Plan	Multiple study regions	S/N	NYCOEM NYCDCP	Ongoing	2009	FEMA approved multi-hazard mitigation measures, expected update 2014		X	X	X	X	X
Natural Hazard Mitigation Plan, Bergen County, New Jersey	Multiple study regions	S/N	BCOEM NJMC BCDPW and participating municipalities	Ongoing	2008	FEMA approved multi-hazard mitigation measures, expected update 2013		X	X			X
DMA 2000 Hazard Mitigation Plan, Hudson County New Jersey	Multiple study regions	S/N	HCOEM and participating municipalities	Ongoing	2008	FEMA approved multi-hazard mitigation measures, expected update 2013		X	X			X
DMA 2000 Hazard Mitigation Plan Update, Somerset County, New Jersey	Lower Raritan River	S/N	SCOEM and participating municipalities	Ongoing	2008	FEMA approved multi-hazard mitigation measures, expected update 2013		X	X			X
Multi-Jurisdictional Hazard Mitigation Plan, Passaic County, New Jersey	Newark Bay, Hackensack River, Passaic River	S/N	PCOEM and participating municipalities	Ongoing	2010	FEMA approved multi-hazard mitigation measures, expected update 2015		X	X			X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Orange County Single Jurisdiction Natural Hazard Mitigation Plan, Orange County, New York	Hudson River	S/N	OCOEM and participating municipalities	Ongoing	2010	Multi-hazard mitigation measures, expected update 2015		X	X			X
Multi-Jurisdictional Natural Hazard Mitigation Plan, Rockland County, New York	Hudson River	S/N	RCOFES and participating municipalities	Ongoing	2010	Multi-hazard mitigation measures, expected update 2015		X	X			X

Table 5. Summary of Prior Local Stakeholder Studies and Existing Projects

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Special Initiative for Rebuilding and Resiliency (SIRR): A Stronger, More Resilient New York	Multiple study regions	S/N	NYCOLTPS NYCDCP	ST /LT	2013	Multiple, depending on measure		X	X	X	X	X
A Greener, Greater New York	Multiple study regions	S/N	NYC OLTPS NYCDCP	Various timeframes	2011	Multiple, depending on measure		X	X			X
Vision 2020: NYC Comprehensive Waterfront Plan	Multiple study regions	S/N	NYCDCP NYCEDC	ST /LT	2013	Multiple, depending on measure		X	X	X	X	X
The New York City Waterfront Revitalization Program: Proposed Revisions for Public Review	Multiple study regions	S/N	NYCDCP	Various timeframes	2012	Policy for waterfront planning		X	X			X
Coastal Climate Resilience: Urban Waterfront Adaptive Strategies (UWAS)	Multiple study regions	S/N	NYCDCP	Various timeframes	2013	Waterfront strategies based on geomorphological categories		X	X	X	X	X
Metropolitan Transit Authority (MTA) Adaptations to Climate Change: A Categorical Imperative	Multiple study regions	S/N	MTA	Various timeframes	2008	Vulnerable infrastructure, lists recommendations		X	X			X
City of Perth Amboy Waterfront Recovery and Redevelopment Advisory Committee, Natural Hazard Mitigation Community	Lower Raritan River	S/N	City of Perth Amboy, Office of Economic and	Various timeframes	2013	Planning assistance, describes damages, etc.		X	X			X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Planning Assistance Program Application and Outline for Implementation			Community Development, WR&RAC									
East River Blueway Plan	Harlem River, East River, Western Long Island Sound	S/N	Manhattan Borough, NYS Division of Coastal Resources	Ongoing/ ST	2013	Multi-purpose projects for flood risk management and community resilience along the East River		X	X	X		X
Bronx River Watershed Flood Mitigation and Water Quality Improvement Planning Report	Harlem River, East River, Western Long Island Sound	S/N	Westchester Department of Environment	ST	2010	Stormwater improvements, detention, stream bank stabilization			X	X	X	X
Cranford Flood Advisory Committee (CFAC) Technical Reports	Newark Bay, Hackensack River, Passaic River	S/N	CFAC	ST /LT	2012	Flood risk management projects in Cranford, NJ		X	X			X
Jersey City Municipal Utility Authority (JCMUA) Stormwater Management Plan	Newark Bay, Hackensack River, Passaic River	S/N	JCMUA	Ongoing	2011	Stormwater Best Management Practices, identifies flooding locations			X		X	X
Southwest Hoboken Flooding Analysis	Newark Bay, Hackensack River, Passaic River, Hoboken	S	NHSA City of Hoboken	ST	2002	Planning-level study for collection system modifications			X			
Stormwater Reconnaissance Plan for the Saw Mill River-Pocantico River Watershed	Hudson River	S/N	Westchester Department of Planning, Public Works and Transp., County Board	Various timeframes	2012	Flood risk management actions, flood prone areas, data collected through municipal survey for Westchester County Flood Mitigation			X		X	X

Study / Report	Focus Area	Structural or Non-Structural	Responsible Parties/ Sponsors	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Date	Status/Summary	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
			of Legislators			Program						
Stormwater Reconnaissance Plan for the Bronx River Basin Watershed Westchester County, New York	Hudson River	S/N	Westchester Department of Planning, Public Works & Transp., County Board of Legislators	Various timeframes	2013	Recommendations and flood risk management actions			X		X	X
Clarkstown, NY Final Comprehensive Plan, West Nyack Drainage Task Force	Hudson River	S/N	Town of Clarkstown Town Board, Planning Department	Various	2013	Existing and proposed community projects, Hackensack draft study in 2013		X	X	X	X	X

5. Plan Formulation

Six planning steps in the Water Resource Council's Principles and Guidelines are followed to focus the planning effort and recommend a plan for potential future investigation. The six steps are:

- Identify problems and opportunities
- Inventory and forecast conditions
- Formulate alternative plans
- Evaluate effects of alternative plans
- Compare alternative plans
- Select a recommended plan

The iterations of the planning steps typically differ in the emphasis that is placed on each of the steps.

This focus area report emphasizes identification of problems and opportunities. The following sections present the results of the initial iterations of the planning steps conducted during the focus area analysis. This information will be refined in future iterations of the planning process that will be accomplished during future study phases.

5.1 Problems and Opportunities

Flooding and flood-related damage is the primary water resource problem. Flooding caused by coastal storms continues to be most frequent, destructive, and costly natural hazard facing the region. The study area is vulnerable to damage from storm surge, wave attack, erosion, and intense rainfall-stormwater runoff events that cause riverine or inland flooding. These forces constitute a threat to human life and increase the risk of flood damages to public and private property and infrastructure.

The study area encompasses the New York Metropolitan Area including the most populous and densely populated city in the United States and the six largest cities in New Jersey. This region is the hub of financial centers and international trade, qualifying it as one of the most important economic regions in the world. The study area is highly urbanized, and with existing geography, topography, and proximity to tidally influenced areas, it is highly vulnerable to coastal storm damage. Public and private property-at-risk includes densely populated sections of the study area. Combined with projections for climate change and sea level change, the vulnerability of this area to future flooding events and coastal storm damage is effectively increased.

A second-tier, related water resource problem is urban flooding caused by undersized drainage systems, poor system maintenance, and antiquated combined sewer systems. During storm surge events, the water level in the water body may be greater than the water level within a collection system. Connected low-lying areas may be more susceptible to flooding. Land development has increased impervious areas and urban runoff rates, decreased groundwater recharge, and degraded stormwater quality. Another secondary flooding source is elevated groundwater levels in natural and urban areas. Seasonal groundwater fluctuations, natural stormwater infiltration and recharge, and aquifer rebound due to cessation of groundwater pumping can contribute to flooding from groundwater sources even if surface flooding is not present.

Coastal storms have played important roles in shaping the present-day shoreline resulting in erosion and movement of sand. The desire to develop housing and waterfront properties along the coastline has placed many property owners in areas of high vulnerability due to the lack of shoreline stabilization and erosion of supportive and protective landforms.Historic sea level change has exacerbated flooding over the past century, and potential sea level change in the future will only increase the magnitude, frequency, and extent of the problem. Since 1900, relative sea level has risen by more than a foot within the study area due to global climate change and local land subsidence (NPCC2, 2013). According to the NYS 2100 Commission Report (2013), experts project sea level to rise in New York City and Long Island by as many as six feet under certain scenarios within the next 90 years. As sea levels continue to rise, coastal storms will cause flooding over a larger area and at increased heights than they otherwise would have in the past.

The States of New Jersey and New York, in their respective state hazard mitigation plans, have documented the numerous, historic instances of flooding, Presidential disaster declarations, and damage estimates. Coastal storms have and will continue to cause flooding and severe impacts to the NYNJHT study area. It is projected that the frequency and intensity of these coastal storms will increase (NPCC2, 2013). Between 1996 and 2013, 22 major coastal flooding events were recorded for the study area (NOAA NCDC, 2013). **Tables 6 and 7** list flooding-related FEMA Emergency and Disaster Declarations for New Jersey and New York counties within the NYNJHT study area.

Most recently, Hurricane Sandy damaged or destroyed at least 650,000 houses and left approximately 8.5 million customers without power during the storm and its aftermath. Preliminary estimates from the event exceed $50 billion in damages (NOAA, 2013), with 24 states impacted by the storm. Hurricane Sandy caused devastation in the NYNJHT study area, damaging property and disrupting millions of lives. As a result of the storm, 48 people lost their lives in NY and 12 people lost their lives in NJ. Some of the highest storm surges and greatest inundation, which reached record levels, occurred in New York and New Jersey. Storm surge caused flooding exceeding 8 feet above ground level in some locations. The storm exposed vulnerabilities associated with inadequate coastal storm risk management measures and lack of defense to critical transportation and energy infrastructure. Environmental impacts to the study area were also significant. Storm surge inundated regional wastewater plants and with additional loss of power to key electrical and operational components, billions of gallons of untreated and partially-treated wastewater were discharged into receiving water bodies. Hazardous waste sites, such as those identified through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), otherwise referred to as Superfund sites, brownfields, petrochemical plants, and fuel refineries were also inundated and spills reported. Hurricane Sandy's size, path, and timing caused unprecedented damages within the study area. Collateral losses also include disruption of commerce, unemployment due to inundated workplaces and transportation systems, expenses for disaster relief and cleanup, and other related costs.

Current recovery efforts are progressing. Based on a press release dated August 29, 2013, for disaster recovery efforts from Hurricane Sandy for the entire state of New York, the total Federal assistance is $8 billion. Within the FEMA Individual Assistance Program, more than $3.7 billion in National Flood Insurance Program payments made to policy holders and more than $996 million in Federal Emergency Management Agency grants approved for individuals and households. Within the FEMA Public Assistance (PA) Program, nearly $1.8 billion in grants to reimburse local, state and tribal governments and eligible private nonprofits for some of the costs of emergency response, debris removal, repairing or rebuilding damaged public facilities.

Based on a press release dated September 16, 2013, for disaster recovery efforts from Hurricane Sandy for the entire state of New Jersey, the total Federal assistance is $5.6 billion. Within the FEMA Individual Assistance Program, more than $3.5 billion in total National Flood Insurance Program payments made on claims to date, $413 million in FEMA grants disbursed for individuals and households. Within the FEMA PA Program, $886 million approved in grants to state agencies, local communities and certain private nonprofit organizations that serve the public.

Table 6. FEMA Disaster and Emergency Declarations in New Jersey

Disaster Number	Date	State	Incident	Declaration Type
41	08/20/1955	New Jersey	Hurricane, Floods	Major Disaster
124	03/09/1962	New Jersey	Severe Storm, High Tides, Flooding	Major Disaster
245	06/18/1968	New Jersey	Heavy Rains, Flooding	Major Disaster
310	09/04/1971	New Jersey	Heavy Rains, Flooding	Major Disaster
402	08/07/1973	New Jersey	Severe Storms, Flooding	Major Disaster
477	07/23/1975	New Jersey	Heavy Rains, High Winds, Hail, Tornadoes	Major Disaster
701	04/12/1984	New Jersey	Coastal Storms, Flooding	Major Disaster
973	12/18/1992	New Jersey	Coastal Storm, High Tides, Heavy Rain, Flooding	Major Disaster
1145	11/19/1996	New Jersey	Severe Storms/Flooding	Major Disaster
3148	09/17/1999	New Jersey	Hurricane Floyd	Emergency
1295	09/18/1999	New Jersey	Hurricane Floyd	Major Disaster
1588	04/19/2005	New Jersey	Severe Storms And Flooding	Major Disaster
1694	04/26/2007	New Jersey	Severe Storms And Inland And Coastal Flooding	Major Disaster
1897	04/02/2010	New Jersey	Severe Storms And Flooding	Major Disaster
3332	08/27/2011	New Jersey	Hurricane Irene	Emergency
4021	08/31/2011	New Jersey	Hurricane Irene	Major Disaster
4039	10/14/2011	New Jersey	Remnants Of Tropical Storm Lee	Major Disaster
4048	11/30/2011	New Jersey	Severe Storm	Major Disaster
3354	10/28/2012	New Jersey	Hurricane Sandy	Emergency
4086	10/30/2012	New Jersey	Hurricane Sandy	Major Disaster

Table 7. FEMA Disaster and Emergency Declarations in New York

Disaster Number	Date	State	Incident	Declaration Type
26	10/07/1954	New York	Hurricanes	Major Disaster
45	08/22/1955	New York	Hurricane, Floods	Major Disaster
52	03/29/1956	New York	Flood	Major Disaster
129	03/16/1962	New York	Severe Storm, High Tides, Flooding	Major Disaster
158	08/23/1963	New York	Heavy Rains, Flooding	Major Disaster
311	09/13/1971	New York	Severe Storms, Flooding	Major Disaster
338	06/23/1972	New York	Tropical Storm Agnes	Major Disaster
401	07/20/1973	New York	Severe Storms, Flooding	Major Disaster
487	10/02/1975	New York	Severe Storms, Heavy Rain, Landslides, Flooding	Major Disaster
702	04/17/1984	New York	Coastal Storms, Flooding	Major Disaster
974	12/21/1992	New York	Coastal Storm, High Tides, Heavy Rain, Flooding	Major Disaster
1095	01/24/1996	New York	Severe Storms/Flooding	Major Disaster
3149	09/18/1999	New York	Hurricane Floyd	Emergency
1296	09/19/1999	New York	Hurricane Floyd	Major Disaster
1564	10/01/2004	New York	Severe Storms And Flooding	Major Disaster
1565	10/01/2004	New York	Tropical Depression Ivan	Major Disaster
1589	04/19/2005	New York	Severe Storms And Flooding	Major Disaster
1650	07/01/2006	New York	Severe Storms And Flooding	Major Disaster
1692	04/24/2007	New York	Severe Storms, Inland, Coastal Flooding	Major Disaster
1724	08/31/2007	New York	Severe Storms, Flooding, And Tornado	Major Disaster
1899	04/16/2010	New York	Severe Storms And Flooding	Major Disaster
1943	10/14/2010	New York	Severe Storms, Tornadoes, Winds	Major Disaster
1957	02/18/2011	New York	Severe Winter Storm And Snowstorm	Major Disaster
3328	08/26/2011	New York	Hurricane Irene	Emergency
4020	08/31/2011	New York	Hurricane Irene	Major Disaster
3341	09/08/2011	New York	Remnants of Tropical Storm Lee	Emergency
3351	10/28/2012	New York	Hurricane Sandy	Emergency
4085	10/30/2012	New York	Hurricane Sandy	Major Disaster

As part of this focus area report, plan formulation will include identification of potential measures to help these vulnerable areas become more resilient to coastal storm damage.

In order to collect data on problems and opportunities for the NYNJHT area, stakeholder meetings and webinars were conducted with USACE, state, regional, and local agencies. **Appendix A** includes a list of the points of contact (POCs) invited to participate in meetings and webinars, meeting materials, and questionnaires. **Appendix B** includes meeting minutes with a list of participants, and **Appendix C** includes comments received from agencies and stakeholders that were unable to attend meetings and/or webinars or from attendees that provided additional feedback following meetings and webinars.

Stakeholder input was incorporated into the development and analysis of potential measures for this focus area report. A summary of stakeholder input for the NYNJHT focus area report is summarized in **Tables 8 to 10**. For brevity, certain entities were abbreviated. Please refer to the acronym list at the beginning of this report for complete names.

Table 8. Feedback from New Jersey Stakeholders

Stakeholder	Source	Water Resources Problem Identification	Areas/Water Bodies	Damage Description	Prior Studies
City of Perth Amboy **Middlesex County**	Transmittal from City Planner, Office of Economic and Community Development	Flooding induced by storm surge, wave action, shoreline erosion	Raritan River, Arthur Kill, Raritan Bay, Woodbridge Creek. Exacerbated by lack of/poor condition of waterfront infrastructure, impervious industrial upland areas, lack of natural riparian zone	Estimated $20 million (includes $5.8 million for marina and walkway) in waterfront damages to esplanade, marina, fishing piers, public facilities, beaches, infrastructure, and private property.	Waterfront Recovery and Redevelopment Advisory Committee (WR&RAC) Recommendations: Outline of Work to be Implemented (2013)
Borough of Carteret **Middlesex County**	Letter from Carteret OEM, Narrative from Dept. of Municipal Engineering and DPW, transmitted materials	Flooding induced by storm surge	Noe's Creek, Arthur Kill, Rahway River, drainage way between Edwin and Bergen Streets, surcharged diversion tunnel. Borough uses two sets of tide gates to control influence of Arthur Kill.	Public and private property damages, infrastructure and roads damaged, private property destroyed by gas explosion caused by structure floatation off foundation, public facilities rendered unusable. Estimated $17 million in public facilities damage assessments.	Ongoing stormwater system capacity and connectivity study to Noe's Creek, Noe's Creek capacity study
Township of Saddle Brook **Bergen County**	Meeting with Congressman Bill Pascrell, submitted stakeholder comments	Flooding induced by storm surge, stormwater runoff	Saddle River, Saddle Brook	Public and private property damage in Hurricanes Irene and Sandy	N/A
Borough of Rutherford **Bergen County**	Meeting with Congressman Bill Pascrell, submitted stakeholder comments	Flooding induced by storm surge, stormwater runoff, shoreline erosion	Passaic River, Hackensack River. Exacerbated by malfunctioning flood gate.	Public and private property damage in Hurricanes Irene and Sandy. Identified millions of dollars of damage to commercial area.	Studies south of Kearny and north of the Falls
Multiple Jurisdictions **Bergen County**	Meeting with Congressman Bill Pascrell, stakeholder feedback	Flooding induced by storm surge, stormwater runoff	Passaic, Hackensack, and Saddle Rivers	Public and private property damage in Hurricanes Irene and Sandy	Existing USACE Passaic River Basin Flood Damage Reduction projects and studies

Stakeholder	Source	Water Resources Problem Identification	Areas/Water Bodies	Damage Description	Prior Studies
City of Hoboken **Hudson County**	Transmittal from Resiliency Task Force, Office of Business Administrator	Flooding induced by storm surge, stormwater runoff, tidally influenced collection systems, combined sewer systems	Storm surge from Upper New York Bay through Long Slip Canal, Weehawken Cove, and Hudson River flooded Central and Western Hoboken. Exacerbated due to lack of electricity to pump stations.	70% of city affected numerous critical, public works, private facilities, Lackawanna Terminal/ transportation center inundated – all mass transit halted. Estimated damages of $100 million private property, $25 million to FEMA PA, $7-10 million of city facility or Small Business Administration (SBA), $100's of million in transit system.	The New Jersey Department of Community Affairs 2013 Community Development Block Grant Disaster Recover Action Plan; Various Revitalization, Master, Hazard Mitigation, and Emergency Operation Plans
City of Jersey City **Hudson County**	Discussion during stakeholder meeting, Email from OEM, transmitted materials	Flooding induced by storm surge, stormwater runoff, tidally influenced collection systems, combined sewer systems	Hudson River, Hackensack River, Tidewater Basin, Mill Creek, Big Basin tertiary waterway. Exacerbated by inundation of combined sewer systems, contaminated soil, loss of power and electricity	Severe to moderate damages in Downtown, Greenville sections and Country Village, Pt. Liberte, Gloria Robinson, Duncan, Lafayette Senior Center, Glennview, Woodward Townhouse housing developments inundated. Estimated $35 million in damages based on transmitted invoices and NJUMA assessment.	Hudson County Multi-Jurisdictional Pre-Disaster Mitigation All Hazards Plan (2008), Jersey City Municipal Utility Authority studies, Jersey City Stormwater Management Plan (2008)
City of Elizabeth **Union County**	Email from City Engineer	Flooding induced by storm surge, stormwater runoff, tidally influenced collection systems, combined sewer systems	From Arthur Kill and Kill Van Kull to Newark Bay and Elizabeth River. Entire waterfront area affected.	Damage to public works infrastructure incl. waterfront parks, recreation areas, 3 pump stations, 2 combined sewer netting facilities	Third Avenue Flood Control Project Feasibility Study (2010)

Table 9. Feedback from New York Stakeholders

Stakeholder	Source	Water Resources Problem Identification	Areas	Damage Description	Prior Studies
Town of Cortlandt **Westchester County**	Email from Director, Department of Environmental Services	Flooding induced by storm surge	Hudson River, Annsville Creek, Sprout Brook, Lake Meahagh	Flooding of Rt. 6, Kings Ferry Road, and others. Evacuation of mobile home occupants due to inundation.	N/A
Town of Stony Point **Rockland County**	Town of Stony Point New York Rising Community Committee Meeting	Flooding induced by storm surge, wave action, shoreline erosion	Cedar Pond Brook, Hudson River, Stony Point shoreline	Damage to sewer pipeline, undermining of Stony Point Battlefield Ferry landing, River Rd and Beach Rd seawall, jetties along River Rd, and breakwater structure	N/A
New York State Department of Environmental Conservation **Multiple Counties**	Memo, attachments, and maps associated with the Hudson River Estuary	Flooding induced by storm surge, stormwater runoff, salt intrusion to drinking water	Westchester, Rockland, Putnam, Orange, Ulster, Greene counties. Specifically, the jurisdictions of Saugerties, Kingston, and Piermont.	Estimated $85 million FEMA PA in six Hudson counties. Unrepresented damages in Dutchess, Columbia, Rensselaer, and Albany Counties.	N/A
New York City **Bronx, Kings, New York, Queens, and Richmond Counties**	Email and letter from Director of Resiliency, Special Initiative for Rebuilding and Resiliency (SIRR)	Flooding induced by storm surge, stormwater runoff, tidally influenced collection systems, combined sewer systems	New York Harbor, Jamaica, Sheepshead, Gravesend, Gowanus Bays, Upper New York Harbor, East, Hudson Rivers. 51 square miles of City, 17% of total landmass inundated. SIRR Report maps inundation extents.	Estimated $19 billion, 43 deaths. Numerous buildings, facilities, infrastructure systems inundated. SIRR Report details extensive categorical damages.	SIRR Report, 2020 Vision, UWAS, NYC HMP

Table 10. Feedback/Information from Regional Stakeholders

Stakeholder	Source	Water Resources Problem Identification	Areas	Damage Description	Prior Studies
Port Authority of NY and NJ (PANYNJ)	Report from Assistant Director, Environmental Initiatives	Flooding induced by storm surge, stormwater runoff, tidally influenced collection systems, combined sewer systems	Numerous facilities at various locations including, but not limited to: PATH, LGA, JFK, EWR, TA, PNMT, EPAMT, HHMT, PJMT, BMT, AMT, GWB, GB, OBX, BB, HT, WTC	18 out of 22 (82%) of overall facilities were damaged, including flooding and debris fields. Estimated $2 billion in damages based on summary. Further detail provided.	Case Study: Assessment of the Vulnerability of Port Authority of NY and NJ Facilities to the Impacts of Climate Change
New Jersey Meadowlands Commission (NJMC)	Letter from Executive Director	Flooding induced by storm surge	Hackensack River, Berry's, Peach, Moonachie Creeks, Losen Slote, Water level reached 8.5 feet, remained at 7 feet for > 6 hours.	70% of the residences and businesses in the towns of Moonachie and Little Ferry were inundated. Overtopped berms, tide gates, control structures. Estimated $2.2 million in damages based on transmitted summary.	USACE NY District 1989, 1993 Study Hackensack River Basin Flood Control Study Reconnaissance Report, FEMA 2005 Flood Insurance Study
Metropolitan Transit Authority (MTA)	Press Release; MTA's Fix and Fortify Sandy Recovery Work Website	Flooding induced by storm surge	Various areas of MTA subway tube system, subway car yards, ventilation plants encompassing Metro New York including Metro-North and Long Island Rail Road	Estimated $4.755 billion worth of damage as railroad and subway lines, vehicular tunnels, subway stations and power and signal equipment.	Adaptations to Climate Change: A Categorical Imperative
New Jersey Transit Corporation (NJT)	Press Release/Website; Hurricane Sandy Storm Damage, Superstorm Sandy Recovery Progress Scorecard	Flooding induced by storm surge	Various areas of NJT rail, bus, and light rail systems, especially in Hoboken, Weehawken, Newark, South Amboy	Inundation of NJ TRANSIT's Rail Operations Center, Hoboken Terminal, Newark Light Rail Broad St. and Penn Station, and other terminals; washouts at North Jersey Coast Line, Hudson-Bergen Light Rail, Morgan Drawbridge in South Amboy, 300	Meadows Maintenance Complex, Rail Operations Center Rail Stations Resiliency, Rail Infrastructure Resiliency, Light Rail Resiliency, NJ Transit System Repairs/Restoration, Superstorm Sandy Grant

Stakeholder	Source	Water Resources Problem Identification	Areas	Damage Description	Prior Studies
				pieces of rail equipment damaged, downed trees and power outages, and debris system-wide.	Reimbursement 7/19/13, Superstorm Sandy Task Order Contract Status
Amtrak	Press Release/Website; Amtrak: Invest and Build More Rail Capacity and Resilience in New York Region	Flooding induced by storm surge	Various areas of Amtrak rail system, Hudson River, Newark, Kearny,	Inundation of West Side Yard, Penn Station, North River Tunnel, East River Tunnel, Kearny substation, Princeton Junction, Trenton, Washington Union station, 9 miles of NYC-Albany line flooded below track level	N/A
Public Service Electric and Gas Company (PSE&G)	Press Release/Website; Petition to the State of New Jersey Board of Public Utilities, Energy Strong Program	Flooding induced by storm surge	Passaic, Hackensack, Hudson Rivers; Arthur Kill	Affected 90% (2 million) customers, 20 electric switching and substations. Required 41,500 premise gas inspections, dewatered 30,000 feet of gas mains.	N/A
Consolidated Edison Company of New York	Post-Sandy Enhancement Plan	Flooding induced by storm surge	Greater New York	1.4 million customers in study area lost power. Dewatered 2,126 vaults and manholes. 20,000 repairs to underground system. Approx. $600 million in damages from Sandy, Irene, nor'easters, and tornado.	N/A
Passaic Valley Sewerage Commission (PVSC)	Press Release/Website; Message from the Executive Director	Flooding induced by storm surge	Newark Bay, Passaic River, Upper New York Bay	Plant out of service from 10/29 to 11/7. Estimated 200 million gallons of floodwater inundated facility. USACE Task Force Unwatering mission for PVSC. Tentatively $100 million from FEMA PA program.	N/A

5.2 Objectives

The national or Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with managing risk to the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

USACE also has a National Ecosystem Restoration (NER) objective in response to legislation and administration policy. The NER objective is to contribute to the nation's ecosystems through ecosystem restoration, with contributions measured by changes in the amounts and values of habitat.

Projects which produce both NED and NER benefits will result in a "best" recommended plan so that no alternative plan or scale has a higher excess of NED benefits plus NER benefits over total project costs. This plan shall attempt to maximize the sum of net NED and NER benefits, and to offer the best balance between two Federal objectives. Recommendations for multipurpose projects will be based on a combination of NED benefit-cost analysis, and NER benefits analysis, including cost effectiveness and incremental cost analysis.

In addition to Federal water resources planning objectives, the main goals of the NACCS under which this focus area analysis is being conducted, are to:

1) Reduce risk to which vulnerable coastal populations are subject.
2) Ensure a sustainable and robust coastal landscape system, considering future sea level change and climate change scenarios, to reduce risk to vulnerable populations, property, ecosystems, and infrastructure.

Specific objectives for this focus area report are:

1) Manage risk from storm surge.
2) Manage flood risk.
3) Provide adaptive and sustainable solutions for future development that account for future changes such as sea level change, land subsidence, and climate change.
4) Maintain or improve ecosystem goods and services provided (social, economic and ecological balance).
5) Incorporate opportunities for nature-based infrastructure, alone and in combination with traditional measures.
6) Maintain economic viability of the working coastline.
7) Improve emergency response and evacuations by improving the transportation systems before and during flood events.
8) Incorporate problems, needs, and opportunities identified by stakeholders to manage flood risk.
9) Manage erosion occurring along the shoreline.
10) Manage risk to National Register of Historic Places and other cultural resources

5.3 Planning Constraints

Planning constraints consist of both Institutional (policy/programmatic, legislative, and funding-related) and physical (such as sensitive ecosystem areas, land use, etc.):

5.3.1 Institutional Constraints

1) Comply with all Federal laws and executive orders, such as the National Environmental Policy Act (NEPA), the Clean Water Act, the Endangered Species Act, and Executive Order 11988.
2) Avoid increasing the flood risk to surrounding communities and facilities.
3) Avoid solutions that cannot be maintained, whether due to expense or complicated technologies, by the non-Federal sponsors.
4) Comply with local land use plans and regulations.
5) Difficulty in funding long-term operation and maintenance costs.
6) Permitting with Federal, state, and local agencies.
7) Many of the beaches within the study area are recognized as a recreational resource. It is important that this resource not be compromised.
8) Acquisition of real estate and easements.

5.3.2 Physical Constraints

1) Areas within this study area are highly urbanized, and the density of population may limit the amount of space available for staging and constructing a project.
2) Avoid additional degradation of water quality, which would put additional stress on aquatic ecosystems.
3) Avoid impacting or exacerbating existing hazardous, toxic, and radioactive wastes (HTRW) that have been identified within the project area.
4) Minimize the impact to authorized navigation projects.
5) Minimize the impact to other projects, protected areas, sensitive wetlands, wildlife management areas, etc.
6) Minimize effects on cultural resources and historic structures, sites, and features.
7) Loss of streetscape character and potential economic losses from elevation of structures or placement of floodwall/levee.
8) Lack of sand borrow areas for projects.

5.4 Future Without Project Condition

The future without project (FWOP) condition is the most likely condition expected to exist in the future in the absence of proposed projects. The FWOP condition is the baseline against which all project plans are evaluated. FWOP conditions, including sea level change considerations, will be developed along with the no-action alternative during the future phases of study.

5.5 Measures to Address Identified Planning Objectives

This section identifies a broad range of potential solutions (measures) to address the study area objectives. Many of these measures are outlined in "Coastal Risk Reduction and Resilience: Using the Full Array of Measures" (USACE, 2013). Any of these potential measures will be weighed against a "No-action Plan" in the future phases of study.

5.5.1 Structural Measures

Structural measures are used to control floodwaters. Broad-based structural measures identified include:

1) Seawall/Revetment: Seawalls are built parallel to the shoreline with the purpose of reducing overtopping and consequent flooding of areas behind the seawall due to storm surge and waves. Revetments are onshore sloping structures which manage shoreline erosion. Areas immediately seaward of seawalls or revetments may be impacted because of isolation from an inland sediment source.

2) Groins: Groins are narrow structures, built perpendicular to the shoreline, that stabilize a beach experiencing longshore erosion. Beach material will accumulate on the updrift side of a groin, but the downdrift side will experience erosion caused by isolation from the longshore sediment transport source. Both the accretional and erosional effects extend some distance alongshore away from the groin.

3) Detached Breakwaters: The primary function of a detached breakwater is to reduce beach erosion by reducing wave heights in the lee of the structure. The reduction in wave heights reduces longshore and cross-shore sediment transport. Detached breakwaters are built near shore, in shallow water, and generally parallel to the shoreline. They are low-crested structures which decrease wave energy and help promote an even distribution of material along the coastline. Since detached breakwaters can impact the transport of beach material, there can be erosional impacts in downdrift areas. In addition, detached breakwaters, when submerged, can cause a non-visible hazard to boats and swimmers.

4) Berms / Levees: Berms, levees, or dunes can be constructed along the shoreline, tying into high ground or surrounding an area entirely, to reduce risk of storm surge, wave run-up, and erosion to the landward shoreline. These measures have a large footprint, since their stability is partially dependent on a maximum side slope from the top to the toe, and the levees often composed of earthen materials. Levees or berms also need to be constructed to prevent or control underseepage of floodwaters through the existing soils. They may need to include pumping stations to remove interior stormwater drainage. Roads sometimes need to be ramped to cross these features.

5) Multipurpose Berms/Levees: Berm and levee features require a large footprint to remain stable. However, it is possible to incorporate features in the design of the levees, such as parking areas/garages, commercial or residential development, recreational greenways, etc., to take advantage of the increased elevation.

6) Floodwalls and Bulkheads: Floodwalls or bulkheads can be constructed along the shoreline, tying into high ground or surrounding an area entirely to reduce risk of storm surge, wave run-up, and erosion to the landward shoreline. These measures have smaller footprints than berms and levees but require concrete or steel pilings for stability to withstand force from floodwaters,

including waves. Floodwalls must also be designed to prevent or control underseepage in the existing soils. Floodwalls may need to include pumping stations to remove interior stormwater drainage and often include floodgates to allow for access roads to any waterside property.

7) Flood/Tide Gates: A flood or tide gate can be constructed across a waterway to provide risk reduction from coastal inundation upstream of the gate. Flood and tide gates are constructed with openings to allow for recreational or industrial uses of a tributary to continue and also to allow for some connectivity of the ecosystem. There are several types of flood gates; two types include an Obermeyer Gate and a Steel Gate. The Obermeyer gate lifts a steel gate flap to close the gate, whereas a Steel gate slides horizontally into closing position. Inflatable dams can also be used as a gate, as they can be filled with air or water to inflate and act as a closed gate.

   If the watershed upstream of the flood or tide gate does not have enough natural floodplain storage to hold increases in water level due to precipitation runoff, then either additional storage will need to be created and/or pumping stations will need to be added to remove interior drainage upstream of a flood or tide gate.

8) Portable Floodwalls: Portable floodwalls are a potentially viable measure when complete portability is necessary and no permanent fixings or structures are desired. Portable floodwalls are typically constructed of lightweight aluminum and rely on the weight of the water to press down and stabilize the wall to create a water tight seal. Temporary floodwalls can vary in height to accommodate the change in existing elevation and optimize cost. However, installation of a system of portable floodwalls may need to begin several days prior to a pending eevent depending on available resources. Therefore, portable floodwalls may not be suitable for some events and areas when installation time exceeds event warning time. Additionally, portable floodwalls are not applicable where subject to storm wave action.

9) Portable Berms/Cofferdams: Portable cofferdams are another rapidly deployable, temporary method that can be used for flood risk management. The cofferdam, made of commercial grade vinyl coated polyester, is a water inflated dam, which consists of a self-contained single tube with an inner restraint baffle/diaphragm system for stability. The dam has the ability to stand alone as a positive water barrier without any additional external stabilization devices. The system can be installed easily in the field when needed and removed when the threat is over. Once laid out, it can be inflated using any available water source. Each unit is up to 100 feet long and 8 feet high. Portable cofferdam units can be joined together by overlapping end to end at any angle to provide risk reduction to large areas.

   Temporary pumps are required to fill the cofferdam units; however, the pumps can be used as temporary pump stations to pump trapped water on the “dry” side of the cofferdam and discharge the water into the “wet” side.

10) Storm Surge Barrier: Storm surge barriers are often coupled with levees to prevent storm surge from propagating up waterways. Storm surge barriers generally consist of a series of movable gates that are normally open to let flow pass, but will close when storm surge exceeds a certain water level.

11) Road, Rail, or Light Rail Raises: Roads can be raised on berms or levees. The advantage of raising a road is two-fold. First, to raise main evacuation routes so they will not be flooded during a coastal and heavy precipitation event. Secondly, existing easements can provide some

of the property needed for the footprint for building a berm or levee. However, main routes in the study area are heavily developed. In order to raise existing main routes, a large amount of property along the roadways likely will need to be acquired and this could have a major impact for the main business corridors. Additionally, the side roads leading to these main roads would need to be ramped for access.

Another option is raising existing rail or light rail lines on berms or levees. A road, rail, or light rail line raise may create interior drainage problems if stormwater storage is insufficient. Additional storage space and/or pumping stations may be required to remove interior stormwater drainage.

12) Beach and Dune Restoration: Shoreline restoration by sand nourishment or replenishment of beaches subject to erosion. Restoration often includes include dune restoration/enhancement to provide additional risk reduction for flooding and wave action.

13) Stormwater System Improvements: Existing stormwater systems can be improved by increasing capacity, through additional piping and stream channelization, increasing pipe sizes and inlets and adding more storage areas, adding gates to outfall pipes to prevent storm surge from entering the storm sewer system, and pumping water from the storm system.

14) Bridge Trash Racks: Trash racks can be installed upstream of critical bridges to collect debris during a flood event to help preserve the structural integrity of the bridge support structure.

5.5.2 Non-Structural

Broad-based non-structural measures identified include:

1) Acquisition / Buyouts: Homes that are subject to repetitive loss from flooding and are outside of an area proposed for a structural flood risk management project are ideal candidates for buyouts or relocations. A buyout occurs when the homeowner is paid fair market value for the property, and moves to a new location. Relocations can occur when the homeowner has a parcel large enough that a home can be moved to higher ground on the existing parcel or a home can be relocated to a different parcel entirely. Acquisitions and buyouts restore the natural floodplain in the location of previous development.

2) Early Warning Systems: Flood warning systems are important to notify citizens of a flooding event. Coastal storms typically have a several-day timeframe where the community is aware of the possibility of impact, but last minute changes in speed and direction can alter the level of impact dramatically, and evacuations need to be planned well in advance for these types of storms in flat coastal areas. It is important for communities to have the means to reach out to their citizens before and during a large storm event. Large precipitation events from storms other than coastal storms may develop with little notice. Road signs that indicate flooded areas using real-time communications from citizens are one way to alert the community of these issues.

3) Elevating Structures: This measure involves elevating the building in place so that the lowest floor is above the flood level for which floodproofing is provided. The building is jacked up and set on a new or extended foundation consisting of pilings, concrete pillars or concrete blocks.

4) Floodproofing: There are two types of floodproofing techniques: dry floodproofing and wet floodproofing. Dry floodproofing keeps the floodwaters from entering the structure while wet floodproofing allows the floodwaters to enter the building but minimizes the damages.

Dry floodproofing involves sealing the walls of structures such as buildings with waterproofing compounds, impermeable sheeting, or other materials and using closures for covering openings from floodwaters. Dry floodproofing is most applicable in areas of shallow, low-velocity flooding.

Wet floodproofing allows the structure to flood inside while ensuring minimal damage to the building and any contents. By allowing the force of the water to pass through a building, the interior flooding allows hydrostatic force on the inside of the building walls to equally counteract the hydrostatic force on the outside, thus eliminating the chance of structural failure. Wet flooding practices include installation of flood vents in the ground floor or crawl space to allow floodwater to flow through the building without causing structural damage or conversion of ground floor living space to uninhabitable space such as a carport or open garage.

5) Increase Storage: In order to manage flooding from precipitation events, natural storage of the watershed can be restored or additional storage can be added. Restoration of natural storage includes restoring wetlands and returning floodplains to undeveloped states in riverine areas. Increasing natural storage in stormwater systems includes reducing impervious areas to allow infiltration of runoff from precipitation events. Additional storage can be added through detention ponds and on a more localized basis through rain barrels or cisterns. A major component of increasing natural infiltration in stormwater management includes the use of nature-based infrastructure.

6) Public Engagement and Education: A community can aid in flood risk management by educating its citizens about the existing flooding hazards and what their citizens can do to reduce risk to their property. Additionally, if a flood risk project is constructed, educating the community on residual project risk must occur.

7) Relocating Utilities and Critical Infrastructure: A community can manage risk to its own public infrastructure by relocating utilities underground and moving critical infrastructure out of floodplain areas. Examples of critical infrastructure include hospitals and shelters.

8) Preservation: Land preservation programs should be developed to place environmentally sensitive land in permanent easements to manage watersheds and their interrelated systems.

9) Resilience Performance Standards: Develop resilience performance standards for infrastructure to be used when making investment decisions. These standards may include information such as the recurrence interval of a storm that infrastructure should be designed to withstand, how long different end users can be without power, or how and when to include climate change or sea level change into design standards.

10) Emergency Response Systems: Emergency response systems include preparation for floods in anticipation of the flood event and flood-fighting plans to assist after the fact. The plans should include contingency and emergency floodproofing and must be properly integrated with emergency evacuation plans.

11) Modify / Remove Structures for Better Channel Function: Channel alterations such as modifying or removing features or widening/deepening channels can help manage flooding by improving channel function.

12) Design or Redesign and Location of Services and Utilities: Services and utilities can be relocated to areas of low risk or to higher areas not subject to flooding. Additionally, existing

services/features can be elevated above the flood elevation or can include floodproofing features in the design.

13) Surface Water / Stormwater Management: Management of surface water and stormwater systems can improve water quality, decrease erosion, and increase storage to minimize flood risks in the event of a storm. The development of a surface water or stormwater management plan can help facilitate best management practices of the systems.

14) Building Codes and Zoning: Climate change and coastal hazard considerations should be incorporated into building and zoning codes. Building codes can promote construction techniques that minimize damages to future construction or to areas of redevelopment. Some examples include requiring new structures to be elevated above flood elevations and structures to be built on piling foundations in areas of wave action. Zoning can be used to avoid activities on the floodplain other than those compatible with periodic flooding.

15) Strategic Acquisition: Purchase of undeveloped land for flood risk management.

16) Emergency Plans/Hazard Mitigation Plans: Emergency planning allows a community to be prepared for storm events, such as flood inundation from coastal storms. Hazard mitigation plans are developed to document hazards a community is exposed to and determine mitigation measures a community would like to implement to manage risk from these hazards. It is important for both of these plans to be kept up to date with local issues in order to prepare and recover after an event.

17) Retreat: Consider managed retreat, allowing wetlands and beaches to take over land that is dry. Include land use and zoning appropriate for coastal storm risk management.

18) Wetland Migration: Adjust zoning laws to allow for wetland migration.

19) Regional Sediment Management (RSM): Continuation of RSM practices in place and identifying new opportunities.

20) Coastal Zone Management (CZM): CZM regulates activities within the "Coastal Zone" to ensure that development is accomplished with the least amount of damage to the coastline.

5.5.3 Natural and Nature-Based Infrastructure

Nature-Based Infrastructure (NBI) refers to the planned use of natural and engineered features to produce engineering functions in combination with ecosystem services and social benefits. Natural and nature-based features include a spectrum of features, ranging from those that exist due exclusively to the work of natural process, to those that are the result of human engineering and construction. The built components of the system include nature-based and engineered structures that support a range of objectives, including coastal storm risk management (e.g., seawalls, levees), as well as infrastructure providing economic and social functions (e.g., navigation channels, ports, harbors, residential housing). Natural coastal features can take a variety of forms, including reefs (e.g., coral and oyster), barrier islands, dunes, beaches, wetlands, and maritime forests. The relationships and interactions among the natural and built features comprising the coastal system are important variables determining coastal vulnerability, reliability, risk, and resilience.

1) Green Stormwater Management: Management practices can be used to reduce impervious areas and increasing storage on a localized basis for stormwater. Some examples include bio-swales, rain gardens, green roofs, rain barrels or cisterns. Green stormwater management

practices that involve plantings also allow for evapotranspiration of stormwater and provide for a pleasing aesthetic component. Reducing impervious areas allows for infiltration of stormwater which reduces runoff quantity and improves runoff quality. Green stormwater management can also allow for opportunities to add public recreational features and provide for ecosystem restoration, while providing for wave attenuation and stormwater storage.

2) Constructed or Rehabilitated Reefs: Reefs can act as a natural barrier to dampen storm wave activity.

3) Salt Marshes: Wetland areas can act as a natural barrier to reduce storm surge and dampen wave action. Construction of new wetland areas or engineered rehabilitation of existing wetlands can offer a natural, low cost approach to reducing floods. The traditional rule of thumb (USACE, 1963) was that for every 2.7 miles of marsh, storm surge is reduced by one foot; however, the degree of flood risk reduction that wetlands provides form storm surge is extremely complicated.

4) Freshwater Wetlands: Freshwater wetlands can provide flood management by detention and/or storage for floodwaters. Infiltration through a freshwater wetland to an aquifer below can assist in groundwater recharge and provide water quality benefits. Freshwater wetlands also provide sediment stabilization benefits.

5) Vegetated Dunes and Beaches: Vegetation helps to stabilize dunes and beaches from erosion due to wind and wave action.

6) Vegetated Submerged Aquatic Vegetation (SAV), Salt Marshes and Wetlands: Vegetated features help to break waves, attenuate wave energy, slow the inland transfer of storm water and increase infiltration.

7) Oyster and Coral Reefs: Reefs can act as a natural barrier to dampen wave action, while providing essential habitat to marine organisms.

8) Barrier Island Restoration: Barrier islands act as the first line of defense in reducing risk to the mainland from storm surge and wave action. Restoration includes increasing barrier island elevation or plan form (length/width) and can include vegetation components such as dune/beach grass to stabilize sediments and increase wave dissipation.

9) Maritime Forests / Shrub Communities: The dense vegetation of maritime forests and shrub communities helps to stabilize soils while dissipating wave action and slowing the inland transfer of storm water.

The broad measures identified herein, structural, non-structural, and nature-based, have the potential for further development to target specific areas for coastal storm risk management. The goal of measures development is to achieve the objectives by combining one or more measures while avoiding constraints. Measures identified will be further evaluated, screened and used in combination in future phases of study to determine area-specific project viability to meet the planning objectives.

5.5.4 Area Specific Measures

The previously described broad-based measures (structural, non-structural, and nature-based) are applicable to many areas within the study area. Specific area-focused measures provided through stakeholder input and/or otherwise derived from previous studies are listed below. As part of the focus area analysis, stakeholders were asked to provide input to help identify ongoing or proposed coastal storm risk management measures.

The lists and summaries herein were compiled from a variety of sources, on different time scales, and to varying degrees of specificity. As expected, there is overlap, redundancy, possible contradiction, and inconsistencies between measures documented in the following section. This comprehensive list includes some measures that are beyond the purview of USACE. However, the purpose of this section is to capture the range of measures that may warrant further phases of study and may be applied on either a regional or local basis.

The commonality of geomorphologic conditions, coastal storm damages during Hurricane Sandy, and the applicability to address impacts to communities facing flooding, broad-based strategies and structural, non-structural, and nature-based measures can be further applied on a regional or local basis. These measures are found in Section 5.5.1-5.5.3. Area-specific measures lay the groundwork for identifying possible solutions for coastal storm risk management.

Due to the size of the study area, specific measures are again generally organized by planning region: Jamaica Bay; Lower New York Bay; Lower Raritan River; Arthur Kill and Kill Van Kull; Newark Bay, Hackensack River, Passaic River; Hudson River; Harlem River and East River; and Upper New York Bay.

5.5.4.1 Multiple Study Regions

NYS 2100 Commission, Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure, January 11, 2013.

In this report, the NYS 2100 Commission provides recommendations to New York State for a broad range of proposed flood risk management strategies.

1) Immediately manage coastal storm risk to the most vulnerable populations in coastal area by restoring damaged dunes, beaches, and barrier islands; repairing and strengthening critical hard infrastructure along the coast such as Mt. Loretto, Oakwood Beach, Asharoken, and Roberto Clemente State Park; repairing and managing coastal storm risk to wastewater infrastructure; and repairing public recreational infrastructure.
2) Develop a resilience strategy for New York Harbor by developing a plan for a combination of natural shoreline restoration/hard infrastructure improvements where appropriate and consider feasibility of natural infrastructure: beaches and dunes, tidal wetlands, oyster reefs, living shorelines, natural berms, and levees.
3) Conduct a comprehensive storm surge barrier assessment for New York Harbor.
    - Option 1: Verrazano Narrows, mouth of the Arthur Kill between Perth Amboy, NJ and Staten Island
    - Option 2: Sandy Hook, NJ to the Rockaways, NY
    - Additional Option: East River from Long Island Sound
4) Dredge inlets and address beach breaches on Long Island by establishing a dredging schedule and reviewing the breach contingency plan.

Port Authority of New York and New Jersey, Response to Stakeholder Feedback Inquiry and Supporting Documents, September 5, 2013.

The Port Authority of New York and New Jersey provided a summary narrative documenting damages and identified potential flood risk management measures for short-term and long-term resilience efforts. The Port Authority prioritized projects in the next 2 years in areas such as aviation, tunnels, and bridges.

1) Embark on the installation of 85 short-term, coastal storm risk management measures and projects to allow facilities to weather another storm with minimal service interruption or damage. Estimated costs are $59 million.
2) Utilize metal panels, temporary concrete barriers, and water-filled jersey barriers to floodproof doorways in buildings and station entrances. A total of approximately 3.4 miles of flood risk management measures are proposed.
3) Initiate the 32 long-term resilience efforts concerning aviation, tunnel, and bridge projects. The Port Authority has submitted Letters of Intent for projects in New York and in New Jersey for long-term mitigation as part of the FEMA Section 404 Hazard Mitigation Grant Program. Additionally, the Port Authority is currently working on over 110 FEMA project worksheets, which include Section 406 mitigation measures, with a current total in excess of $250 million.

MTA, Website/Press Release: Update on Superstorm Sandy Recovery and Rebuilding Efforts, May 23, 2013.

A press release from the MTA detailed ongoing recovery efforts and the creation of the MTA Sandy Recovery and Resiliency Division. The goal of the recovery efforts is to manage flood risk at vulnerable locations of the subway infrastructure and significant underground assets. Measures identified include the following.

1) Manage flood risk to outdoor subway yards.
2) Install submarine-type doors at subway entrances in low-lying areas.
3) Design waterproof covers for ventilation grates.
4) Prepare barriers to manage flood risk to above-ground fan plants.
5) Examine technologies and other modifications to the system to minimize impacts of water infiltration.

Locations where flood risk management measures may be implemented are as follows:

1) 53rd Street, Cranberry Street, Rutgers Street, Clark Street, Canarsie and Montague subway tubes under the East River and the Greenpoint tube under Newtown Creek;
2) Coney Island, 148th Street and 207th Street subway car yards and 12 ventilation plants in multiple low-lying areas of Manhattan, Brooklyn, and the Bronx; St. George Terminal and Clifton Shop of the Staten Island Railway; and
3) Low-lying Lower Manhattan subway stations: Rector Street, Broad Street, Bowling Green, Whitehall Street, South Ferry, and Old South Ferry Loop Station.

MTA, Greening Mass Transit and Metro Regions: Final Report of the Blue Ribbon Commission on Sustainability and the MTA, Climate Adaptation Chapter, 2009 and Adaptations to Climate Change: A Categorical Imperative Draft (Unabridged), October 2008.

This report chapter and unabridged "white paper" acknowledges that changes to the physical and natural environment require agencies and organizations to adapt its infrastructure, operations, and policies. The study provides a risk-based framework and identifies regional and solutions to address system vulnerabilities.

1) Investigate the feasibility and costs (and then implementing where possible) for removal of "open access" of tunnels via street-level ventilation grates and subway entrances, at least in service areas with high flood potential (from local street flooding and coastal storm surges).
2) Install effective subway entrance devices/floodgates that would be closed only shortly before and during the times when expected or actual flood heights exceed the entrance curb elevations.
3) Included into these fundamental adaptation options should be any new and newly planned subway structures and route expansions(e.g. all the potentially flood prone portions of the 2nd Avenue line; the #7 subway line extension to the Hudson Yards; the new Fulton Street Center, and Staten Island Ferry subway station).
4) Some options may include, in select inundation-prone areas, the routing above street and/or foreseeable inundation elevations. This option could be explored for the outstanding phases for the new 2nd Avenue line.
5) Evaluate and consider construction of three or four storm barriers at key entrances to the entire NY/NJ Harbor and Hudson/East River Estuary.
6) Consider mitigation options to fortify Queens-Midtown and Brooklyn-Battery Tunnels, Long Island Rail Road East River Tunnels, Hunters Point Station, Long Beach Branch, and Atlantic Avenue Tunnels, Metro-North Hudson and New Haven Lines, and a number of low-elevation bridges and causeways.

NJ TRANSIT, Website/Press Release: Superstorm Sandy Recovery Progress Scorecard, September 6, 2013.

NJ Transit, in accordance with Executive Order 125 (EO-125), signed by Governor Chris Christie, maintains a web database and recovery progress scorecard of the transparent procurement process. NJ Transit has commenced design and implementation of flood risk management measures for their transportation assets.

1) Manage flood risk to substations with a row of 4 to 6-ft flood barriers/trap bags.
2) Elevate critical electrical power substations sufficiently. Elevate or relocate the Rail Operations Center uninterruptable power supply.
3) Harden various buildings, facilities, and functions of the Hoboken Terminal complex and Secaucus Junction.
4) Restore and strengthen Hoboken Ferry Service infrastructure.

5) Build sections of seawall at Morgan, install sheeting to prevent washouts at bridge approaches, raise interlocking apparatuses, and elevate equipment at the Kearny Connection and along the North Jersey Coast Line.
6) Design and implement drainage modifications, berms, floodwalls, and gates at the Meadows Maintenance Complex.
7) Dredge and clear slips of the Weehawken Ferry Terminal.
8) Modify, harden, or fill the Long Slip Canal in Hoboken Yard to eliminate it as a floodway.

Amtrak, Website/Press Release: Invest and Build More Rail Capacity and Resilience in New York Region, December 6, 2012.

This press release provides commentary on incurred damages and proposed flood risk management measures for Amtrak's rail and tunnel systems. Appended to this press release is the testimony of Joseph H. Boardman, Amtrak President and Chief Executive Officer before the Senate Committee on Commerce, Science, and Transportation Subcommittee on Surface Transportation and Merchant Marine Infrastructure, Safety, and Security Hearing, "Superstorm Sandy: The Devastating Impact on the Nation's Largest Transportation Systems."

1) Raise critical electrical power substations, specifically Substation 41 at Kearny, NJ that supplies power to North River Tunnels and Penn Station New York.
2) Provide permanent and substantial levels of flood risk management, redundancy, and capacity by advancing design and construction of the Gateway Program for two new Hudson River tunnels between New York and New Jersey.
3) Enhance and improve recovery capability of Penn Station New York and its tunnels against flooding. Estimated costs are $276 million.

Consolidated Edison Company of New York (Con Edison), Website/Press Release: Post-Sandy Enhancement Plan, June 20, 2013.

As a result of Hurricane Sandy, Con Edison experienced severe damage to critical infrastructure within their energy generation and delivery system. Utilizing a targeted approach based on observations during Hurricane Sandy, studies, and lessons learned, specific measures are selected for flood risk management.

1) Establish common Post-Sandy design standards and install submersible equipment in flood prone areas of the underground network.
2) Design and harden substations and generation stations to a new flood-level design. The minimum height is defined as the highest of: Base Flood Elevation + 2 feet, Category 1 hurricane flood inundation elevation from predicted Sea, Lake, and Overland Surges from Hurricanes (SLOSH), maximum water surface elevation at the facility during Hurricane Sandy.
   - East 13th Street, East River, East 15th Street, East 36th Street, Seaport, Trade Center, Gowanus, Goethals, Fresh Kills, West 49th Street, Academy, Sherman Creek, Hellgate, and Bruckner substations
   - 59th Street, 74th Street, and East River generating stations
   - 60th Street and Ravenswood steam stations
3) Minimize water infiltration to tunnels with vent cover plates.

4) Construct reinforced concrete head houses for five tunnels.

5) Deploy flood doors, gates, and additional de-watering capabilities at tunnel entrances.

PSE&G, Website/Press Release: Petition for Approval of the Energy Strong Program, February 20, 2013.

Similar to Con Edison, PSE&G also experienced severe damage to critical infrastructure within their energy delivery and generation system. They summarized efforts to implement the Energy Strong Program to minimize impacts of flooding to critical infrastructure locations. The estimated costs of this program are $1.678 billion over 10 years of implementation.

1) Harden electric delivery infrastructure at 34 stations by installing floodwalls.

2) Relocate critical electrical and gas operating centers or substations.

3) Elevate or install flood risk management structures at substations, nine metering and regulation stations, one liquefied natural gas (LNG) plant, and consider elevating the liquefied petroleum gas (LPG) storage tanks in Linden, Harrison, and Camden.

PVSC, Website/Press Release: Message from the Executive Director of the Passaic Valley Sewerage Commission, September 3, 2013.

The PVSC wastewater facility in Newark, NJ experienced severe damage to critical infrastructure. In partnership with PVSC, USACE staff performed emergency measures as part of “Task Force Unwatering” to pump approximately 200 million gallons of seawater that inundated the facility. During recovery efforts, PVSC installed a 1.5-mile flood barricade system surrounding key facilities. PVSC submitted 44 FEMA project worksheets with a current total in excess of $100 million.

New York City Special Initiative for Rebuilding and Resiliency (SIRR), A Stronger, More Resilient New York, June 11, 2013.

The New York City Special Initiative for Rebuilding and Resiliency (SIRR) developed a plan to create a more resilient New York City during the recovery efforts of Hurricane Sandy. The SIRR Report proposes a broad range of coastal storm risk management measures and implementation locations. The breadth of measures reflects the fact that various coastal areas in New York City face different risks and therefore require strategies that are tailored to specific needs. The list of four overarching coastal storm risk management strategies, the 37 Phase I Initiatives, and neighborhood specific strategies from the NYC SIRR report are documented in the following section. Estimated costs are $14 billion over a 10 year period.

Increase coastal edge elevations by beach nourishment, revetments, bulkheads, or tide gates/drainage devices.

1) Complete emergency beach nourishment in Coney Island (USACE Flood Control and Coastal Emergencies [FCCE]).

2) Complete emergency beach nourishment in Rockaway Peninsula (USACE FCCE).

3) Complete dune construction and shoreline protection on Staten Island.

4) Install revetments on Coney Island.

5) Install revetments on Staten Island.

6) Raise bulkheads in low-lying neighborhoods across the city to minimize inland tidal flooding.

7) Complete emergency bulkhead repairs adjacent to the Belt Parkway in Southern Brooklyn.
8) Complete bulkhead repairs and roadway drainage improvements adjacent to Beach Channel Drive on the Rockaway Peninsula.
9) Complete emergency floodgate repairs at Oakwood Beach, Staten Island.
10) Complete tide gate repair study at Flushing Meadows Corona Park, Queens.

Minimize upland wave zones by installing dunes, offshore breakwaters, wetland/reefs/living shorelines, or groins.

1) Complete existing studies of the Rockaway Peninsula and implement coastal protection projects.
2) Study and install primary and secondary dune systems in vulnerable Rockaway Peninsula neighborhoods (such as Breezy Point).
3) Study and install offshore breakwaters adjacent to and south of Great Kills Harbor.
4) Study and install wetlands for wave attenuation in Howard Beach and study further flood protection improvements within Jamaica Bay.
5) Study and install living shorelines for wave attenuation in Tottenville.
6) Complete its Plumb Beach breakwater and beach nourishment project in Southern Brooklyn.
7) Complete living shorelines and floating breakwaters for wave attenuation in Brant Point, Queens.
8) Complete its Sea Gate project in Southern Brooklyn.

Protect against storm surge by installing integrated flood protection systems, floodwalls/levees, local storm surge barriers, or multi-purpose levees.

1) Install an integrated flood protection system in Hunts Point.
2) Install an integrated flood protection system in East Harlem.
3) Install an integrated flood protection system in Lower Manhattan, including the Lower East Side.
4) Install an integrated flood protection system at Hospital Row.
5) Install an integrated flood protection system in Red Hook.
6) Complete existing studies on Staten Island and implement coastal protection projects.
7) Call on and work with Con Edison to protect the Farragut substation.
8) Study and install local storm surge barriers at Newtown Creek.

Improve coastal design and governance

1) Complete its comprehensive flood protection study of New York Harbor.
2) Implement the Waterfront Vision and Enhancement Strategy (WAVES) Action Agenda.
3) Implement citywide waterfront inspections to better manage the City’s waterfront and coastal assets.

4) Study design guidelines for waterfront and coastal assets to better mitigate the effects of flooding.
5) Evaluate soft infrastructure as flood protection and study innovative coastal protection techniques.
6) Evaluate the city's vulnerability to drainage pipe flooding and identify appropriate solutions to minimize those risks.
7) Evaluate strategies to fund wetland restoration and explore the feasibility of wetland mitigation banking structures.
8) Work with agency partners to improve the in-water permitting process.
9) Enhance waterfront construction oversight by strengthening the City's waterfront permit and dockmaster units.
10) Identify a lead entity for overseeing the collaboration on the USACE NACCS and for overseeing the implementation of coastal flood protection projects.
11) Call on and work with USACE and FEMA to collaborate more closely on flood protection project standards.

Brooklyn-Queens Waterfront Initiatives

1) Work with the Port Authority to continue a study of innovative coastal protection measures using clean dredge material in Southwest Brooklyn.
2) Call on and work with USACE to develop an implementation plan and preliminary designs for a local storm surge barrier along the Gowanus Canal.
3) Implement strategies to protect Brooklyn Bridge Park and District Under the Manhattan Bridge Overpass (DUMBO).
4) Support private investments that reduce flood risk along Newtown Creek.
5) Create an implementation plan for comprehensive flood protection improvements on public and private property along the Williamsburg, Greenpoint, and Long Island City coastlines.

Southern Brooklyn Initiatives

1) Continue to work with USACE to study strengthening the Coney Island/Brighton Beach nourishment.
2) Call on and work with USACE to study Manhattan Beach oceanfront protection.
3) Call on and work with USACE to study mitigating inundation risks through Rockaway Inlet, exploring a surge barrier and alternative measures.
4) Develop an implementation plan and preliminary designs for new Coney Island Creek wetlands and tidal barrier.
5) Call for USACE to develop an implementation plan for the reinforcement of existing Belt Parkway edge protections.
6) Complete planned drainage improvements in Coney Island to mitigate flooding.

Southern Manhattan Initiatives

1) Create an implementation plan and design for an integrated flood protection system for remaining Southern Manhattan areas.
2) Conduct a study for a multi-purpose levee along Lower Manhattan's eastern edge to address coastal flooding and create economic development opportunities.

East and South Shores of Staten Island Initiatives

1) Call on and work with USACE to study the construction of a floodgate at Mill Creek.

South Queens Initiatives

1) Call for USACE to develop an implementation plan to mitigate inundation risks through Rockaway Inlet, exploring a surge barrier and alternative measures.
2) Develop an implementation plan to address frequent tidal inundation in Broad Channel and Hamilton Beach, incorporating international best practices.
3) Complete short-term dune improvements on the Rockaway Peninsula.

City of Hoboken Office of the Business Administrator, Strategic Recovery Planning Report, Response to Stakeholder Feedback Inquiry, and Supporting Documents, July 1, 2013 and September 5, 2013.

The City of Hoboken developed the Strategic Recovery Planning Report in accordance with the New Jersey Department of Community Affair Community Development Block Grant Disaster Recovery (NJDCA CDBG-DR) Action Plan and the Post-Sandy Planning Assistance Grant Program Description. The recovery plan is a guide for overall actions to address vulnerabilities emphasized during Hurricane Sandy. In addition, the City of Hoboken provided area-specific measures in their stakeholder response specific to this focus area report.

1) Develop a network of shoreline coastal storm risk management measures consisting of armored levees, seawalls, and flood barriers. Focus on areas along the NJ Transit redevelopment area, Hoboken Rail Yards, and North End Rehabilitation Area.
2) Perform a feasibility study of armored levee or flood barrier into the Phase II design of 1600 Park Avenue/Hoboken Cove project at Weehawken Cove.
3) Eliminate and/or harden Long Slip Canal.
4) Develop a microgrid for energy resilience to deliver uninterrupted electrical service during disaster events.
5) Support construction of the North Hudson Sewerage Authority's wet weather pump station and additional flood pumps during storms.
6) Implement emergency notification systems using deployable, solar powered message boards.
7) Incorporate, design, and fund stormwater best management practices and "green infrastructure" through programs such as Re.InvestInitiative.org, Together New Jersey Local Demonstration Project, and Sustainable Jersey. Acquire land for parks and open space with stormwater retention facilities.
8) Support hazard mitigation planning through capital improvements, open space preservation, and recreation as part of the NJDCA CDBG-DR grant program.

9) Overcome design challenges and code issues and develop resilient building codes.
10) Engage in a public Information and awareness campaign by implementation of a city-wide workshop series.
11) Use the Resiliency Task Force to mainstream flood risk management into the sustainable development agenda. Implement the Community Rating System and adopt the advisory base flood elevations with an additional freeboard.

City of Jersey City Response to Stakeholder Feedback Inquiry and Supporting Documents, September 6, 2013.

The City of Jersey City provided a variety of documents from numerous municipal departments regarding proposed flood risk management measures. These measures were identified through letters of intent to FEMA 404 Hazard Mitigation Grant Program (HMGP), NJ Urban Mayors' Association (NJUMA) Sandy Assessment, and transmitted internal memos and documents from the City. Jersey City is collaborating and developing flood risk management measures with Center for Maritime Systems at Stevens Institute of Technology with the New Jersey Sea Grant Consortium through the NOAA Sea Grant Community Climate Change Adaptation Initiative 2013.

1) Install stormwater pumps in JCMUA netting facilities at Essex Street, Country Village, 18th Street, Clendenny Avenue, Sip Avenue, Mill Creek, Claremont and Carteret Avenue. Upgrade water storage vessels. Estimated costs are $61,200,000.
2) Elevation and implement flood risk management projects for Jersey City Housing Authority at Holland Gardens and Booker T. Washington and Marion Gardens. Estimated costs are $16,995,000.
3) Install engineered barriers to accomplish a redundant, tiered approach to flood risk management: harbor-based structures, reach-based or neighborhood-level of flood risk management. Encourage site or building-specific mitigation.
4) Elevate land through redevelopment tracts at Liberty Harbor North, Grand Jersey, Bayfront, Newport, Western Waterfront, and Harborside.
5) Harden existing structures along the waterfront.
6) Elevation streets in strategic locations (Route 440/1 and 9T, Kellogg Street, Hudson River Waterfront Walkway). Evaluate elevation along the Hudson River side of Jersey City (portions of Grand Street, Washington Boulevard, etc.)
7) Install land-based floodgates in public right-of-ways and pumps to alleviate interior drainage issues.
8) The Jersey City Stormwater Management Plan (2011) provides general structural and non-structural stormwater management strategies. As a result of damages from Hurricane Sandy, proposed stormwater management strategies include:
    - Convert previously abandoned sedimentation tanks at JCMUA site/Phillips Drive to detention basins before transfer to Passaic Valley Sewerage Commission Treatment Plant.
    - Install submersible pumps at the 18th Street and Claremont/Carteret outfalls and the Essex Street Netting Facility.

Hudson County Office of Emergency Management, DMA 2000 Hazard Mitigation Plan Hudson County, New Jersey, September 2008 and updated in 2010.

The Hudson County Hazard Mitigation Plan identifies mitigation actions that may manage the impact of natural hazards on communities. There were twelve municipalities within the study area with mitigation actions. Both broad-based measures as defined in the HMP and area-specific measure are included.

1) Improve drainage infrastructure at the Witt-Penn Bridge Project. Install new pump station, detention basin, drainage pipes, tide gates, and retaining walls to alleviate flooding along the Hackensack River
2) Implement the St. Paul's Pump Station and Outfall to drain Penhorn Creek to Secaucus and Jersey City at a different entry point in the Hackensack River.
3) Implement Cedar Creek pump station, outfall, and bulkhead Project along the Passaic River in Kearny to drain properties along Cedar Marsh including Newark-Jersey City Turnpike. Estimated costs are $5 million for USACE to reconstruct with PANYNJ and NJ Transit as co-participants.
4) Elevate flood prone roadways.
5) Increase capacity of storm water drainage on State, County, Municipal roads and evacuation routes.
6) Encourage retrofitting of structures in flood prone areas, especially repetitive loss.
7) Improve the combined sewer and stormwater systems in Bayonne, Harrison, Jersey City, Kearny, and Union.
8) Improve the North Bergen Sewerage Treatment Plan configuration by increasing capacity of the North Bergen Plant, increasing capacity of overflow line, or increase capacity with a parallel pipe and chamber to handle excess flow through river in Guttenberg.
9) Install four new wet weather pump stations for the North Hudson Municipal Utilities Authority (NHMUA) in Hoboken.
10) Consider design of a combined sewer overflow consolidation conduit to improve drainage in southwestern Hoboken.
11) Retrofit flood prone residents with sump pumps or relocation of utilities in Hoboken.
12) Consider design of a JCMUA deep tunnels project, a 20-ft in diameter storage tunnel to manage flooding and increase stormwater conveyance.
13) Upgrade the Sellers Street pump station to withhold and remove tidal flow in Kearny.
14) Dredge Bellman's Creek to manage flooding at 91-95th Street. This open channel body of water discharges to the Hackensack River in North Bergen.
15) Rehabilitate the 8th Street Sewage Pump Station and 6100 Tonnelle Avenue Pump Station. Enhance drainage system on 91st street to provide increased capacity.
16) Replace the storm sewer system on 1st Street and Minnie Place to manage flooding, support the county project to reconstruct the St. Paul's Pump Station and outfall in Secaucus.
17) Construct Center Lane drainage system from Stonewall Lane to Marianne Terrance in Secaucus.

Bergen County Hazard Mitigation Plan Leadership Team, Bergen County Natural Hazards Mitigation Plan, August 2008.

The Bergen County Hazard Mitigation Plan identifies mitigation actions that may reduce the impact of natural hazards on communities. There were 44 municipalities within the study area with mitigation actions. Both broad-based measures as defined in the HMP and area-specific measure are included.

1) Clean and maintain the Hirshfield Brook in Bergenfield.
2) Repair drainage at Veterans Memorial Park in Bergenfield.
3) Remove debris from ditch and replace culvert in Bogota and Teterboro.
4) Dredge Tenakill Brook in Cresskill.
5) Improve drainage and maintenance in Demarest, Dumont, and Teaneck.
6) Clean and maintain Flasher's Brook in Elmwood Park.
7) Remove debris from Palisade's Cliff in Edgewater.
8) Install additional drainage projects in Emerson.
9) Perform a drainage and flood study for Bellman's Creek in Fairview
10) Replace footbridge, remove debris at the Crescent Stream crossing, and the streams near Closter in Haworth.
11) Construct pump stations in Little Ferry to alleviate flooding from the Hackensack River.
12) Upgrade pump stations in North Arlington.
13) Implement a flood warning system in Oradell.
14) Dredge outfalls to Overpeck Creek in Palisades Park.
15) Upgrade stormwater conveyance system in Palisades Park and Wood-Ridge.
16) Perform engineering analysis to determine mitigation measures for Bergen Turnpike and Hackensack River/Overpeck Creek.
17) Clean and maintain Sparkill Creek in Rockleigh.
18) Restore the Kane Tract Levee to manage flood risk to the Boroughs of Carlstadt, Little Ferry, South Hackensack, and Moonachie. Construct a proposed earthen replacement to a drivable 12-ft wide crest, 2:1 side slope, and engineered soil core.
19) Restore and upgrade the West Riser tide gates at the terminus of Berry's Creek in Moonachie. Replace the existing sheet pile wall with corrosion resistant material, install rubber duckbill tide gate valves, construct local berms, install trash racks, and scour control.
20) Restore and upgrade the Peach Island tide gates in Carlstadt. Replace with corrugated metal pipes and associated metal tide gates and duckbill tide gate check valves, construct local berms, install trash racks, and scour control.
21) Restore functionality of the Rutherford/East Rutherford drainage system by enlarging the ditch to 15-ft wide at the base, stabilize with vegetation and bio-mats.

22) Implement remainder of the NJMC floodplain management plan, which includes tide gate installation, pump station improvements, drainage system improvements, and drainage ditch clean outs within the Meadowlands.

Passaic County Office of Emergency Management, Multi-Jurisdictional Hazard Mitigation Plan, August 1, 2010.

The Passaic County Hazard Mitigation Plan identifies mitigation actions that may manage the impact of natural hazards on communities. There were three municipalities within the study area with mitigation actions. Both broad-based measures as defined in the HMP and area-specific measures are included.

1) Install stormwater management culverts for the Department of Public Works building on East 7th Street in Clifton.
2) Upgrade the stormwater collection system along Route 46 at Main Avenue overpass and along Route 3 and Hepburn Road in Clifton.
3) Upgrade culvert on Sylvan Avenue and Main Avenue in Clifton.
4) Stabilize and augment the stream banks of the Passaic River located at 8th, 9th, and 10th Streets near Passaic Street and River Drive in Passaic.
5) Elevate or floodproof repetitive loss properties located on Henry Street in Passaic.
6) Stabilize and augment the stream banks of the Passaic River Corridor along River Street in Paterson.
7) Acquire flood prone homes on the following roads: East Main Street, Corridor Street, Hilman Street, Presidential Boulevard, Amity Street, North First Street, Percie Street, Stout Street, North Street, Watson Street, and Bergen Street in Paterson.

Somerset County Office of Emergency Management, DMA 2000 Hazard Mitigation Plan Somerset County, New Jersey, September 2008.

The Somerset County Hazard Mitigation Plan identifies mitigation actions that may manage the impact of natural hazards on communities. There were four municipalities within the study area with mitigation actions. Both broad-based measures as defined in the HMP and area-specific measure are included.

1) Design and construct a new flap valve and pump station for the South Main Street/Railroad underpass in Manville Borough. Improvements would prevent flooding due to rising water from the Raritan River during large storm and flash flooding events.
2) Support completion of Millstone River Flood Study with USACE.
3) Support completion of Green Brook Flood Control Project with USACE.
4) Support completion of Bound Brook element of Green Brook Flood Control Project with USACE.
5) Support completion of Somerset County portion of the Green Brook Flood Control Project with USACE.
6) Eliminate the Cedarbrook Park impoundment area. Propose to remove the existing outlet structure at Cedarbrook Park to allow free flow of stormwater from the impoundment area in Bridgewater Township.

Orange County Office of Emergency Management, DMA 2000 Hazard Mitigation Plan Orange County, New York, April 2010.

The Orange County Hazard Mitigation Plan identifies mitigation actions that may manage the impact of natural hazards on communities. There were two municipalities within the study area with mitigation actions. Broad-based measures as defined in the HMP are included.

1) Participate in the National Flood Insurance Program and Community Rating System.
2) Install floodwalls, barriers, and elevate roads in flood prone areas.
3) Implement a stormwater management plan.
4) Maintain a constant stream maintenance program.
5) Manage risk to bridges and streams from scour.
6) Maintain wetlands development regulations.

Rockland County Office of Fire Emergency Services, Multi-Jurisdictional Natural Hazard Mitigation Plan, Rockland County, New York, April, 2010.

The Rockland County Hazard Mitigation Plan identifies mitigation actions that may manage the impact of natural hazards on communities. There were four municipalities within the study area with mitigation actions. Broad-based measures as defined in the HMP are included.

1) Develop a stormwater management plan that includes subdivision regulations to control runoff; both for flood risk management and slope stability.
2) Identify and document repetitively flooded properties. Explore mitigation opportunities for repetitively flooded properties, and if necessary, carry out acquisition, relocation, elevation, and floodproofing measures to these properties.
3) Identify locations/structures suitable for construction of floodwalls and other barriers such as raised roads.
4) Investigate the construction of bulkheads and other structural waterfront flood risk management measures.
5) Establish setback distances for construction in areas likely to be vulnerable to inundation, erosion, and wave action during storm surges.
6) Install erosion control measures to prevent damage from flooding and wave action.
7) Consider installation of tidal backflow valves.

City of New York Office of Emergency Management, Hazard Mitigation Plan, New York City, New York, March 2009.

The City of New York Hazard Mitigation Plan identifies mitigation actions that may manage the impact of natural hazards on communities. Broad-based and area-specific measures as defined in the HMP are included. Mitigation actions listed are likely superseded or supplemented by the NYC SIRR Report.

1) Improve and increase the culvert diameter from 18-in to 24-in for drainage improvements along Pelham Bay.
2) Upgrade floodgate hardware and mechanisms to control rise rate of water into Penn Station tunnels.
3) Upgrade the Mid-River and East River pumps to handle flooding conditions in tunnels under the river.

4) Install combined sewer overflow (CSO) storage tanks projects at Paerdegat Basin, Spring Creek, Flushing Bay, and Alley Creek. These tanks will capture and store millions of gallons of combined sanitary and stormwater during extreme weather to reduce CSO into surrounding water bodies. The collected combined sewage is later conveyed to a wastewater treatment plant after the sewer system returns to normal to be fully treated before discharged into surrounding water bodies.

5) Install additional storm sewers in the following flood prone areas: Southeast Queens, the Rockaway Peninsula, Coney Island, and Flushing.

6) Construct tide gates on outfalls to manage storm surge into the system.

7) Install various shoreline coastal storm risk management structures to mitigate coastal erosion on Rikers Island.

8) Renourish Orchard Beach in the Bronx.

9) Design and install flood gates and barriers at Brooklyn-Battery Tunnel and Queens-Manhattan Tunnel. Determine the coastal storm vulnerability of the Triborough Bridge.

New York City Green Infrastructure Plan: A Sustainable Strategy for Clean Waterways, September, 2010.

The New York City Green Infrastructure Program is a multiagency effort led by the New York City Department of Environmental Protection with agency partners, including the PlaNYC team. The Green Infrastructure Plan details future implementation strategies to reduce combined sewer overflows. Although its primary focus is on improving water quality, related flood risk management measures are interspersed throughout the Plan.

1) Optimize the existing wastewater system by completing drainage plans, performing system-wide hydraulic analysis, rehabilitating tide gates, and performing inflow/infiltration surveys.

2) Control runoff from 10% of impervious surfaces through green infrastructure by implementing stormwater management measures across the 13 identified urban watersheds.

3) Institutionalize adaptive management by monitoring system performance, infrastructure implementation, and progress towards improving water quality.

4) Engage and enlist stakeholders, primarily the public.

5.5.4.2 Jamaica Bay

Jamaica Bay, its ecosystem, and the marsh island complex is currently undergoing restoration as part of combined efforts across multiple Federal, state, and local agencies including USACE, PANYNJ, National Park Service, NYCDEP, U.S. Department of Agriculture Natural Resources Conservation Service, NY-NJ Harbor Estuary Program, and NYSDEC. Flood risk management measures are identified in the NYC SIRR report (Initiative 14: Study and install wetlands for wave attenuation in Howard Beach and study further flood risk management improvements within Jamaica Bay). On August 13th, 2013, Secretary of the Interior Sally Jewell and Mayor Michael Bloomberg announced the forming of the Jamaica Bay Science and Resilience Institute (JBSRI), a project led by the City the University of New York. The JBSRI will build upon current USACE restoration efforts and develop natural storm defense barriers such as additional tidal wetlands, salt marshes, and dunes. USACE also has an existing authority to develop a long term, cost-effective solution to the effects of continued erosion on the Rockaway Peninsula.

Another option would be to reevaluate the Jamaica Bay Federal Navigation Project to determine the Federal Standard (least-costly, environmentally-acceptable method of dredged material placement) based on the development of Ecosystem Goods and Service Performance Metrics for Natural and Nature-Based Infrastructure for the NACCS.

5.5.4.3 Lower New York Bay

USACE currently has existing authorities to implement coastal storm risk management measures and beach nourishment along the shorelines of the Lower New York Bay planning region, specifically along the South Shore of Staten Island, Raritan Bay and Sandy Hook Bay, and the Shrewsbury River and Navesink River area. Other areas within this planning region, although studied in the past, may require updated investigations. These measures, once constructed and maintained, will provide coastal storm risk management to those communities. Additional measures that may be considered are:

1) Regional sediment management should be incorporated and institutionalized into any Federal and non-Federal navigation or nourishment project in this area to minimize costs and impacts to neighboring communities.
2) Consider other broad-based structural or non-structural measures such as those recommended in the Hudson County HMP, New York City HMP, or the NYC SIRR Report.

5.5.4.4 Lower Raritan River

USACE currently has an authorized but unconstructed project for flood risk management in the South River, a major tributary to the Lower Raritan River basin. Outcomes from study efforts for the South River may be considered as the foundation of other efforts in the Lower Raritan River. Other broad-based structural or non-structural measures such as those recommended in the State of NJ HMP could also be taken into consideration.

City of Perth Amboy, Response to Stakeholder Feedback Inquiry and Supporting Documents, September 17, 2013.

The City of Perth Amboy created the Waterfront Recovery and Redevelopment Advisory Committee (WR&RAC) to develop a recovery plan following Hurricane Sandy. The City of Perth Amboy and WR&RAC provided a list of area-specific measures and priority projects in their stakeholder response. Estimated costs are $18 million.

1) Replace, rebuild, and enhance with waterfront infrastructure (such as seawalls, bulkheads, and revetments) to 2.5-ft above River and Harbor walk elevations. Ensure proper bulkhead and scour-pad design.
2) Create sand dunes along beach area.
3) Replace, rebuild, and enhance waterfront facilities including marina, fishing piers, and walkways.
4) Repair Bayview Park Hillside and area south of Raritan Yacht Club with erosion control or retaining walls.

5.5.4.5 Arthur Kill and Kill Van Kull

Borough of Carteret, Response to Stakeholder Feedback Inquiry and Supporting Documents, September 6, 2013.

The Borough of Carteret, in the transmittal to the stakeholder feedback inquiry, stated that the Borough performed site-specific mitigation measures, specifically elevation of mechanical and electrical systems and floodproofing of damaged facilities.

Mayors Council, Rahway River Watershed Flood Control Needs Statement and Press Release, April, 2012.

Following Hurricane Irene in 2011, mayors from municipalities within the Rahway River Watershed convened to determine regionally focused solutions. Input from the mayors of Millburn, West Orange, Union, Springfield, Kenilworth, Garwood, Westfield, Cranford, Winfield Park, Rahway, and representatives from Essex and Union Counties were included. The needs statement summarizes local flood risk management efforts and calls upon NJDEP and USACE for future projects.

1) Evaluate flood storage alternatives, specifically South Mountain Reservation, Echo Lake Park, Lenape Park Detention Basin, Nomahegan Park, Cameron Field, Meadowlands, and the Maplewood Golf Course.
2) Evaluate bridges as flooding and debris constraints, specifically Route 22 East and West bridges, Millburn Road, Morris Avenue, I-78, I-124, Vauxhall Road, Hazel Avenue Bridge.
3) Review and amend current storm water management ordinances and practices to minimize adverse impacts due to impervious areas.
4) Acquire repetitive loss properties for open space in alignment with the State of New Jersey's Blue Acres program.
5) Improve river debris cleanup and maintenance of Rahway River.
6) Local flood mitigation projects are:
   - Union – repair to Franklin Street flood risk management facilities, debris and sediment removal in Vauxhall Branch.
   - Cranford – Northwest Quadrant Flood Control Plan for dike and pump station, rehabilitation of Riverside Drive dikes, connection between storm drain system to Riverside Drive pump station.
   - Millburn – improvements to storm drainage system, pump station, and additional floodwalls.
   - Springfield and Rahway – improvements to mitigate local flooding.
7) Support New Jersey Department of Transportation (NJDOT) stream maintenance program to mitigate flooding in Union and Millburn near the I-24 and I-78 bridges.
8) Expand flood risk management planning by USACE, specifically Franklin Street in Union Township, South Mountain area in Millburn, Springfield, Cranford, Robinson's Branch, East Branch storage.

5.5.4.6 Newark Bay, Passaic River, Hackensack River

New Jersey Meadowlands Commission (NJMC) Response to Stakeholder Feedback Inquiry and Supporting Documents, September 16, 2013.

The NJMC exercises jurisdiction over the 30.4 square mile Hackensack Meadowlands District. The District is composed of parts of 14 municipalities in Bergen and Hudson Counties (Carlstadt, East Rutherford, Jersey City, Kearny, Little Ferry, Lyndhurst, Moonachie, North Arlington, North Bergen, Ridgefield, Rutherford, Secaucus, South Hackensack, and Teterboro).

As a result of damages from Hurricane Sandy, NJMC submitted a letter of intent (LOI) to the FEMA 404 HMGP for proposed mitigation projects totaling nearly $25.3 million:

1) Dredge 14 miles of ditches within the Meadowlands District.
2) Replace the Peach Island Creek tide gate and structure.
3) Enhance 16 miles of earthen berm to an average elevation of 6 feet.
4) Upgrade the existing tide gate structures.
5) Repair and replace culverts at Cayuga Dike.
6) Manage flood risk to NJMC complex, school, and landfill.

In a transmitted document, a summary of a previous USACE study was detailed. The 1993 proposal included details for a ring levee system for areas within the District in Carlstadt and Moonachie. The total investment cost at the time was approximately $92.7 million with annual maintenance costs of $221,000.

1) Install levees: 20,800 linear feet with average elevations between 8 to 10.5 feet.
2) Install reinforced concrete walls: 9,800 linear feet with average elevations between 6 to 8 feet.
3) Excavate a diversion ditch: 2,900 linear feet (10-ft by 8-ft).
4) Elevate roads to a maximum elevation between 7.5 to 9 feet.
5) Install pump stations: Five total, with a capacity ranging from 35 to 280 cfs.
6) Install closure gates at a railroad crossing (20-ft by 8-ft) and three road crossings (60-ft by 6-ft).
7) Elevate four residential structures by 3 feet.

City of Elizabeth, Response to Stakeholder Feedback Inquiry and Supporting Documents, September 6, 2013.

The City of Elizabeth, in the transmittal to the stakeholder feedback inquiry, stated that the City is performing a feasibility study to upgrade the collection system in the areas affected by tide and storm surge. In addition, the City is performing the following measures:

1) Floodproof damaged facilities.
2) Install weighted restraints to timber bulkheads and other waterfront structures.
3) Install erosion prevention measures to waterfront areas.

Township of Saddle Brook, Submitted Stakeholder Comment Sheet at Bergen County Stakeholder Meeting, July 16, 2013.

The Township of Saddle Brook indicated that installation of retention basins along the Saddle River would be possible flood risk management measures.

Borough of Rutherford, Submitted Stakeholder Comment Sheet at Bergen County Stakeholder Meeting, July 16, 2013.

The Borough of Rutherford indicated that existing studies for the Passaic River do not incorporate the Borough of Rutherford for flood risk management. The Borough suggested correct installation and operation of the tide gates.

Passaic River Basin Flood Advisory Commission, Report to the Governor: Recommendations of the Passaic River Basin Flood Advisory Commission, February, 2011 and updated March, 2013.

On April 23, 2010, New Jersey's Governor Chris Christie, established the Passaic River Basin Flood Advisory Commission to develop regionally focused solutions to chronic flooding issues. This report and follow-on update provides a list of flood risk management strategies that may minimize the impact of flooding in the Passaic River Basin.

1) Acquire property in floodways and floodplains.
2) Elevate structures in floodplains.
3) Acquire and preserve open space.
4) Improve operation of the Pompton Lakes Dam floodgates.
5) De-snag and dredge shoals of creeks, streams, and rivers.
   - On September 19, 2013, the Christie Administration announced that local and county governments in the Passaic River Basin may apply for state grants to help them keep streams and rivers clear of snags, debris and shoals under a new $3 million program.
6) Adopt National Flood Insurance Program (NFIP) regulations statewide.
7) Expedite the permitting process for tree-clearing, river wall repair, and shoal dredging.
8) Improve effectiveness of county and local emergency response plans.
9) Enhance Passaic River flood warning system.
10) Map inundation and flood risk extents.
11) Enhance public involvement for flood response.
12) Request USACE to reevaluate flood risk management projects for levees and floodwalls, including an update of the cost/benefit analysis for a flood tunnel.
    - In July 2012, USACE executed a Feasibility Cost Sharing Agreement with NJDEP for a General Reevaluation Study of the Passaic River Project.
13) Issue moratorium on all new development within the floodplain.

5.5.4.7 Upper New York Bay

Although no USACE coastal storm risk management projects or authorities exist for this planning region, both regional and local stakeholders have expressed interest in a comprehensive approach to flood risk management. Consider recommendations that were provided in the Hudson County HMP, stakeholder feedback from Jersey City or Hoboken, and the NYC SIRR report.

5.5.4.8 Hudson River

Hudson River Estuary, NYS DEC Response to Stakeholder Feedback Inquiry and Supporting Documents: Village of Piermont, City of Kingston, and Town of Saugerties, May-June, 2014.

NYS DEC responded to the stakeholder feedback inquiry and provided a memo summarizing the impacts of storm surge and other related water resources problems to the Hudson River Estuary area. The memo also listed the counties that were impacted, which includes Westchester, Rockland, Putnam, Orange, Ulster, and Greene counties. Impacts were also felt in Dutchess, Columbia, Rensselaer and Albany counties but were not quantified. Specific information was provided from Saugerties, Piermont, and Kingston. Through the New York Rising Community Reconstruction Program, impacted areas, vulnerable assets, and potential projects were identified. The Village of Piermont identified various projects that were proposed for the FEMA 404 Hazard Mitigation Grant Program. The City of Kingston also identified various projects with information from the Kingston Tidal Waterfront Flooding Task Force in addition to a $5 million hazard mitigation proposal for riparian buffers, engineered dock improvements, buy outs, and adaptation of key assets.

Town of Stony Point, Response to Stakeholder Feedback Inquiry and Supporting Documents, September 19, 2013.

Through the New York Rising Community Reconstruction Program, the Town of Stony Point has started to develop a long term recovery plan and flood risk management initiatives.

1) Replace the existing 21-inch Cedar Pond Brook Sewer Line, which was undermined from storm-related damages caused by Irene, Lee, and Sandy.
2) Maintain and preserve the Stony Point Battlefield Ferry Landing, a registered historic site.
3) Refortify seawalls, jetties, and breakwaters along River and Beach Roads and in Stony Point Bay.
4) Elevate critical wastewater treatment plant equipment, controls, and emergency power.

5.5.4.9 Harlem River, East River, Western Long Island Sound

Manhattan Borough, New York State Assembly, and New York State Department of State Division of Coastal Resources, East River Blueway Plan, March 2013.

The plan presents guiding principles to the revitalization of the East River waterfront and defines measures for three areas: South Street Waterfront Area, East River Park Waterfront Area, and the Stuyvesant Cove/Waterside Plaza Waterfront Area. The multi-purpose strategies emphasize flood risk management, public access, and community resilience.

1) Create the Blueway Crossing and Flood Barrier spanning FDR Drive at East 14th Street to eliminate the Esplanade bottlenecks and to manage flood risk to critical infrastructure such as the Con Edison power station.
2) Incorporate wetlands and marshes with the development/restoration of the Brooklyn Bridge Beach.
3) Create freshwater wetlands along the Esplanade to capture stormwater runoff from FDR Drive.
4) Create intertidal salt marshes at Stuyvesant Cove.

5) Incorporate secondary flood risk reduction through the construction of green infrastructure upland from the waterfront, such as bioswales and green roofs.

5.5.4.10 Summary

The broad measures identified herein, structural, non-structural, and nature-based have the potential for further development into alternative plans targeting specific areas for coastal storm risk management. Based on the breadth and depth of measures identified in previous studies, and in consultation with various potential non-Federal sponsors, a wide-range of potential measures exists to address coastal storm risk management in the NYNJHT area. The goal of alternative plan development is to achieve the objectives by combining one or more measures while avoiding constraints. Measures identified will be further evaluated, screened, and used in combination in future phases of study to determine specific project viability to meet the planning objectives.

6. Preliminary Financial Analysis

Given the size of the NYNJHT study area (1380 square miles) and the significant extent of coastal storm risk management and flood risk problems and opportunities, there are likely to be multiple future studies and potentially multiple non-Federal sponsors. Potential non-Federal sponsors include the State of New York (NYSDEC), State of New Jersey (NJDEP), New York City, and the Port Authority of New York and New Jersey.

Based on current policy, the non-Federal sponsors identified in **Table 11** would be required to provide 50 percent of the cost of the potential future investigation. One hundred percent of the non-Federal sponsor's share can be work in-kind. The potential non-Federal sponsor(s) are also aware of the cost-sharing requirements for potential project implementation. A letter of support from the non-Federal sponsor stating a willingness to pursue potential future investigation and to share in its cost, and an understanding of the cost sharing that is required for project construction will be required.

7. Summary of Potential Future Investigation

Based on the identified measures, potential alternative plan development, and future screening of alternatives, there appears to be a large array of solutions that have the potential to be economically justified, environmentally acceptable, addressable through engineering solutions, and consistent with USACE policies and the Infrastructure Systems Rebuilding Principles (NOAA and USACE, 2013).

Table 11 summarizes the potential non-Federal sponsors with potential interest in future phases of study that could be conducted under this authority to address coastal storm risk management, flood risk management, and related purposes.

Table 11. Potential Future Investigation and Non-Federal Sponsors

Agency/Organization	Portion of Study Area Interest	Navigation	Coastal Storm Risk Management	Flood Risk Management	Nature-Based	Water Resource Management	Community Resilience
State of New York (NYSDEC)	Jamaica Bay; Upper and Lower New York Bay; Arthur Kill and Kill Van Kull; Hudson River; Harlem River, East River, Western Long Island Sound	X	X	X	X	X	X
State of New Jersey (NJDEP)	Upper and Lower New York Bay; Lower Raritan River; Arthur Kill and Kill Van Kull; Newark Bay, Passaic River, Hackensack River; Hudson River	X	X	X	X	X	X
New York City	Jamaica Bay; Upper and Lower New York Bay; Arthur Kill and Kill Van Kull; Hudson River; Harlem River, East River, Western Long Island Sound	X	X	X	X	X	X
Port Authority of New York and New Jersey	Jamaica Bay; Upper and Lower New York Bay; Lower Raritan River; Arthur Kill and Kill Van Kull; Hudson River; Newark Bay, Passaic River, Hackensack River; Hudson River; Harlem River, East River, Western Long Island Sound	X	X	X	X	X	X

8. Views of Other Resource Agencies

Due to the funding and time constraints of this focus area analysis, very limited coordination was conducted with other agencies. Coordination with other resource agencies is being conducted as part of the overall NACCS. Additional coordination would occur during the future phases of study.

9. References

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APPENDIX A

STAKEHOLDER INQUIRY LETTER AND SAMPLE EMAIL TRANSMISSION

LIST OF CONTACTS: NEW JERSEY, NEW YORK, AND REGIONAL STAKEHOLDERS

Bui, Frances

From: Cresitello, Donald E NAN02 [Donald.E.Cresitello@usace.army.mil]
Sent: Friday, August 23, 2013 7:09 AM
To: csanders@piermont-ny.org; supervisor@orangetown.com; mayor@hastingsgov.org; bsmith@irvingtonny.gov; mblau@tarrytowngov.com; jmaybury@mtpleasantny.com; jtp2@westchestergov.com; eeb6@westchestergov.com; mayorconnett@dobbsferry.com; lwiegman@crotononhudson-ny.gov; aruggiero@cityofpeekskill.com; Smurray@villageofbuchanan.com; hanauer@villageofossining.org; pzegarelli@briarcliffmanor.org; agiaccio@villageofsleepyhollow.org; lindap@townofcortlandt.com; laura.sager@ccswcd.org; dutch@dutchessswcd.org; jeff@gcswcd.com; joel@gcswcd.com; kevin.sumner@ocsoil.org; lauri.taylor@putnamcountyny.gov; envcomm@alpinenj.org; jfussa@baynj.org; kcavanagh@bellevillenj.org; rmccarthy@bloomfieldtwpnj.com; mayor@bogotaonline.org; zoningdept@carlstadtnj.us; oem@carteret.net; szoklu@cliffsideparknj.gov; administrator.boro@cresskillboro.org; mayor@eastbrunswick.org; boroughofeastnewark@verizon.net; cityadmin@ci.east-orange.nj.us; DPW@EastRutherfordNJ.net; info@edgewaternj.org; mayorricigliano@edisonnj.org; DLoomis@ElizabethNJ.org; frankhuttle@englewoodmayor.com; dtesta@fairviewborough.com; mayor@fortleenj.org; apavlica@garfieldnj.org; townclerk@myguttenberg.com; adib@hackensack.org; mlgravinese@harrisontwp.us; Mayor@hasbrouck-heights.nj.us; minkoffhp@gmail.com; qwiest@hobokennj.org; rbyrne@jcnj.org; mayor@kearnynj.org; jterhune@leonianj.gov; rbanks@linden-nj.org; mayor@littleferrynj.org; recruitment@emergencysquad.com; MaywoodMayor@aol.com; weboerth@metuchen.com; tciannamea@moonachie.us; gpatterson@cityofnewbrunswick.org; cdemiris@newmilfordboro.com; ramosa@ci.newark.nj.us; pmassa@northarlington.org; jcraviolo@northbergen.org; mayorpetracco@nutleynj.org; Mayor@oldbridge.com; mayor@oradell.org; borohall@palisadesparknj.us; BoroClerk@paramusborough.org; mayor@cityofpassaicnj.gov; lmartinez@perthamboynj.org; mceder@piscatawaynj.org; mayorproctor@cityofrahway.com; rpdeputy@nj.rr.com; ddondiego@bor.river-edge.nj.us; clerk@rockleigh.org; acacciatore@rutherford-nj.com; terry@sayreville.com; mgonnelli@secaucus.net; mayor@southamboynj.gov; poconnor@southrivernj.org; Npoliseno@spotswoodboro.com; jevelina@teanecknj.gov; phale@tenafly.net; senstack@njleg.org; v.baginski@verizon.net; roladahboul@tow-nj.net; gpope@westnewyorknj.org; WBMAYOR@twp.woodbridge.nj.us; erica.betti@co.middlesex.nj.us; engineering@co.middlesex.nj.us; ettiere@ucnj.org; jgraziano@ucnj.org; joedi@admin.essexcountynj.org; svarghese@essexcountynj.org; gjaramillo@hcnj.us; mferrara@hcnj.us; countyexecutive@co.bergen.nj.us; TCasey@co.bergen.nj.us
Cc: Cackler, Olivia N NAN02; Bui, Frances; Croom, Ginger
Subject: NACCS -NY Bay, Its Tributaries and Jamaica Bay Reconnaissance Level Analysis - COORDINATION (UNCLASSIFIED)
Attachments: NYBTJB_RLA_letter.pdf

Importance: High

Classification: UNCLASSIFIED
Caveats: NONE

Dear Stakeholder,

Please see attached letter regarding the North Atlantic Coast Comprehensive Study NY Bay, Its Tributaries and Jamaica Bay Reconnaissance Level Analysis. We are looking to coordinate with you to gain input to the Study, no later than September 6, 2013.

As stated in the letter, please coordinate directly with Ginger Croom (contractor) and Roman Rakoczy (USACE), both copied on this email.

Thanks,
Donald E. Cresitello
Coastal Planning Regional
Technical Specialist
26 Federal Plaza, Room 2145
New York, NY 10278
917-790-8608

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278–0090

REPLY TO
ATTENTION OF

CENAN-PL-F

23 August 2013

Dear Stakeholder,

The United States Army Corps of Engineers (USACE) is conducting the North Atlantic Coast Comprehensive Study (NACCS) under the authority of Public Law 113-2, the Disaster Relief Appropriations Act of 2013, Chapter 4, which authorized USACE investigations as follows:

- *"That using up to $20,000,000 of the funds provided herein, the Secretary shall conduct a **comprehensive study** to address the flood risks of **vulnerable coastal populations** in areas that were affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the Corps.*
- *"....as a part of the study, the Secretary shall **identify those activities warranting additional analysis by the Corps**".*

The goals of the NACCS are to:

- Promote resilient coastal communities with sustainable and robust coastal landscape systems, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable populations, property, ecosystems, and infrastructure; and
- Provide a risk reduction framework (reducing risk to which vulnerable coastal populations are subject) consistent with USACE-NOAA Rebuilding Principles.

To identify those activities warranting additional analysis, USACE is conducting a Reconnaissance-Level Analysis (RLA) for New York Bay, Its Tributaries and Jamaica Bay. The area that will be studied as part of this RLA is shown in Figure 1 (attached).

The purpose of the RLA is to determine if there is a Federal (USACE), interest in participating in a cost-shared feasibility study to formulate and evaluate specific coastal flood risk management projects in the New York Bay, Its Tributaries and Jamaica Bay study area. Possible coastal flood risk management measures could include: structural, non-structural, natural, nature-based, and policy and programmatic measures or a combination of them, if a feasibility study is initiated.

To conduct the RLA, **USACE requests feedback from your jurisdiction** on related problems and potential opportunities to address these issues such as those experienced during Hurricane Sandy and other storms.

<u>Specific feedback requested is as follows:</u>

1) **Problem identification for your area:**

a. Did your area experience tidal or tidally influenced storm surge?
b. Be specific on particular areas and water bodies within your jurisdiction that experienced storm surge.
c. What factors, if any, exacerbated damages from storm surge?

2) **Description of damages for your area:**
   a. Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.
   b. Provide a map depicting the spatial extent of damages.

3) **Prior related studies or projects (local, state, federal) in the damaged area.**

4) **List measures that your jurisdiction has considered to address the problem** (for documentation purposes, should there be a follow-on study).

Responses should be emailed to:

Ginger Croom, croomgl@cdmsmith.com (USACE Contractor)
Or faxed to Ginger Croom at 617-452-6594

Due to the aggressive schedule to complete the RLA and to meet the Congressional mandate to complete the NACCS, please provide responses to these questions by **September 6, 2013.**

If you have any questions related to this request, please contact Ginger Croom, CDM Smith (USACE Contractor) at 617-452-6594 or myself at 917-790-8608.

For more information on the NACCS, please visit:

http://www.nad.usace.army.mil/Missions/CivilWorks/HurricaneSandyCoastalRecovery/NorthAtanticComprehensiveStudy.aspx

Sincerely,

Donald E. Cresitello

Donald E. Cresitello
USACE, New York District

Encl
1. Figure 1: Study Area Map

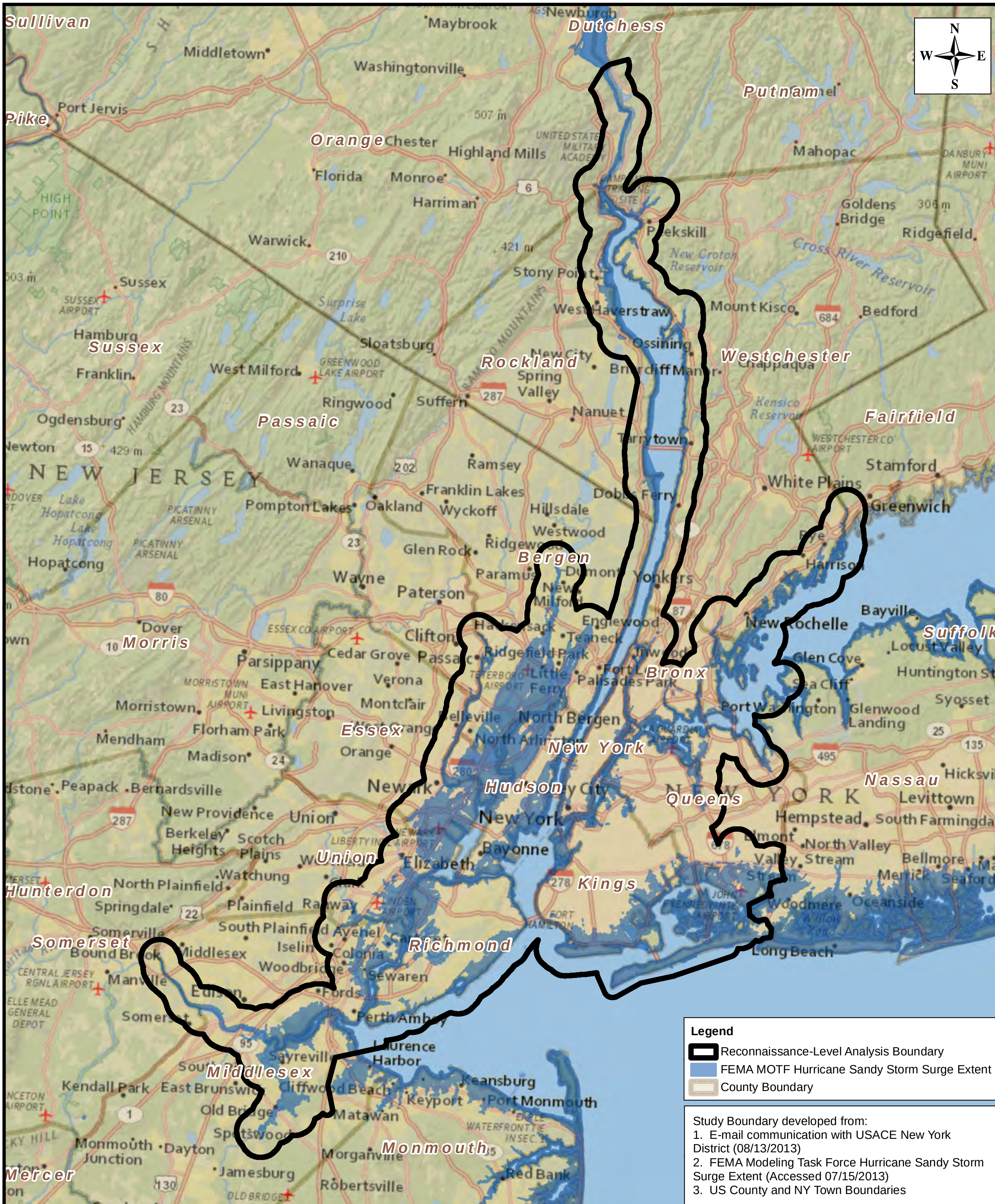

FIGURE 1

U.S. ARMY CORPS OF ENGINEERS

NEW YORK BAY, ITS TRIBUTARIES AND JAMAICA BAY

NORTH ATLANTIC COAST COMPREHENSIVE STUDY

APPROXIMATE SCALE
0 5 10 15 20 Miles

RECONNAISSANCE-LEVEL ANALYSIS BOUNDARY MAP

Path: C:\GIS\NACCS\MXD\NY_Bays.mxd

USACE New York District

New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis - New Jersey Point of Contacts

Municipality	County	firstname	mdl	lastname	title	Term Ends	Email/Contact
Alpine Boro	Bergen	Paul	H.	Tomasko	Mayor	2014	Gtanno@alpinenj.org
Bogota Boro	Bergen	Patrick		McHale	Mayor	2015	mayor@bogotaonline.org
Carlstadt Boro	Bergen	William	J	Roseman	Mayor	2015	zoningdept@carlstadtnj.us
Cliffside Park Boro	Bergen	Gerald	A.	Calabrese	Mayor	2015	szoklu@cliffsideparknj.gov
Cresskill Boro	Bergen	Benedict		Romeo	Mayor	2015	administrator.boro@cresskillboro.org
East Rutherford Boro	Bergen	James	L.	Cassella	Mayor	2015	DPW@EastRutherfordNJ.net
Edgewater Boro	Bergen	James	F.	Delaney	Mayor	2015	info@edgewaternj.org
Englewood City	Bergen	Frank		Huttle	Mayor	2015	frankhuttle@englewoodmayor.com
Fairview Boro	Bergen	Vincent		Bellucci	Mayor	2015	dtesta@fairviewborough.com
Fort Lee Boro	Bergen	Mark		Sokolich	Mayor	2015	mayor@fortleenj.org
Garfield City	Bergen	Joseph		Delaney	Mayor	2016	apavlica@garfieldnj.org
Hackensack City	Bergen	John	P.	Labrosse	Mayor	2017	adib@hackensack.org
Hasbrouck Heights Boro	Bergen	Rose	M	Heck	Mayor	2015	Mayor@hasbrouck-heights.nj.us
Leonia Boro	Bergen	John		DeSimone	Mayor	2015	jterhune@leonianj.gov
Little Ferry Boro	Bergen	Mauro	D.	Raguseo	Mayor	2015	mayor@littleferrynj.org
Lyndhurst Twp	Bergen	Robert	B.	Giangeruso	Mayor	2013	recruitment@emergencysquad.com
Maywood Boro	Bergen	Gregg	A	Padovano	Mayor	2015	MaywoodMayor@aol.com
Moonachie Boro	Bergen	Dennis		Vaccaro	Mayor	2014	tciannamea@moonachie.us
New Milford Boro	Bergen	Ann		Subrizi	Mayor	2014	cdemiris@newmilfordboro.com
North Arlington Boro	Bergen	Peter	C.	Massa	Mayor	2014	pmassa@northarlington.org
Oradell Boro	Bergen	Joseph	L.	Murray	Mayor	2015	mayor@oradell.org
Palisades Park Boro	Bergen	James		Rotundo	Mayor	2014	borohall@palisadesparknj.us
Paramus Boro	Bergen	Richard		LaBarbiera	Mayor	2014	BoroClerk@paramusborough.org
Ridgefield Park Village	Bergen	George	D.	Fosdick	Mayor	2016	rpdeputy@nj.rr.com
River Edge Boro	Bergen	Sandy		Moscaritolo	Mayor	2013	ddondiego@bor.river-edge.nj.us
Rockleigh Boro	Bergen	Robert	R.	Schaffer	Mayor	2014	clerk@rockleighnj.org
Rutherford Boro	Bergen	Joseph		DeSalvo	Mayor	2015	acacciatore@rutherford-nj.com
Teaneck Twp	Bergen	Mohammed		Hameeduddin	Mayor	2014	jevelina@teanecknj.gov
Tenafly Boro	Bergen	Peter	S.	Rustin	Mayor	2015	phale@tenafly.net
Wallington Boro	Bergen	Walter	G.	Wargacki	Mayor	2015	v.baginski@verizon.net
Hackensack	Bergen	Kathleen	A	Donovan	County Executive		countyexecutive@co.bergen.nj.us
Hackensack	Bergen	Joseph	A	Femina	Engineering Div Dir.		TCasey@co.bergen.nj.us
Belleville Twp	Essex	Raymond		Kimble	Mayor	2014	kcavanagh@bellevillenj.org
Bloomfield Twp	Essex	Raymond	J	McCarthy	Mayor	2015	rmccarthy@bloomfieldtwpnj.com
East Orange City	Essex	Robert	L.	Bowser	Mayor	2013	cityadmin@ci.east-orange.nj.us
Newark City	Essex	Cory	A.	Booker	Mayor	2013	ramosa@ci.newark.nj.us
Nutley Twp	Essex	Alphonse		Petracco	Mayor	2016	mayorpetracco@nutleynj.org
Newark	Essex	Joseph	N.	DiVincenzo	County Executive		joedi@admin.essexcountynj.org
Verona	Essex	Sanjeev		Varghese	Director		svarghese@essexcountynj.org
Bayonne City	Hudson	Mark		Smith	Mayor	2014	bayonneplanner@gmail.com
East Newark Boro	Hudson	Joseph	R.	Smith	Mayor	2013	boroughofeastnewark@verizon.net
Guttenberg Town	Hudson	Gerald		Drasheff	Mayor	2013	townclerk@myguttenberg.com
Harrison Town	Hudson	Luois		Manzo	Mayor	2013	mlgravinese@harrisontwp.us
Hoboken City	Hudson	Dawn		Zimmer	Mayor	2013	qwiest@hobokennj.org

USACE New York District

New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis - New Jersey Point of Contacts

Municipality	County	firstname	mdl	lastname	title	Term Ends	Email/Contact
Hoboken City	Hudson	Stephen		Marks	Assistant Business Administrator		smarks@hobokennj.org
Jersey City	Hudson	Doug		Greenfeld			douglas@jcnj.org
Jersey City	Hudson	David		Donnelly			donnellyd@jcnj.org
Kearny Town	Hudson	Albert	G.	Santos	Mayor	2013	mayor@kearnynj.org
North Bergen Twp	Hudson	Nicholas	J.	Sacoo	Mayor	2015	jcraviolo@northbergen.org
Secaucus Town	Hudson	Micheal	J	Gonnelli	Mayor	2013	mgonnelli@secaucus.net
Union City	Hudson	Brian	P.	Stack	Mayor	2014	senstack@njleg.org
Weehawken Twp	Hudson	Richard	F.	Turner	Mayor	2014	roladahboul@tow-nj.net
West New York Town	Hudson	Felix		Roque	Mayor	2014	gpope@westnewyorknj.org
Jersey City	Hudson	Thomas	A.	DeGise	County Executive		gjaramillo@hcnj.us
Secacucus	Hudson	Demetrio		Arencibia	County Engineer		Fgiarratana@hcnj.us
Carteret Boro	Middlesex	Daniel	J	Reiman	Mayor	2014	oem@carteret.net
East Brunswick Twp	Middlesex	David		Stahl	Mayor	2016	mayor@eastbrunswick.org
Edison Twp	Middlesex	Antonia		Ricigliano	Mayor	2013	mayorricigliano@edisonnj.org
Highland Park Boro	Middlesex	Gary	L.	Minkoff	Mayor	2016	minkoffhp@gmail.com
Metuchen Boro	Middlesex	Thomas		Vahalla	Mayor	2015	weboerth@metuchen.com
New Brunswick City	Middlesex	James	M	Cahill	Mayor	2014	gpatterson@cityofnewbrunswick.org
Old Bridge Twp	Middlesex	Owen		Henry	Mayor	2015	Mayor@oldbridge.com
Perth Amboy City	Middlesex	Wilda		Diaz	Mayor	2016	lmartinez@perthamboynj.org
Piscataway Twp	Middlesex	Brian	C.	Wahler	Mayor	2015	MSeader@piscatawaynj.org
Sayreville Boro	Middlesex	Kennedy		O'Brien	Mayor	2015	terry@sayreville.com
South Amboy City	Middlesex	Fred		Henry	Mayor	2014	mayor@southamboynj.gov
South River Boro	Middlesex	John	M	Krenzel	Mayor	2015	poconnor@southrivernj.org
Spotswood Boro	Middlesex	Nicholas		Poliseno	Mayor	2016	Npoliseno@spotswoodboro.com
Woodbridge Twp	Middlesex	John	E.	McCormac	Mayor	2015	WBMAYOR@twp.woodbridge.nj.us
New Brunswick	Middlesex	John	A.	Pulomena	County Administrator		erica.betti@co.middlesex.nj.us
New Brunswick	Middlesex	Richard		Wallner	County Engineer		engineering@co.middlesex.nj.us
Passaic City	Passaic	Alex		Blanco	Mayor	2013	mayor@cityofpassaicnj.gov
Elizabeth City	Union	J. Christian		Bollwage	Mayor	2015	DLoomis@ElizabethNJ.org
Linden City	Union	Richard	J.	Gerbounka	Mayor	2014	jbrown@linden-nj.org
Rahway City	Union	Richard		Proctor	Mayor	2015	mayorproctor@cityofrahway.com
Elizabeth	Union	Alfred		Faella	County Manager		jpellettiere@ucnj.org
Scotch Plains	Union	Joseph		Graziano	Director		jgraziano@ucnj.org
Carteret	Middlesex	Bob		Panazzolo	Vice President		rnp002@verizon.net

USACE New York District
New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis - New York Point of Contacts

COUNTY	firstname	mdl	lastname	title	org	email
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ROC	Christopher		Sanders	Mayor	Village of Piermont	csanders@piermont-ny.org
ROC	Bonnie		Christian	Mayor	Village of South Nyack	
ROC	Andy		Stewart	Supervisor	Town of Orangetown	supervisor@orangetown.com
WST	Peter		Swiderski	Mayor	Village of Hastings on Hudson	mayor@hastingsgov.org
WST	Brian	C.	Smith	Mayor	Village of Irvington	bsmith@irvingtonny.gov
WST	Michael	S.	Blau	Administrator	Village of Tarrytown	mblau@tarrytowngov.com
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WST	Anthony		Ruggiero	City Manager	City of Peeksill	aruggiero@cityofpeekskill.com
WST	Sean		Murray	Mayor	Village of Buchanan	Smurray@villageofbuchanan.com
WST	William	R.	Hanauer	Mayor	Village of Ossining	hanauer@villageofossining.org
WST	Phillip	E.	Zegarelli	Manager	Village of Briarcliff Manor	pzegarelli@briarcliffmanor.org
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Greene	Joel		Dubois	Conservation District Program Specialist	Greene County Soil & Water Conservation District	joel@gcswcd.com
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Rockland	Vincent		Altieri	Executive Director	Rockland County Drainage Agency	highway@co.rockland.ny.us
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USACE New York District
New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis - Regional Point of Contacts

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John	Moyle	NJ DEP		John.Moyle@dep.state.nj.us
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John	McLaughlin	NYC DEP		jmclaughlin@dep.nyc.gov

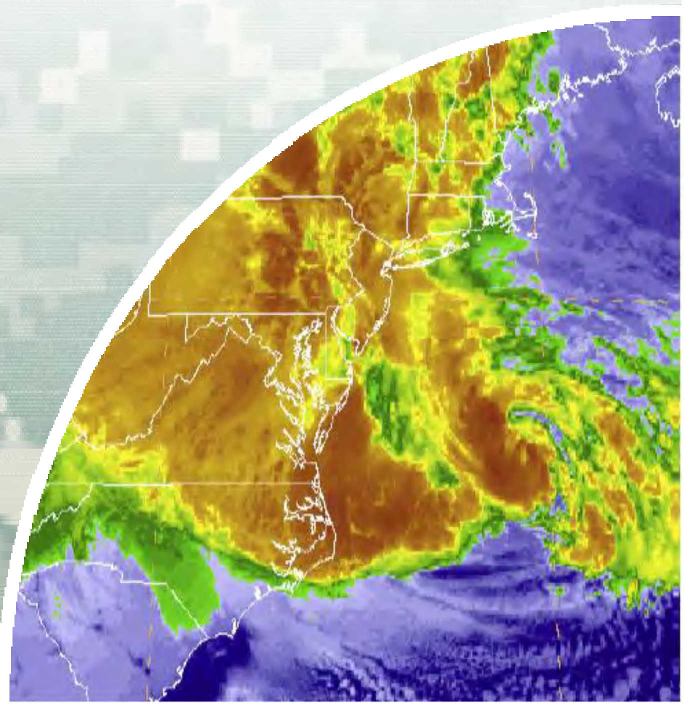
APPENDIX B

MEETING DOCUMENTATION FROM STAKEHOLDER OUTREACH MEETINGS

- PRESENTATION
- 7/16/2013 BERGEN COUNTY STAKEHOLDER MEETING, MEMORADUM FOR RECORD, AND SIGN-IN SHEET
- 8/26/2013 STAKEHOLDER WEBINAR MEETING MINUTES
- 8/27/2013 STAKEHOLDER WEBINAR MEETING MINUTES
- 9/3/2013 JERSEY CITY STAKEHOLDER MEETING, MEMORADUM FOR RECORD AND SIGN-IN SHEET
- 9/6/2013 HOBOKEN STAKEHOLDER MEETING, MEMORADUM FOR RECORD AND SIGN-IN SHEET
- 9/11/2013 NYC STAKEHOLDER MEETING, MEMORADUM FOR RECORD AND SIGN-IN SHEET
- 9/12/2013 NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION, MEMORANDUM FOR RECORD
- 9/19/2013 NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, MEMORANDUM FOR RECORD

North Atlantic Coast Comprehensive Study
New York Bay, Its Tributaries and Jamaica Bay
Reconnaissance-Level Analysis

U.S. Army Corps of Engineers
Coastal Storm Risk Management
Planning Center of Expertise
3 September 2013



Background

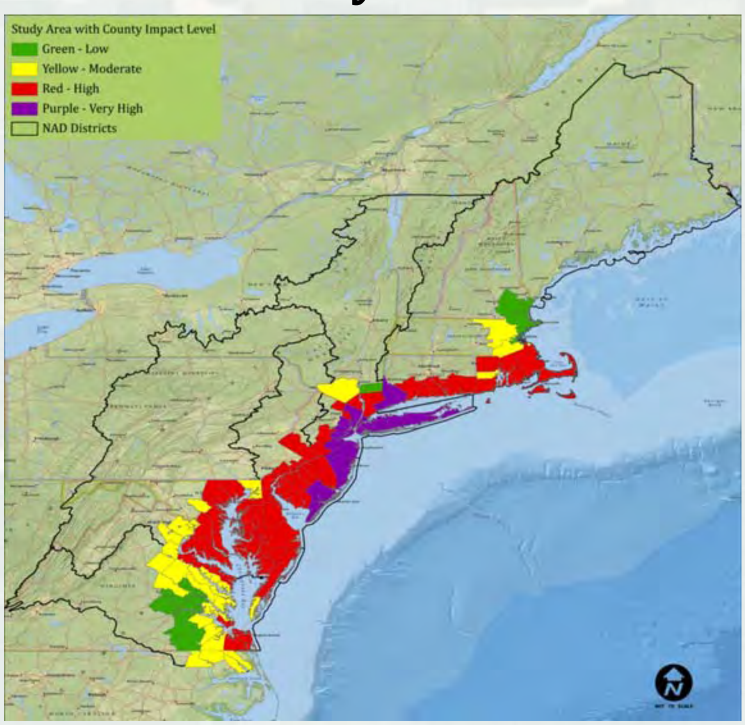
- Greatest areas of Sandy's impact: NJ, NY, CT
- Public Law 113-2
- "That using up to $20,000,000 of the funds provided herein, the Secretary shall conduct a **comprehensive study** to address the flood risks of **vulnerable coastal populations** in areas that were affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the Corps…"
- Comprehensive Study to be complete by Jan 2015

NACCS Study Goals

1. *Provide Risk Reduction Framework– Reduce risk to which vulnerable coastal populations are subject.*
2. *Promote Resilient Coastal Communities – Ensure a sustainable and robust coastal landscape system, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable population, property, ecosystems, and infrastructure.*

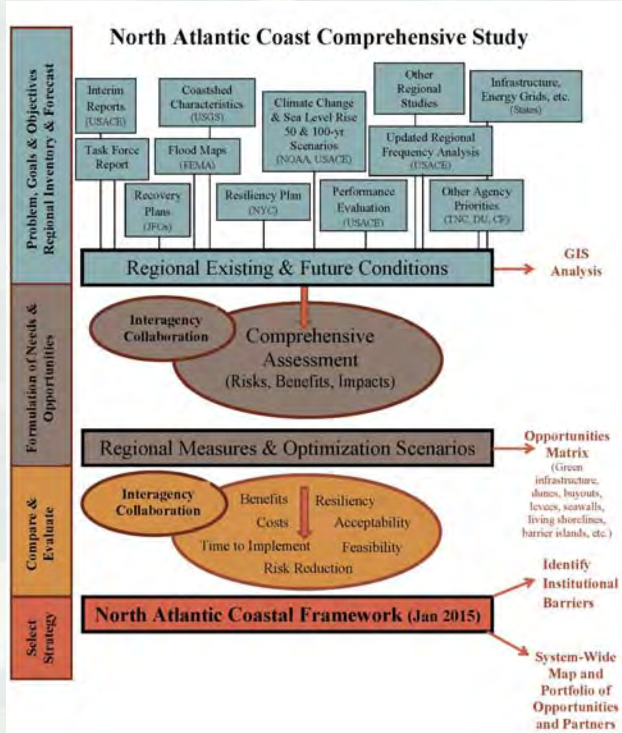
**Consistent with USACE-NOAA Rebuilding Principles*

Study Area



NACCS Scope

- **Coastal Framework**
  - Regional scale
  - Interagency collaboration
  - Opportunities by region/state
  - Identify range of potential solutions and parametric costs by region/state
  - Identify activities warranting additional analysis



Key Technical Components

- Engineering
- Environmental, Cultural, and Social
- Sea Level Rise and Climate Change (SLR & CC)
- Economics
- Plan Formulation
  - ► Policy & programmatic
- Coastal GIS Analysis

NACCS Schedule

- ✓ Feb-March 2013 – Development of scope of analyses
- ✓ April 2013 – Interagency collaboration on scope of analyses
- ✓ June 2013 – Launch of public website; Federal Register notice
- ✓ June 2013 – Modeling and Measures Working Meetings
- July - Dec 2013 –Webinar Collaboration Series
- Winter/Spring 2014 – Interagency & international validation and collaboration
- Summer 2014 – Begin finalizing report and routing for reviews
- January 2015 – Final Report due to Congress

Reconnaissance-Level Analyses

Reconnaissance-Level Analyses

- Investigation is being conducted as a part of the North Atlantic Coast Comprehensive (NACC) Study under the authority of Public Law 113-2, the Disaster Relief Appropriation Act of 2013
- Specific language within PL 113-2 states, "…*as a part of the study, the Secretary shall identify those activities warranting additional analysis by the Corps*
- Reconnaissance-level analyses will identify activities warranting additional analysis that could be pursued

Reconnaissance-Level Analyses

- The purpose is to determine if there is a Federal, (USACE) interest in participating in a cost-shared feasibility phase study in the interest of providing potential types of projects in the New York Bay, Its Tributaries and Jamaica Bay
- Possible coastal flood risk management measures could include: structural, non-structural, natural, nature-based, and policy and programmatic measures or a combination of them, if a feasibility study is initiated.

Reconnaissance-Level Analyses

- What is the water resources problem to be solved?
- Is there a viable engineering solution to the problem?
- Are there potential National Economic (NED) benefits associated with a potential project?
- Is there a need/interest for Federal (USACE) participating and is there a qualified non-federal sponsor?

Reconnaissance-Level Analyses

Typically identify the following:

- Study area boundaries
- Problems and Opportunities
- Planning Objectives
- Planning Constraints
- Measures to Address Planning Objectives
- Next Steps

Feedback Requested

1. Problem identification for your area:

- ► Did your area experience storm surge?
- ► Specify particular areas and water bodies within your jurisdiction that experienced storm surge.
- ► What factors, if any, exacerbated damages from storm surge?

Feedback Requested

2. Description of damages for your area:

- ► Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.
- ► Provide a map depicting the spatial extent of damages.

Feedback Requested

3. Prior related studies or projects (local, state, federal) in the damaged area.

4. Measures that your jurisdiction has considered to address the problem

Stakeholder Outreach

- Letters emailed by USACE New York District (August 23)
- Feedback requested by September 6

Next Steps

- Fall 2013 – Draft RLA
- Fall 2013 – Requests for FY15 funding
- Spring 2014 – Final RLA
- FY 2014 – sign letters of intent with local sponsor, work towards Project Management Plan (PMP) for Feasibility Phase
- FY 2015 – Move to Feasibility phase IF:
  - Federal interest is determined during Recon-phase
  - Non-federal Sponsor is identified
  - Federal funding is available

Questions/POCs

- Donald Cresitello– USACE New York District
  - Donald.E.Cresitello@usace.army.mil
  - 917-790-8608 (ph)
- Ginger Croom – CDM Smith (USACE Contractor)
  - croomgl@cdmsmith.com
  - 617-452-6594 (ph and fax)
  - 617-999-9631 (mobile)

North Atlantic Coast Comprehensive Study

New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis
Meeting Memorandum for Record
Subject: Bergen County, New Jersey

On Tuesday, July 16th, 2013 the US Army Corps of Engineers met with representatives from Congressman Bill Pascrell's office, representatives from the NJ State Senator's office and NJ Department of Environmental Protection, and local officials from communities in Bergen County. Approximately 30 people attended the two-hour meeting.

Congressman Pascrell introduced the issues that face the region and Bergen County. Specifically, he highlighted the consistent flooding problems that the region faces (especially during Hurricanes Irene and Sandy) and the years of multiple studies that the Corps has performed on the Hackensack and Passaic Rivers.

Tom Hodson, Chief of the Plan Formulation Branch at the New York District, presented a brief overview of the North Atlantic Comprehensive Coast Study (NACCS). Donald Cresitello, Project Manager of the NY Bay Study, presented the topic of a focus area analysis, the transition process between a focus area analysis study to a feasibility study, and then opened the floor to feedback from the public. Questions and concerns from the audience included:

- Would Corps re-evaluation of studies fully utilize the information or recommendations from previous studies?
- What is the status of previous USACE recommendations for dredging in the Saddle and Passaic Rivers?
- What is the timeline and deliverables from the focus area analysis and comprehensive studies?

After USACE representatives clarified that the Study's purpose is to identify long-term solutions to regional problems, meeting participants inquired as to what they, as public officials, should be doing in the interim. Mitigation measures from FEMA's 404 Hazard Mitigation Grant Program were shortly discussed as a more site-specific interim solution.

Sign-in sheets, comment cards, and contact information were provided to members of the audience. The information gathered was scanned and uploaded to the Corps' SharePoint site.

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study

New York Bay, its Tributaries, and Jamaica Bay

July 16, 2013

10:00 AM – 12:00 PM

Location: Robert A. Roe Federal Building, 200 Federal Plaza, Suite 500, Paterson NJ 07505 – 1000 Hours

Attendees: See Sign-In Sheets

Organized by Congressman Bill Pascrell's Office

Meeting Minutes:

- Introduction
    - **Congressman Pascrell** addressed the audience. Members of the audience included mayors, emergency management officials, borough clerks, town engineers, USACE staff, and NJ DEP Dam and Flood Safety officials. Topics of interest included:

      1. What projects are intended for the Hackensack River and the Meadowlands
      2. To what extent do these projects assist in flooding in the Passaic River and Lower Saddle River?
      3. What will be the final product? What is the timeline for the deliverable?
      4. What came out of the 1980's proposal for a large-scale tidal bay study? What about funding for the project? Is there a possibility for re-evaluation of those proposed measures?

- Presentation
    - **Tom Hodson**, USACE Senior Economist/New York District Plan Formulation Lead gave a presentation on the NACCS.
    - **Donald Cresitello**, USACE NY Bays Plan Lead, explained the focus area analysis effort:

1. The purposes of the reconnaissance level effort are to identify the water resources problems and determine Federal interest in proceeding to feasibility study, based on:

a) If there are feasible engineering solutions,
b) If there will be National Economic Development (NED) benefits, and
c) If there is non-Federal sponsor (NJ has been non-Federal sponsor in the past).

2. The NY Bays Reconnaissance study is located within the New York-New Jersey Reach 1 of the NACCS study. It spans the Upper and Lower Bays of New York-New Jersey Harbor, Jamaica Bay, and associated tributaries.

3. Level of effort for reconnaissance studies typically involve documentation of water resources problem and work necessary to determine Federal interest. More detailed investigations to support a project authorization are conducted later in Feasibility studies. USACE with support from CDM Smith, is soliciting feedback from the public regarding the problems that they often faced.

4. The NY Bays Reconnaissance study is scheduled for completion in Fall 2013.

- **Tom Shea**, USACE Project Manager of Passaic River Study, discussed the Passaic River project and discussed what was authorized by Congress in the Tidal Passaic River study area
- Discussed areas at the mouth of the Passaic, in Newark Bay, where levees or floodwalls are being considered
- for stabilization near Kearny

- The floor was opened up to discussion with the local officials.
  - Local Problems identified:
    - Riverine flooding (from Irene, Nor'easters, rainfall-driven runoff issues)
    - Coastal flooding (from Sandy recently, but often recurring)
    - Up-county development result in stormwater runoff quantity issues
    - Silting of creeks and streams

  - Past Studies
    - USACE Saddle River, Township of Saddle Brook
      - Mayor of Saddle Brook stressed that multiple, previous studies (50+ years) have recommended dredging of Saddle River or Passaic River
      - $3 million Lower Saddle River allocated in state and local budget, but funds never arrived for projects. NJDEP rep clarified that local funds are allocated, but due to complications with USACE funding cost-share, that money is not yet to be used until matching Federal funds are available(?)
    - USACE Hackensack River and Meadowlands
      - "Unprotected" tidal area floods often – drains into Newark

Bay

- A member of the audience asked about the status of the proposed measures from the 1980's Hackensack River USACE report and why there had been no action?
  - Bryce Wisemiller, USACE, responded that the benefit-cost ratio of the best measure was <0.2, therefore, alternative was not economically justified and could not be implemented.

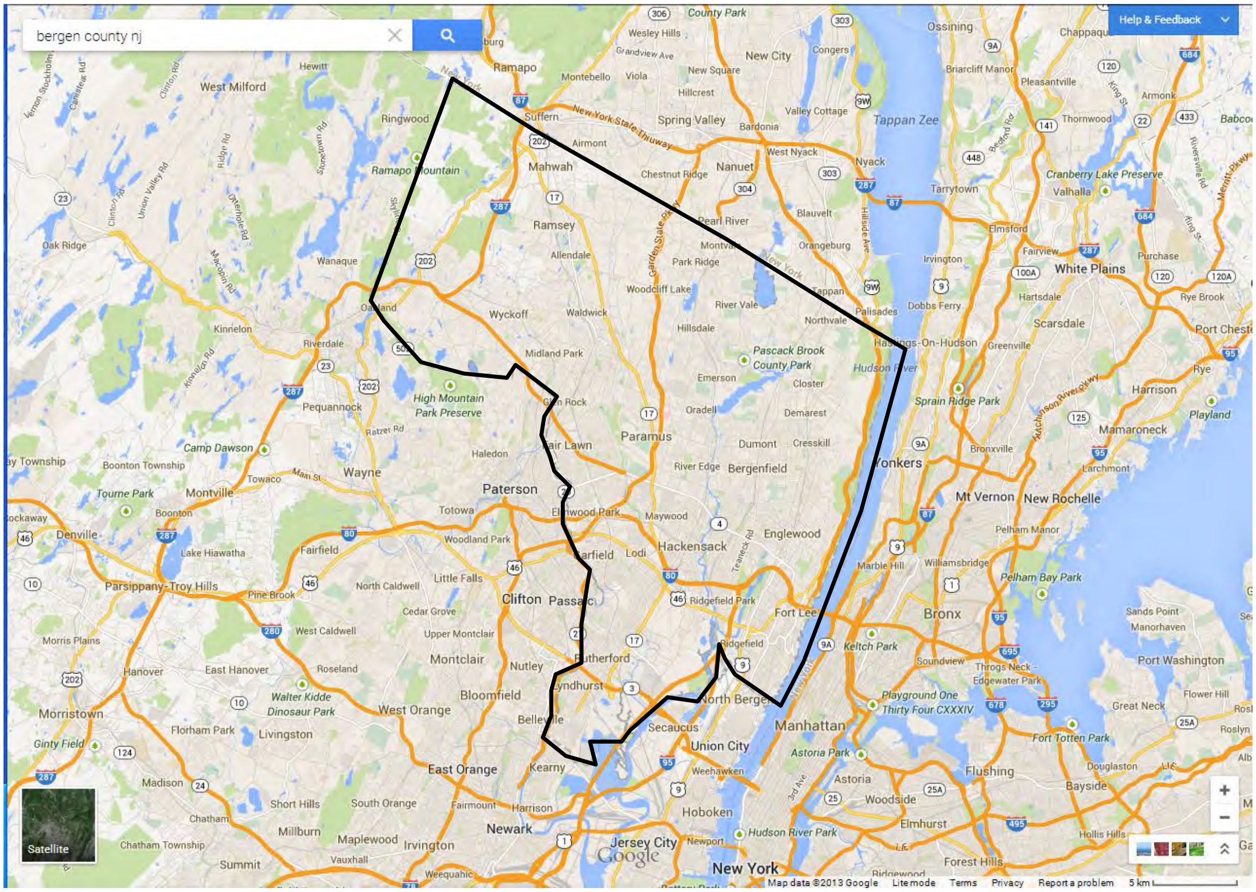
- [USACE Passaic River]
  - Documented flooding since 1903, billions in dollars of flood damage. Some structural alternatives identified and are currently going through design – construction schedule starting in the next 4 years.
- Bergen County
  - Engineering department has report documentation of flooding, or what changes they have undertaken to mitigate local flooding [INQUIRE TO COUNTY]

- Discussion of Interim Solutions
  - Repeated issue/question: What can we do in the interim given that the Comp Study isn't due to Congress until Jan 2015? What should we tell our constituents?
  - USACE response: These are first-steps to a long-term solution, not a short-term one. As an example, NYC released a plan to develop coastal protection barrier, but they have the funds or cost-sharing benefit to expedite construction
  - Need for non-federal sponsor: town(s) can partner with each other, or with the State to become non-federal sponsor for cost-share by signing MOU.
  - FEMA 404 HMGP list of proposed mitigation measures was shortly discussed. Mitigation measures are more site-specific based on state-run prioritization list.
  - USACE and NJ DEP have initiated dialogues with local colleges, universities, and other research institutions to identify other tech-advanced solutions.

- Challenges
  - Permitting
    - Receiving permits through NJ DEP is time- and paper-intensive. NJ DEP rep stated that it has made progress in expediting the process.
  - Cost-share, and/or identifying potential non-federal sponsor

Adjourn: 1200

---End of Minutes---



USACE New York District

New York Bay Reconnaissance Meeting - Paterson, NJ - 7/16/2013

Name	Community/Agency	Title	E-Mail	Telephone
Bryce Wisemiller	U.S. Army Corps of Engrs	Project Manager	bryce.w.wisemiller@usace.army.mil	917-790-8307
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USACE New York District

New York Bay Reconnaissance Meeting - Paterson, NJ - 7/16/2013

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Richard A Mola	Elmwood Pk	Mayor		201-796-1833
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Matt Marinello	Senator Bob Gordon	Deputy Chief of Staff	sengordon@njleg.org	201-703-9779
Krystyna Surowiec	Wallington	Council	Ksurowie@aol.com	973-224-3159

USACE New York District

New York Bay Reconnaissance Meeting - Paterson, NJ - 7/16/2013

Name	Community/Agency	Title	E-Mail	Telephone
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SKILCRAFT®

Name	Phone	Email
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Peter Lo Dico	201-675-0290 cell	plodico@saddlebrooknj.gov
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Krystyna Surowiec	973-224-3154	ksurowiec@aol.com

USACE New York District Focus Area Analysis
New York Bay, Its Tributaries, and Jamaica Bay Study Area
26 Aug 2013
3 pm
Stakeholder Meeting/Teleconference/Webinar

Attendees:
Donald Cresitello – NAN Planning
John Moyle –NJ DEP Bureau of Dam Safety and Flood Control
Mary Kimball – NYC Department of Planning
Jamie Bartel, Frannie Bui, Ginger Croom – CDM Smith

Presentation

1. Donald Cresitello presented the overview of the North Atlantic Coast Comprehensive Study (NACCS). See PowerPoint presentation.

Stakeholder Questions/Discussion
Universities and NGO Input

1. John Moyle (NJDEP) discussed the recently executed contract with universities/academics for a 6-month study.
    a. Hackensack River, Hudson River, and Arthur Kill
    b. 3-month, half-way point deliverable for interim solutions for implementation
2. Donald stated that the purpose of the RLA is to document what studies have previously been performed, problem areas, and what the stakeholders would like to see for future solutions.
3. Although the RLA report is due before the university studies are complete, a comment/stakeholder coordination period will take place in early 2014 to incorporate comments as part of state's commenting period.
4. John suggested reaching out to the New Jersey Meadowlands Commission (Marcia A. Karrow, Executive Director) who potentially has a list of proposed measures and solutions for the Hackensack River.

Economic Benefits

1. Mary Kimball (NYC Planning) inquired about the process of determining federal interest based on NED benefits and whether or not environmental impacts were considered in overall benefits.
2. Donald replied that the RLA study, based on its scale and schedule, would not include any detailed economic analysis. The overall NACCS would consider cost-effectiveness of proposed measures. The federal interest would be tied to reducing risk to structures.

Level of Detail of Incorporating Prior or Ongoing Studies

1. Mary inquired about the level of detail for the RLA.
2. Donald replied that in coordination with NYC, specific measures detailed in the SIRR would be incorporated. Similar to NYC, a report by the City of Hoboken would also be incorporated.
3. John suggested also coordination with NJ Transit Authority for current studies to protect their infrastructure (i.e. the PATH train).

Meeting adjourned 3:30 PM.

USACE New York District Focus Area Analysis
New York Bay, Its Tributaries, and Jamaica Bay Study Area
27 Aug 2013
11 am
Stakeholder Meeting/Teleconference/Webinar

Attendees:
Donald Cresitello – NAN Planning
Dave Rosenblatt –NJ DEP
Francesca Giarratana - Hudson County Planning
Suzanne Mack - City of Bayonne
Jamie Bartel, Frannie Bui, Ginger Croom – CDM Smith

<u>Presentation</u>

1. Donald Cresitello presented the overview of the North Atlantic Coast Comprehensive Study (NACCS). See PowerPoint presentation.

<u>Stakeholder Questions/Discussion</u>

1. Sue Mack (City of Bayonne) on vacation on Friday – turnaround would be difficult.
2. Francesca Giarratana (Hudson County Planning) informed Sue that the County would be providing information to USACE that would also cover Bayonne.
3. Dave Rosenblatt (NJ DEP) confirmed that John Moyle was on the 8/26 call. Donald confirmed that John Moyle would be sending additional information.

Meeting adjourned 11:30 PM.

North Atlantic Coast Comprehensive Study

New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis
Meeting Memorandum for Record
Subject: Jersey City, New Jersey

On Tuesday, September 3rd, 2013 the US Army Corps of Engineers met with representatives from the City of Jersey City. Approximately 4 people attended the two-hour meeting.

Donald Cresitello presented a brief overview of the North Atlantic Comprehensive Coast Study (NACCS), the focus area analysis for New York Bay, Its Tributaries and Jamaica bay and the transition process between this study to a feasibility study, and then opened the floor to feedback from the representatives from Jersey City.

A sign-in sheet and contact information were provided to the jurisdiction. The information gathered was scanned and uploaded to the USACE NAN SharePoint site.

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study

New York Bay, its Tributaries, and Jamaica Bay

September 3, 2013

1:00 PM – 3:00 PM

Location: Jacob K. Javits Federal Building, 26 Federal Plaza, Room 2042, New York City, NY

Attendees: David Donnelly, Senior Administrative Analyst, City of Jersey City
Douglas Greenfeld, Supervising Planner, City of Jersey City
Donald Cresitello, USACE New York District
Frannie Bui, CDM Smith

Meeting Minutes:

- Introductions and Initial Comments

  Doug Greenfeld and David Donnelly provided background information regarding the change in the Jersey City administration, which went into effect July 1, 2013.

  Doug Greenfeld stated that a NOAA Sea Grant was disbursed to Stevens Institute of Technology, signed at the end of August, to research and provide recommendations for innovative flood mitigation measures for Jersey City and similar urban areas.

- Presentation

  Donald Cresitello presented the overview of the North Atlantic Coast Comprehensive Study (NACCS). See PowerPoint presentation.

- Stakeholder Comments/Discussion
  - **Doug** requested a clarification on the scope of the NACCS and the associated storm surge modeling efforts
    - **Donald** provided background information regarding the engineering component of the NACCS which involves ADCIRC modeling and the associated model domains/reaches.
  - **Donald and Doug** discussed the potential for Jersey City or a partnership of jurisdictions to be the non-federal sponsor during the feasibility study. Most likely, the State of NJ would be the non-federal sponsor for USACE projects and would request a letter of support from jurisdictions. There is possibility

that CDBG funding as appropriated in the Sandy Relief Bill could be used as a jurisdiction's contribution to a non-federal cost-share, but the pot of funds may also be a part of the competitive state-managed program.

- **Donald** clarified the USACE definition of vulnerable populations based on risk as defined by the Predicted Category 4 Hurricane Maximum of Maximums (MOM) derived from the National Hurricane Center SLOSH model. The spatial difference between the maximum storm surge extent and the potential level of protection that a USACE designed project(s) would still leave a vulnerable population and residual risk – no project will remove all risk to hazard. The USACE has tools or is developing tools to assess the impacts of the 100-year event and a potential 3-feet change in sea level as part of the NACCS. Social vulnerability and the indices used to measure vulnerable populations was discussed.
- **Doug** inquired about the USACE incorporation of any existing Dutch flood mitigation or coastal planning processes, specifically as a tiered approach with layers of redundancy to protect State, City, and Individuals.
  - **Donald** replied that a similar approach is being implemented for portions of the Mississippi Coast in response to Hurricane Katrina.
  - **Donald** continued discussion regarding the Dutch approach -- methods currently implemented in the Netherlands cannot necessarily be applied in the built, urban environment of the NY metro area. The Dutch have chosen sacrificial floodplains and developed strategies/projects to a design level of the 1,000-year event in some locations. Some Dutch planning-level concepts can potentially be borrowed and incorporated into the areas such as the back bays.
- **Donald** reiterated that there are no existing USACE studies or projects in the Jersey City/Hoboken/Lower Manhattan to protect against storm surge. There are some existing projects (floodwall in Newark, studies in Passaic and Hackensack Rivers, etc.).
- **Doug** requested access or a copy of the Hurricane Sandy Storm Surge Extent spatial layer. Doug and David stated that they would confirm the observed extents of flooding due to anecdotal evidence of PSE&G's substation being inundated, flooded basements, and fire station reports.
- **Doug and David** discussed areas and locations of redevelopment, specifically the New Port area, which has the potential to incorporate hazard mitigation into their redevelopment plans and future construction.
  - For tracts of land to be redeveloped, an increase in ground surface elevation with freeboard requirements to ensure compliance with the preliminary FEMA DFIRMs. Other flood protection redundancy measures for upland areas would be encouraged during redevelopment.
  - These types of mitigation measures would be piecemeal as certain parts of the waterfront are redeveloped. **Doug and David** expressed concern with providing comprehensive protection for the city.
- The consequence of building a flood wall or barrier would be the "bathtub effect" and then the reliance and requirement of pump installation to drain lower-elevation areas.

        - **Doug and David** referred to an existing project proposal for the Municipal Utility Authority (MUA) for a pump installation prior to Hurricane Sandy.
        - **Frannie** inquired about JCMUA projects listed in the Hudson County Hazard Mitigation Plan (2008) regarding existing flood studies, pump installation, proposed bypass tunnel, etc. Also, Frannie asked about the FEMA 404/406 Public Assistance programs project worksheets, preliminary damage assessments, or identification of structures that suffered severe repetitive loss.
        - **Doug and David** outlined a potential redesign and elevation of Route 440/Lincoln Highway, a Hudson County thoroughfare, to an elevation of 14 feet to provide flood protection from the north.
    - **Doug** inquired about how ground floor apartments and real estate values were accounted for during Benefit-Cost Analysis.
        - **Donald** replied that for this analysis, that specific data is not required, but may be utilized for economic analysis performed as part of the feasibility studies.
    - **David** expressed concern regarding private properties, ownership and maintenance of waterfront areas, and waterfront structures.
        - There is the potential, since these private walkways were redeveloped to grant public access, that state coastal protection funds could be used if it poses an imminent threat.
    - **Donald** explained the purposes of the Interim Reports of the NACCS as reported to Congress.
    - **Doug and David** suggested contacting the Meadowlands Commission for additional information and data regarding Jersey City.
    - **Doug** provided contact information for a representative from the City of Newark, Stephanie Greenwood, the sustainability coordinator, GreenwoodS@ci.newark.nj.us

Adjourn: 3:00 pm

---End of Minutes---

USACE, New York District

New York Bay, Its Tributaries, and Jamaica Bay Study Area Reconnaissance-Level Analysis Meeting

26 Federal Plaza, New York, NY - 9/3/2013

Name	Community/Agency	Title	E-Mail	Telephone
David Donnelly	City of Jersey City	Senior Admin Analyst	DonnellyD@jcnj.org	201-547-5748
Doug Greenfeld	"	Supervising Planner	Douglas@jcnj.org	201.547.4284

CITY OF JERSEY CITY

DAVID P. DONNELLY
SENIOR ADMINISTRATIVE ANALYST

CITY OF JERSEY CITY
CORPORATE SEAL

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North Atlantic Coast Comprehensive Study

New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis
Meeting Memorandum for Record
Subject: Hoboken, New Jersey

On Friday, September 6th, 2013 the US Army Corps of Engineers met with representatives from the City of Hoboken. Approximately 5 people attended the two-hour meeting.

Donald Cresitello presented a brief overview of the North Atlantic Comprehensive Coast Study (NACCS) and the topic of a focus area analysis, the transition process between the current study to a potential feasibility study, and then opened the floor to feedback from the representatives from Hoboken.

A sign-in sheet and contact information were provided to the jurisdiction. The information gathered was scanned and uploaded to the USACE NAN SharePoint site.

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study

New York Bay, its Tributaries, and Jamaica Bay

September 6, 2013

9:00 AM – 11:00 AM

Location: Hoboken City Hall, 94 Washington Street, Basement Conference Room Hoboken, NJ

Attendees:
Caleb Stratton, Principal Planner, City of Hoboken
Stephen Marks, Assistant Business Administrator, City of Hoboken
Ann Holtzman, Zoning Officer, City of Hoboken
Donald Cresitello, USACE New York District
Ginger Croom, CDM Smith

Meeting Minutes:

- Introductions – All
- Presentation

  Donald Cresitello presented the overview of the North Atlantic Coast Comprehensive Study (NACCS) and focus area analysis for New York Bay, Its Tributaries and Jamaica Bay. See PowerPoint presentation.

- Stakeholder Comments/Discussion
  - **All** – discussed Hoboken's draft response to Stakeholder letter/request for feedback, sent by USACE 8/23/13. See handout.
  - **Ann** inquired about the USACE sea level rise tool used or developed for NACCS and if a community could use it to model sea level rise impacts.
    - **Donald** replied that he would look into it.
  - **Donald** mentioned that the FEMA MOTF layer has an omission of Newark Bay. He asked for Hoboken to ensure the accuracy of the storm surge extents in the jurisdiction.
  - **Caleb** asked about the predicted surge depth, which was reported as 19-feet. He considers this an inaccurate result and likely was based on the minimal elevations at the Hoboken waterfront.
    - **Donald** clarified that it was unlikely a total magnitude of 19-feet, but to consider what the high water marks capture.
  - The group expressed concern over the FEMA preliminary work maps and how to balance development in flood-prone areas, implications of higher insurance premiums for individuals, and implementation area of mitigation strategies on

the city to homeowner level. It is noted that the Hoboken preliminary work maps AE-zone extent aligns closely to the extent as mapped by the Hurricane Sandy Storm surge FEMA MOTF.

- The AE-zone extent considers the 1% annual chance elevation as defined by FEMA, but the USACE is currently using results from a historic tide gage analysis performed after the storm and considers the storm between a 200-700 year event.
- **Ann** expressed concern about the current building requirements with respect to elevation and what the city/county/state/federal government has/has not defined for post-disaster recovery. She mentioned a specific project that had to change their design plans multiple times because of inconsistency regarding elevation guidance.
- **Ginger** inquired to Hoboken of their interest in becoming an interviewee regarding policy challenges for an additional task of the overall NACCS. **Stephen** and **Ann** conferred that Ann would be the main POC for this.
- **Donald** inquired whether Hoboken had seen redevelopment of buildings that considered abandonment of the first/ground floor level
    - **Ann** provided an example of a retail space that moved their assets to a mezzanine level, allowed for parking and lobby on the ground floor, but many have returned to the same configuration.
    - Issues that face private developers are the capital, loss of streetscape, and historic buildings that may not have the ability to make updates.
- **Ann** inquired about the NED benefits and how they are measured to determine federal interest. Additional questions/discussion regarding Federal-backed insurance program, and how this is being evaluated or will be evaluated as part of benefit/cost ratios.
    - **Donald** replied that there are discussions that the District may not claim all benefits that it should, or that it is limited to claim certain benefits. The economic analysis will be performed in the overall NACCS study.
- **Steve** stressed the importance of Hoboken's role in the regional transportation, work force, and NY-NJ connectivity, which could justify any future benefits from reducing risk. There was additional discussion regarding 2nd and 3rd order economic impacts from events such as Sandy, and how the NACCS will try to incorporate these effects into the risk reduction framework and analyses.
- Evacuation procedures were discussed to understand the risk and vulnerable populations of Hoboken. Hoboken has a unique and complex situation for evacuation considering the percentage of residents who use mass transit, the number of shelters and potential beds.   There was additional discussion regarding the limited shelters within Hoboken, and those additional shelters that may be provided by Hudson County, that Hoboken residents would have difficulty accessing.   Hoboken currently has less than 500 beds for shelters, and a population of approximately 50,000 people.

Meeting adjourned at 11:00

---End of Minutes---

USACE, New York District

New York Bay, Its Tributaries and Jamaica Bay - RLA Stakeholder Meeting, Hoboken, NJ 9/6/13

Name	Community/Agency	Title	E-Mail	Telephone
Caleb Stratton	City of Hoboken	Principal Planner	cstratton@hobokennj.org	201.239.0626 518.423.8125
Stephen Marks	City of Hoboken	Assistant Bus. Ad.	smarks@Hobokennj.org	201-420-2059 201-212-1192
Ginger Croom	CDM Smith	Project Mgr	croomgl@cdmsmith.com	917-452-6594 917-299-9631
ANN HOLTZMAN	CITY OF HOBOKEN	ZONING OFF/FPM	AHOLTZMAN@HOBOKENNJ.ORG	201-420-2063
Donald E. Cresitello	USACE	Planner	donald.e.cresitello@usace.army.mil	917-790-8608

North Atlantic Coast Comprehensive Study

New York Bay, Its Tributaries, and Jamaica Bay
Focus Area Analysis - Memorandum for Record
Subject: New York City Stakeholder Coordination Meeting

On Wednesday, September 11, the U.S Army Corps of Engineers (USACE) met with representatives from the City of New York's Department of City Planning, Mayor's Office, and Department of Long-Term Planning and Sustainability, and CDM Smith to discuss the North Atlantic Coast Comprehensive Study (NACCS) New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis. 17 people attended the 1.5 hour meeting

Roselle Henn and Joe Vietri USACE provided introductions and the meeting purpose –Baltimore Metropolitan Water Resources Focus Area Analysis.

Dan Zarrilli and Hugh Roberts provided an overview of the modeling that is a component of the Special Initiative for Rebuilding and Resiliency (SIRR).

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study
New York Bay, Its Tributaries, and Jamaica Bay
Focus Area Analysis
Stakeholder Meeting

September 11, 2013

1:30 PM – 3:00 PM

Location: Jacob K. Javits Federal Building, 26 Federal Plaza, Room 2120, New York City, NY 10007 – 1300 Hours

Attendees:
Lynn Bocamazo – USACE New York District
Donald Cresitello – USACE New York District (Focus Area Study Manager)
Roselle Henn – USACE North Atlantic Division
Joe Vietri – USACE North Atlantic Division
Olivia Cackler – USACE New York District
Lisa Baron – USACE New York District
Peter Weppler – USACE New York District
Josh Sawislak – Hurricane Sandy Rebuilding Task Force
Dan Zarrilli – City of New York
Mary Kimball – City of New York
Michael Marrella – City of New York
Carrie Grassi – City of New York
Erika Lindsey – City of New York
Hugh Roberts - ARCADIS
Daniel Hitchings - ARCADIS
Frannie Bui – Coastal Engineer at CDM Smith
Ginger Croom – Project Manager at CDM Smith
Santiago Alfageme - Moffat & Nichol

Meeting Minutes:

- Introductions and Overview
    - **Roselle Henn - USACE**, addressed the meeting participants and provided an overview of the NACCS and the meeting purpose – to discuss the modeling that New York City has completed as part of their SIRR report.

- Presentation

- **Dan Zarrilli**, New York City, and **Hugh Roberts**, ARCADIS, went through a presentation on the SIRR modeling inputs and results.

Other Questions/Discussion:

- **Santiago Alfageme** inquired about the sea level rise scenarios and how the flood depths were chosen.
- **Lynn Bocamazo** inquired about the use of the City's modeling efforts coupled with the ongoing modeling efforts that USACE is undertaking as part of the NACCS.
- **Joe Vietri** inquired about how certain coastal protection initiatives were simulated.

Adjourn: 1500

---End of Minutes---

Name	Organization	Contact Info
Michael Marrella	NYC Dept. of City Planning	mmarrella@planning.nyc.gov
Mary Kimball	NYC Dept of City Planning	mkimball@planning.nyc.gov
HUGH ROBERTS	ARCADIS	HUGH.ROBERTS@ARCADIS-US.COM
CARRIE GRASSI	NYC OLTPS	cgrassi@cityhall.nyc.gov
Erika Lindsey	NYC OLTPS	elindsey@oem.nyc.gov
DAN ZARRILLI	MAYOR'S OFFICE	dzarrilli@cityhall.nyc.gov
Josh Sawislak	Sandy TF	josh.sawislak@hud.gov
Roselle Henn	USACE-NAD	roselle.e.henn@usace.army.mil
Donald E. Cresitello	USACE-NAN	donald.e.cresitello@usace.army.mil
Lynn M. Bocamazo	USACE-NAN-EN	lynn.m.bocamazo@usace.army.mil
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Ginger Croom	CDM Smith	croomgl@cdmsmith.com 617-452-4594
FRANNIE BUI	CDM SMITH	BUIFA@CDMSMITH.COM
Olivia Cackler	USACE-NAN-PL	olivia.n.cackler@usace.army.mil
LISA BARON	USACE-NAN-PPMD	lisa.a.baron@usace.army.mil
Peter Weppler	USACE-NAN-PL-E	peter.m.weppler@usace.army.mil

North Atlantic Coast Comprehensive Study

New York Bay, Its Tributaries, and Jamaica Bay
Focus Area Analysis - Memorandum for Record
Subject: New York City Department of Environmental Protection Stakeholder Coordination Meeting

On Thursday, September 12, the U.S Army Corps of Engineers (USACE) met with representatives from the City of New York's Department of Environmental Protection and CDM Smith to discuss the North Atlantic Coast Comprehensive Study (NACCS) New York Bay, Its Tributaries, and Jamaica Bay Focus Area Analysis. 4 people attended the 1 hour meeting

Donald Cresitello presented an overview of NACCS.

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study
New York Bay, Its Tributaries, and Jamaica Bay
Focus Area Analysis
Stakeholder Meeting

September 12, 2013

11:00 AM – 12:00 PM

Location: Jacob K. Javits Federal Building, 26 Federal Plaza, Room 2120, New York City, NY 10007

1100– 1200 Hours

Attendees: Donald Cresitello –USACE New York District (Focus Area Study Manager)

John McLaughlin – NYC DEP

Frannie Bui – Coastal Engineer at CDM Smith

Ginger Croom – Project Manager at CDM Smith

Meeting Minutes:

- Introductions and Overview
    - **Donald Cresitello** addressed the meeting participants and provided an overview of the NACCS and the focus area analysis –
- Presentation
    - **Donald Cresitello** went through handouts of a presentation on the overall NACCS, the focus area analysis for New York Bay, Its Tributaries and Jamaica Bay
- Discussion

  NYC DEP will soon be releasing a Post-Sandy Infrastructure Analysis. NYC DEP is generally not in favor of tide gates at outfalls, due to both operational concerns, and concerns with future "hybrid" storm events (Irene/Sandy – heavy precipitation plus storm surge). There is concern with gates at outfalls not operating properly and then causing inland flooding (and sewer back-up) issues. Referenced concerns with Oakwood Beach tidegate (Staten Island) and operational issues.

Adjourn 1200

---End of Minutes---

USACE New York District Focus Area Analysis
New York Bay, Its Tributaries, and Jamaica Bay Study Area
19 Sep 2013
9 am
Stakeholder Meeting/Teleconference

Attendees:
Donald Cresitello – USACE New York District
Jim Tierney - Assistant Commissioner of Water and Watersheds
Eileen Murphy - Director of Federal Liaison
Al Fuchs –Bureau of Flood Protection and Dam Safety
Frannie Bui – Coastal Engineer at CDM Smith
Ginger Croom – Project Manager at CDM Smith

Presentation

1. Donald Cresitello addressed the meeting participants and provided an overview and presented the overall NACCS and the focus area analysis for New York Bay, Its Tributaries and Jamaica Bay.

Stakeholder Questions/Discussion

NYSDEC has participated in many background briefings on NACCS and has coordinated with both Joe Vietri and Roselle Henn, and also attended the Measures Working Meeting in Hoboken in June 2013.

Donald discussed Sandy's impacts up the Hudson River to Greene and Columbia Counties, though the boundary for the NACCS ends at Dutchess County. USACE recognizes that some counties outside of study area experienced impacts from Sandy, though are not included in NACCS boundary.

Jamaica Bay is also included in this focus area analysis even though there is existing USACE authorization for Jamaica Bay.

Discussed coordination with various other stakeholders (municipalities) thus far regarding NACCS and the focus area analysis, as follows:

- NYC, Dan Zarilli's Office,
- NYC DEP, John McClaughlin and Steve Zahn
- Mary Kimball
- Angela Lacotta – NYC DEP, Jamaica Bay

Donald and Jim discussed the Jamaica Bay briefing from Monday, 9/16, on the various USACE authorities for ecosystem and marsh island restoration. At a recent meeting, multiple federal, state, and local agencies were present in praise of Jamaica Bay and the eight (8) marsh islands that were restored.

The NYC SIRR was also discussed including the various measures that are recommended in that report (this report has already been evaluated and is included in the focus area analysis draft report).

NYSDEC discussed Hudson to Putnam, Rockland, Orange area

1. Climate change plan
2. Fran Dunwell, Hudson River Estuary Program, and Kristen Marcell – network of people, outside of NYC
    a. Kingston to Westchester
    b. Adapt to climate change, ongoing, funded with NYS money
    c. Pilot project with Hudson Estuary Program, what type of thing would you do, living shorelines, proper mapping, certain areas
3. Exemplify approach in community
4. Eddie Bautista, New York City Environmental Justice Alliance, environmental advocate
    a. Sandy Regional Assembly
5. Eileen referred to the USACE letter that was sent to local stakeholders and that their perception was that if their community did not experience significant Sandy-related impacts then they should not respond. So if they experienced significant impacts from Irene and Lee, such as fluvial impacts they did not respond with that information. Inundation impacts from certain communities were between 2-4 feet. Westchester County did not provide information/response to the USACE letter.
6. NYS DEC staff referred to Fran Dunwell, Hudson River Estuary Program, NYS DEC, involved with good network with Hudson River communities and CDM Smith focus area team should reach out to Fran to help facilitate community information gathering (though draft is due to USACE 9/20).
    a. Main communities interested in sea level rise, City of Kingston
    b. Fran Dunwell contact info: 845-256-3016 and 914-474-7785 (cell); email: ffdunwel@gw.dec.state.ny.us
7. NYS Rising, CRZ, community restoration zone. This program includes 102 communities, including those impacted by Lee, Irene and Sandy. Parts of NYC are included in this plan, along with 12 communities in Ulster. The draft plan is due by March 1st, 2014. (CDM Smith is a contractor on this program – and is currently working for Stony Point, as such Stony Point information is included as part of the stakeholder feedback for the focus area analysis).
8. Damage Information
    a. NY State Office of Emergency Management
    b. Through FEMA's PA program
    c. Rick Ward is the lead POC, 518-292-2370 (phone) and rward@dhses.ny.gov (email)
9. General information and potential requests for USACE project authority
    a. No existing USACE project authority for New York Harbor (with regard to coastal storm damage/risk reduction). This "gap" continues to be discussed at high levels within NYS DEC and USACE.

Meeting adjourned 11:30 PM.

APPENDIX C

STAKEHOLDER FEEDBACK

NEW JERSEY STAKEHOLDERS
CITY OF PERTH AMBOY
BOROUGH OF CARTERET
TOWNSHIP OF SADDLE BROOK
BOROUGH OF RUTHERFORD
CITY OF HOBOKEN
CITY OF JERSEY CITY
CITY OF ELIZABETH

NEW YORK STAKEHOLDERS
TOWN OF CORTLANDT
TOWN OF STONY POINT
NEW YORK CITY

REGIONAL AGENCIES
PORT AUTHORITY OF NY AND NJ
NEW JERSEY MEADOWLANDS COMMISSION
METROPOLITAN TRANSIT AUTHORITY
NEW JERSEY TRANSIT CORPORATION
AMTRAK
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
CONSOLIDATED EDISON COMPANY OF NEW YORK
PASSAIC VALLEY SEWERAGE COMMISSION

CITY OF PERTH AMBOY

FEEDBACK

1. RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY
2. IMPLEMENTATION OUTLINE FROM WR&RAC
3. CITY OF PERTH AMBOY WATERFRONT REDEVELOPMENT AND NATURAL HAZARD MITIGATION COMMUNITY PLANNING ASSISTANCE PROGRAM APPLICATION
4. FEMA PROJECT WORKSHEET FOR WATERFRONT DAMAGES (UPLOADED TO SHAREPOINT SITE)

<u>Requested Feedback Relating to North Atlantic Coast Comprehensive Study</u>

1. <u>Problem identification for your area:</u>
    a. <u>Did your area experience tidal or tidally influenced storm charge?</u>
        i. Yes, at a minimum, the City experienced an eleven (11) foot storm surge and wave action of thirteen (13) feet.
    b. <u>Be specific on particular areas and water bodies within your jurisdiction that experienced storm surge.</u>
        i. The City is surrounded by water on two sides. The Raritan River to the south, and the Arthur Kill to the east. The two converge at the Raritan Bay on the southeast corner of the City. There are also several creeks within the City, the Woodbridge Creek being one that experienced storm surge, along with these other bodies of water.
    c. <u>What factors, if any, exacerbated damages from storm surge?</u>
        i. The following factors exacerbated the situation:
            1. Being at the confluence of major water bodies.
            2. Lack or poor condition of infrastructure, including bulkheads, around the City's waterfront.
            3. Presence of industrial uses and impermeable surfaces along the City's waterfront.
            4. Lack of natural riparian zones along the waterfront to help with filtration and erosion control.
2. <u>Description of damages for your area:</u>
    a. <u>Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.</u>
        i. As a result of super storm Sandy, the City's waterfront experienced over $20 million in damages, including large portions of the esplanade washing away and all its features and amenities, the loss of the City's marina, significant damage to waterfront businesses and homes, and damages to public parks, access points and fishing piers. This resulted in the closure of almost the entire key portion of our popular waterfront walkway.

The municipal marina was flooded and boats washed on shore while boat slips washed away, resulting in almost two-thirds of the slips needing to be replaced. An entire pier surrounding the southern portion of the marina was destroyed. The City's beaches lost significant amounts of sand, a good deal of which was deposited upland. The Armory and the Barge are popular waterfront restaurants that were incapacitated for months. Almost a dozen homes were also flooded and evacuated. The hillside at Bayview Park and the hillside adjacent to the historic Yacht Club washed away. The Yacht Club's marina and docks were also lost. Dozens of trees were knocked over causing personal and public property damage. Brick pavers on the esplanade pushed out of place and fencing was destroyed. Lamp posts along the walkway and marina were damaged or lost as well as most benches and an entire gazebo. The seawall and revetment were also severely damaged

b. <u>Provide a map depicting the spatial extent of damages.</u>
    i. See second attachment to email.

3. <u>Prior related studies or projects (local, state, federal) in the damaged area.</u>
    a. Shortly after the storm, the Mayor assembled a group of residents and business people to study the effects of the storm and make recommendations for recovery and redevelopment. The Waterfront Recovery and Redevelopment Advisory Committee produced in April a report outlining the work that needs to be done to recover from the devastating effects of Sandy. A major element of this plan is the replacement and augmentation of revetment and bulkhead work , along with the wall extensions and scour pad work proposed from second street all the way through to the end of the project area. This is the only study that has been done related to this to date.
4. <u>List measures that your jurisdiction has considered to address the problem (for documentation purposes, should there be a follow-on study).</u>
    a. The City has already begun the process repairing the most urgent needs including some revetment and bulkhead work, as well as replacement of lost portions of the City's esplanade. The City hopes to have its walkway and marina back to capacity by next Memorial Day. There were considerations and recommendations for making the waterfront more resilient through various changes and additions throughout this work.

Outline of Work to be done to implement WR&RAC Recommendations

(Revised 6 may 2013)

OBJECTIVE

Complete marina and walkway work prior to Memorial Day 2014. Complete remaining work prior to end of 2014

- Identify available FEMA funding and supplementary funds needed to perform work
- Identify work to be completed in first phase
- Revise Capital Improvement Program to conform to plan
- Prepare scope of work for engineering
- Seek proposals from qualified engineering firms
- Award contract for engineering
- Design work and review by staff and governing body
- Permitting if required
- Bidding of contract for work
- Award of Contract
- Execution and completion of contract

HIGHEST PRIORITY PROJECTS-Phase One (scope of work)

A. Seawall, Beach and Revetment

- Replace, rebuild and enhance with seawall 2.5 feet above River and Harbor walk elevations topped with 1.0 feet railing
- Raise and expand revetment similarly
- Create sand dunes similarly along beach area
- Estimated Cost $7,426,000

B. Marina and Fishing Pier

- Reconstruct marina with pilings 22 feet above mean high tide (MSL) ($344,000)
    - Alternatives of aluminum docks and current concrete type
- Repair South Pier
- Replace walkway north of Seabra's
- Repair damage to electrical elements on North Pier.
- If approved by NJDEP, replace south east extension to south pier in front of Seabra's ($526,700)
- Estimated Cost (portion of cost includes [portions of A above) $6,630,700

C. River and Harbor Walks

- Rebuild with proper bulkhead and scour-pad design
- Make accessible to pedestrians and bicyclists alike – dual use – coexistence
- Estimated Cost $Included in other numbers

D. Erosion Issues

- Repair Bayview Park Hillside with erosion protection walls ($693,800)
- Repair erosion south of RYC with retaining wall ($300,000)
- Estimated Cost $993,800

TOTAL ESTIMATED COSTS	**$15,050,500**	
Contingency 20%	3,000,000	
Total Estimated Cost with Contingency		$18,000,000

Offsets

a. FEMA Estimated Reimbursement	$4,300,000
b. Viridian for Southeast Extension to south Pier	400,000
c. Possible Additional FEMA Mitigation Funding	2,000,000
i. Portion of bulkheads, revetment, 2.5 feet seawall	
ii. Sand dunes	
iii. Extra height to pilings	
iv. Scour pads for Harbor and River walks	
Estimated Net Financing Need	**$11,300,000**

Following work on Bayview Hillside, provide added parking on Front Street

- Convert Front Street to one-way with parking on east side of street – with appropriately painted spaces.

City of Perth Amboy Waterfront Redevelopment and Natural Hazard Mitigation Community Planning Assistance Program Application

Applicant
City of Perth Amboy

Contact
Leigh Anne Hindenlang
Senior Planner
City of Perth Amboy
Office of Economic and Community Development
260 High Street
Perth Amboy, NJ 08861
Phone: 732-826-0290 ext 4028
Fax: 732-826-1160
Email: ahindenlang@perthamboynj.org

Record of Addressing Community Issues

Perth Amboy is a very unique and beautiful city, but it does have issues that the City has been working to address through the work of all of its departments and by seeking any available funding and help. The City is densely populated with at least 60% of residents falling below the low/moderate income level range. Additionally, as a historic industrial hub, the City has a significant number of brownfield sites and is almost entirely built out. This makes careful and well-thought redevelopment and planning a high priority for the City. The Office of Economic and Community Development (OECD) has a record of successfully undertaking and completing projects to address these, as well as other, community issues. Through working with the redevelopment agency, the OECD has been able to remediate and redevelopment numerous brownfields throughout the City to create housing, commercial and industrial uses and job opportunities and bring these properties back into working sites that benefit the City. In the past year, the City has been able to engage and secure several new large corporations to move into or expand within the City. Through its CDBG/HOME program, the OECD has managed and provided public services and improvements to the neediest populations within the City including senior services, afterschool programs, public infrastructure improvements, affordable housing, and façade improvements. Additionally, the OECD is one of the most active departments within the City for seeking out grant opportunities to address issues within the City and create new or expanding existing opportunities and services. This includes historic preservation, clean energy, infrastructure expansion, arts and cultural activities, and transportation improvements.

Project

As a result of super storm Sandy, the City's waterfront experienced millions of dollars of damage including large portions of the esplanade washing away and all its features and amenities, the loss of the City's marina, significant damage to waterfront businesses and homes, and damages to public parks, access points and fishing piers. This resulted in the closure of almost the entire key portion of our popular waterfront walkway. Beyond that, there are several brownfield sites that still need developing and some sites already underway seeking direction for public improvements. There are great opportunities for park and public access expansion, creation of bicycling infrastructure and planning, and redesign of previously existing resources.

In order to develop a recovery plan for the City's most valuable and threatened asset, an advisory committee of interested and concerned residents and business people was created that will provide recommendations to the Mayor and City Council on the recovery, repair and renewal of the City's waterfront. Under the direction of this Waterfront Recovery and Redevelopment Advisory Committee, and with the help of the OECD and the Community Planning Assistance Program, the City would like to develop a waterfront area plan that will lead the repair and redevelopment of the waterfront. The City would like the CPAP to contribute their expertise in reviewing existing conditions, conducting a public input process, and aiding in the recommendations of the Waterfront Recovery and Redevelopment Advisory Committee for the future of the waterfront to the City Council. While the events and losses experienced as a result of Sandy are horrific, the City sees this as an opportunity to make intelligent and publicly supported plans for one of the City's most valuable resources.

Additionally, damages to the water front from a Nor-Easter in a March 2010 and Hurricane Irene damaged the waterfront and parts of the waterfront were closed and only to reopen not long before Hurricane Sandy. Therefore, we would also like to look at strategies to mitigate damages from another storm, as well as designate and organize the future development of the area.

This importance of this project to the community cannot be overstated. As an older, densely developed, industrial city, Perth Amboy has limited open space. The waterfront area includes beaches, parks, picnic areas, walking trails and esplanade, a marina, and fishing piers. It serves as both a passive and active recreational resource for residents of all ages. In fact, within days of the super storm Sandy, over a 1,000 city residents turned out on a Saturday to volunteer their time to clean up the debris and destruction in an effort to restore order to a resource so precious to the community. Additionally, some of the most famous restaurants and businesses that attract visitors from outside of the City are located on the waterfront and were significantly damaged. For tourism and community enjoyment, the waterfront needs to be reopened, and now is the perfect opportunity to make the plans and changes to enhance this resource for future residents and visitors. Furthermore, proper mitigation planning can help design this park and waterfront area to make it more resilient so that another natural disaster does not leave the waterfront closed off to the public again and cost more public dollars.

Project Outcome (Goals)

As a result of CPAP assistance, the City would like to produce a plan for the recovery, repair, and redevelopment of the waterfront, taking into consideration the need for mitigation measures to reduce the damages from future storms. Specifically:

- Planning for public improvements including the expansion of the esplanade and the bulk head and public improvements
- Design strategies and design options that will be resilient to natural disaster
- Bringing together stakeholders to provide input on the waterfront redevelopment and consider concerns of the public and advisory committee
- Create clear objectives and strategies for redevelopment of the waterfront

Open Public Planning Process

This effort is being driven by a local resident and business owner committee effort. The City wanted to ensure that the product that is produced will reflect the needs and desires of its residents. The City is willing to provide public meeting space and aid in the creation, promotion and carrying out of the public meetings. The first public meeting is scheduled to take place on February 4th.

Stipend and In-Kind Contributions

The City is requesting a waiver for the required stipend. There are no extra funds in the OECD's budget to cover this fee, and most of the administrative funds the office has are restricted by the granting agency for use. However, the OECD is willing to provide in-kind services to CPAP in terms of resident and business volunteers, and with assistance from OECD staff for the planning process.

Need for Services

The City is in need of planning services because the budget is severely constricted due to extensive debt and limited financial resources, particularly grant funding that has become less prevalent. In order to not raise taxes and stay within the 2% tax levy cap, the City has had to reduce staff and rely on those who are already employed to take on more roles and responsibilities. There is insufficient staff to conduct such a plan in-house. There is one full time planner in the City within the understaffed Office of Economic and Community Development. The Waterfront Recovery and Redevelopment Advisory Committee is a citizen driven project that does not have planning expertise and could benefit from Planning Assistance from the Community Planning Assistance Program.

Documentation to Support that the Project Meets Qualifications

Appendix A: Photos of Damages
Appendix B: Waterfront Recovery Redevelopment Advisory Committee letter
Appendix C: Project Manager's Business Card
Appendix D: Resolution (See Appendix E)
Appendix E: Mayoral Letter of Support
Appendix F: Documentation that Services Could Not be Provided in House/Consulting

Appendix A: Photos of Damages



Appendix B: Waterfront Recovery Redevelopment Advisory Committee letter

15 January 2013
PROGRAM OUTLINE
WATERFRONT RECOVERY AND REDEVELOPMENT ADVISORY COMMITTEE

In order to develop a recovery plan for the City's most valuable and threatened asset, its waterfront, an advisory committee of interested and concerned residents and business people is hereby created that will provide recommendations to the Mayor and City Council on the recovery, repair and renewal of the City's waterfront, also taking into consideration the possible need for mitigation measures to reduce the impact of possible future storms.

The City has entered into a contract with Trevcon Contracting Co. to implement plans prepared by Hatch Mott MacDonald Engineers <u>to repair the damage caused by the March 2010 Nor'easter</u>. This follows lengthy processing of damage requests by FEMA and permit approval reviews by NJDEP and the US Army Corps of Engineers. This work has finally begun.

With the added damage to the waterfront by Super Storm Sandy, the City is presented with yet another challenge to properly and adequately repair and redevelop this significant City asset as part of the ongoing recovery from the storm. To assist this office and the City Council and the Mayor in our joint endeavor to restore this treasure, I am creating a WATERFRONT RECOVERY AND REDEVELOPMENT ADVISORY COMMITTEE. While all decisions must in the end be made by the City's governing body, this committee shall provide the governing body with its best recommendations to advance the best interest of the entire City. It shall consist of seven (7) public members and have various department heads as ex-officio members. The membership shall be:

- Robert Bunten
- Michael George
- Michael Keller
- Alan Jacobs, Chair
- Barry Rosengarten, Vice Chair
- Anthony Seabra
- Noelle J Zaleski. Royal Garden Club

Mr. Jacobs will serve as the chair of this committee and Mr. Rosengarten will serve as the vice chair.

Staff who will serve as ex-officio members of the Committee include:

- Emergency Management Coordinator
- Public Works Director
- Chief Financial Officer
- Human Resources Director
- City Administrator

In order to assist the Committee in its deliberations it will require the services of an administrative assistant who shall maintain minutes and "to do" lists for the committee and a consulting engineer

(Hatch Mott MacDonald) familiar with the waterfront issues, limitations and needs. (The City Council will be asked to authorize a contract for these services soon.) We are also seeking the assistance of the New Jersey Chapter of the American Planning Association to provide technical planning assistance to the committee.

It is the mission of the Advisory Committee to investigate ways to:

- Recover from the damage inflicted on the Waterfront by Super Storm Sandy,
- Develop appropriate concepts for reuse and redevelopment of the City's waterfront,
- Maximize the use of the waterfront to engage its full potential and thereby invigorate the entire community

and transmit these concepts and recommendations to the Mayor and City Council.

The work program of the Committee should consist of at least the following:

- Plan to issue a report and recommendations to the Mayor and City Council within 4 months of the first meeting regarding recovery plans and actions.
- Conduct an initial organizational meeting at which the members should express their concerns and set forth their objectives for the anticipated achievements of the committee. Some of these might include the following:
    - Rebuild Harborside Marina.
    - Create additional uses along the Raritan River and Arthur Kill (much of which property is in the Redevelopment District and some of which is under the jurisdiction of the Brownfields Development Area Committee in cooperation with NJDEP).
    - Expand park use and the pedestrian walk (Harbor-walk and River-walk) along the entire waterfront.
    - Assure compliance with the public access plan requirements of the NJDEP
    - Provide additional facilities for boating and marina use.
    - Attract upscale and boutique retail uses, restaurants and hotels to the waterfront area.
    - Create opportunities for other appropriate development
- Conduct at least two public hearings:
    - The first hearing should be the second meeting of the committee at which the committee would receive suggestions, recommendations, comments and concerns from city residents and taxpayers. These would need to be chronicled and maintained.
    - The second public hearing would be one at which the committee will present to the public their proposals and reasons therefore and receive public comment on same.
- Hold not less than three additional meetings at which the members will receive reports from staff and consultants regarding issues identified by committee members.
- The committee will need to balance objectives of being thorough, yet expeditious in their deliberations and determinations regarding recovery. NB: Too much time cannot be spent of the planning portion of this endeavor, so design and implementation of the work can be pursued while administrative details are worked out with FEMA and insurance coverage. The public needs to see progress and achievement.

- Regarding longer term redevelopment of this resource, the Committee will continue to pursue this inquiry within resource constraints.
- During the design and implementation stages of the project, the Committee should be available to review and comment on the work being conducted. During this stage, meetings might take place as often as monthly or every 6 weeks.

Limits on resources and work of committee:

Area in question: Regarding the recovery (short term) effort the area in question would be from the North Jersey Coast Line Bridge to the Tottenville Ferry Slip. Regarding longer term attention, the area in question can be from the Victory Bridge to the Outer Bridge Crossing.

Term: improvement recommendations should be for both short (less than one year) and long (one to ten or more years) terms.

Consulting Services: Current financial constraints dictate that HMM is available to the committee in its deliberation up to but not to exceed that which is set forth in the proposal and the contract authorized by City Council resolution.

Appendix C: Project Manager's Business Card

Annie Hindenlang
Senior Planner
Economic & Community Development

CITY OF PERTH AMBOY
260 High Street
Perth Amboy, New Jersey 08861

Phone (732) 826-0290 Ext. 4028
Fax (732) 826-1160
ahindenlang@perthamboynj.org

Appendix D: Resolution (See Appendix E)

Appendix E: Mayoral Letter of Support

City of Perth Amboy

Wilda Diaz, Mayor

January 30, 2013

American Planning Association – NJ Chapter
CPAP
PO Box 813
New Brunswick, NJ 08903

Dear CPAP Representative,

The City of Perth Amboy's beautiful waterfront is one of the City's most important assets for recreation, industry and tourism. Super storm Sandy caused millions of dollars of damage and rendered the majority of the waterfront used for recreation and public access destroyed and fenced off. Planning for the redevelopment and mitigation of this area for future use is of the utmost important to the City.

In order to create a vision for how the waterfront will be redeveloped, the City created the Waterfront Recovery and Redevelopment Advisory Committee to assist in bringing forth the concerns of citizens, the business community, and the City. However, the City is in desperate need of technical and professional assistance. With the help of the Community Planning Assistance Program, we believe this project has a high potential to create an admirable public area that will accentuate the character and potential of our waterfront.

Since the committee has already begun meeting, the City wishes to submit the proposal for planning assistance early. We have not yet had a chance to pass a resolution that authorizes the submission of the application and agrees to the terms of the Request for Proposals. This will be completed at our next opportunity which is a City Council Meeting on Feb 13^{th}. Until then, I am writing this letter to show the support of the Mayor's Office in moving this project along.

We hope you choose to assist us with this project and look forward to the potential opportunity to work together.

Sincerely,

Mayor Wilda Diaz

260 High Street • Perth Amboy, New Jersey 08861
732-826-0290 • Fax: 732-826-1160

Appendix F: Documentation that Services Could Not be Provided in House/Consulting

DEPT NO	DEPARTMENT	NAME	POSITION	CY 2011 BUDGET	CY 2012 BUDGET	MAYOR'S BUDGET	CY 2012 ADOPTED BUD
20-170	Economic Development	[redacted]	Accountant	57,401.00	57,976.00	57,976.00	current (PT)
20-170	Economic Development	[redacted]	Coord. Fed & State Aid	77,262.00	-		
20-170	Economic Development	[redacted]	Clerk Typist	42,504.00	-		
20-170	Economic Development	[redacted]	Clerk Typist		37,517.00	37,517.00	current (FT)
20-170	Economic Development	[redacted]	P/T Seasonal (1/1-6/30)		6,240.00	6,240.00	current (FT)
20-170	Economic Development	[redacted]	Crd Fed&StateAid(7/1)		30,004.00	25,000.00	
20-170	Economic Development	[redacted]	Executive Director PARA	129,688.00	132,295.00	44,100.00	
20-170	Economic Development	[redacted]	Reimb from UEZ		(33,073.75)	(30,000.00)	
20-170	Economic Development	[redacted]	Reimb from BID		(33,073.75)	(25,000.00)	
20-170	Economic Development	[redacted]	Summer Intern		5,000.00	5,000.00	current (PT)
20-170	Economic Development	[redacted]	OECD Director		75,000.00	75,000.00	
20-170	Economic Development	[redacted]	Executive Assistant		77,051.00	77,051.00	current (FT)
20-170	Economic Development	[redacted]	Reimb from UEZ		(38,525.50)	(18,750.00)	
20-170	Economic Development	[redacted]	Reimb from BID		(38,525.50)	(38,525.50)	
20-170	Economic Development		Sick Incentive	2,000.00	2,000.00	2,000.00	
20-170	Economic Development		Part-Time		5,000.00	5,000.00	
20-170	Economic Development		CDBG FUNDING	(153,592.00)	(101,862.80)	(113,285.90)	
20-170	Economic Development		EECBG Funding	(19,620.00)			
20-170	Economic Development		BID Funding (see above)	(22,234.00)	-		
20-170	Economic Development		UEZ Funding(see above)	(33,057.00)	-	(18,750.00)	
20-170	Economic Development		HOME Funding	(50,683.00)	(25,482.10)	(33,532.90)	
	Economic Development Total			29,669.00	157,539.60	57,039.70	-

BOROUGH OF CARTERET

FEEDBACK

1. LETTER RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY
2. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY
3. MAP DEPICTING INUNDATION EXTENT

BOROUGH OF CARTERET
Office of Emergency Management
183 Roosevelt Ave.
Carteret, New Jersey 07008
OEM@CARTERET.NET
Tel: 732-541-4007 Fax: 732-541-3921

John S. Wyatt
Coordinator

September 5, 2013

Dear Ginger Croom:

This letter is a response to the request sent by Donald E. Cresitello, USACE, NY District on August 25, 2013 via e-mail in a letter dated August 23, 2013 pertaining to the efforts of the United States Army Corps of Engineers (USACE) conducting the North Atlantic Coast Comprehensive Study (NACCS) as authorized by Public Law 113-2.

The Carteret Office of Emergency Management (OEM) located in the Borough of Carteret, New Jersey in Middlesex County, is providing the below responses to the feedback questions requested in the aforementioned letter. To preface this letter due to the delayed reading, other mitigating circumstances and the Labor Day Holiday this letter only represents a part response to the requested information with additional time for a follow-up required.

For clarity, I have included the reference feedback questions with the respective responses indicated.

Questions:
1) Problem identification for your area:
a) Did your area experience tidal or tidally influenced storm surge?
b) Be specific on particular areas and water bodies within your jurisdiction that experienced storm surge.
c) What factors, if any, exacerbated damages from storm surge?
2) Description of damages for your area:
a) Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, person injuries/fatalities.
b) Provide a map depicting the spatial extent of damages.
3) Prior related studies or projects (local, state, federal) in the damaged area.
4) List measures that your jurisdiction has considered to address the problem (for documentation purposes, should there be a follow-on study).

Responses:
1a & b) Yes tidal storm surge was experienced on the length of the Arthur Kill waterway along the Borough boundary including the connected Noe Creek, which drains into the Arthur Kill. The Rahway River to the North of our jurisdiction, which also drains into the Arthur Kill, experienced storm surge along our Northern border of the Borough. Additionally there is a drainage way connected to the Arthur Kill from the areas of Edwin and Bergen Streets in Carteret that experienced a storm surge exacerbated by high tide flooding the area. Areas of flooding related to the surge are identified on the attached Borough Map.

1c) The water surge experienced along Noe Creek, which in part is an open creek when it spills into the Arthur Kill, along the remainder of the Noe Creek through the Borough it is contained within underground diversion tunnels with development areas above and around this tunnel. During the storm surge, the height of the water, natural ground elevations and the location of the creek aided in the flooding experienced in these areas with no location for the water to drain until the storm passed and low tide aided in the drainage of these flooded areas.

2a) I would refer this response to the Borough Engineering Department, and the Borough Director of Municipal Engineering John P. DuPont, P.E., CME, P.P. (dupontj@carteret.net P: 732-541-3847). Due to the delayed nature in seeing, the e-mail sent regarding this matter, the Borough OEM notifies the Engineering Department with this response. The response is limited in part due to the indicated deadlines and timeframe in which the request letter was reviewed.

Regarding the person injuries/fatalities, I would defer that to the Middlesex County OEM. To my knowledge there were no fatalities related to the Storm Surge or Hurricane Sandy within our Jurisdiction.

2b) Map attached indicates only areas of flooding and waterways, rivers, and creeks listed above in items 1a thru 1c.

3 & 4) Recently completed, current on-going and planned project developments and/or measures in the affected areas I am referring this response to the Borough Engineering Department for follow-up.

In summary, for the USACE NACCS effort and future correspondence with the Borough of Carteret, NJ please utilize the OEM e-mail account, which was already included; additionally include the Engineering Department, John DuPont (contact information contained above). Any additional Borough Department Heads will be added as needed in the coordination of this effort to streamline responses.

Respectfully on behalf of the Borough Coordinator,

Gregory Gadomski

Gregory Gadomski
Captain - Personnel & Communications
Carteret Office of Emergency Management

Attachment

September 6, 2013

Ms. Ginger Croom
USACE Contractor

VIA Email – croomgl@cdmsmith.com

Re: USACE – North Atlantic Coast Comprehensive Study
Borough of Carteret – Engineering responses

Dear Ms. Croom,

In addition to the responses you received from the Borough of Carteret Office of Emergency Management, please find the responses which were directed to my office.

Response 2

The Borough experienced significant damage to both public and private property. The Borough had significant damage to its stormsewer system, including culvert and pipe failures, outlet erosion and inlet failures. Roadways were washed out, sound barriers were undermined, and several parks were completely destroyed. Numerous Borough buildings were completely flooded resulting in significant damage to the structure, as well as the mechanical systems and building contents.

Numerous private buildings were destroyed by flooding, and several dwellings were destroyed by a gas explosion, which was the result of flood waters pushing the dwellings off their foundations.

Numerous Borough buildings needed to be evacuated and left vacant until repairs could be made. These buildings included the Department of Public Works Building, the Recreation Center, the Borough Library, the Park Department Building, and the Waterfront Park bathrooms.

Thankfully person injuries were kept to a minimum, and no fatalities were reported to my knowledge.

Response 3

The Borough's stormsewer system and its outlet to Noe's Creek has been the subject of numerous studies in the past. The stormsewer system in this area has been an area of concern for the Borough for a long time, and currently uses two sets of tide gates to help control the tidal influence of the Arthur Kill on the Borough. During Hurricane Sandy this portion of the borough's stormsewer system was completely surcharged.

Response 4

The Borough is currently in the process of designing improvements to the stormsewer system in the Noe's Creek area. The improvements are designed to alleviate localized flooding, repair damage caused by Hurricane Sandy, and increase the capacity of the system. The Borough has hired a consulting engineer to be the lead on these designs. The Borough is also looking at improving the capacity of Noe's Creek.

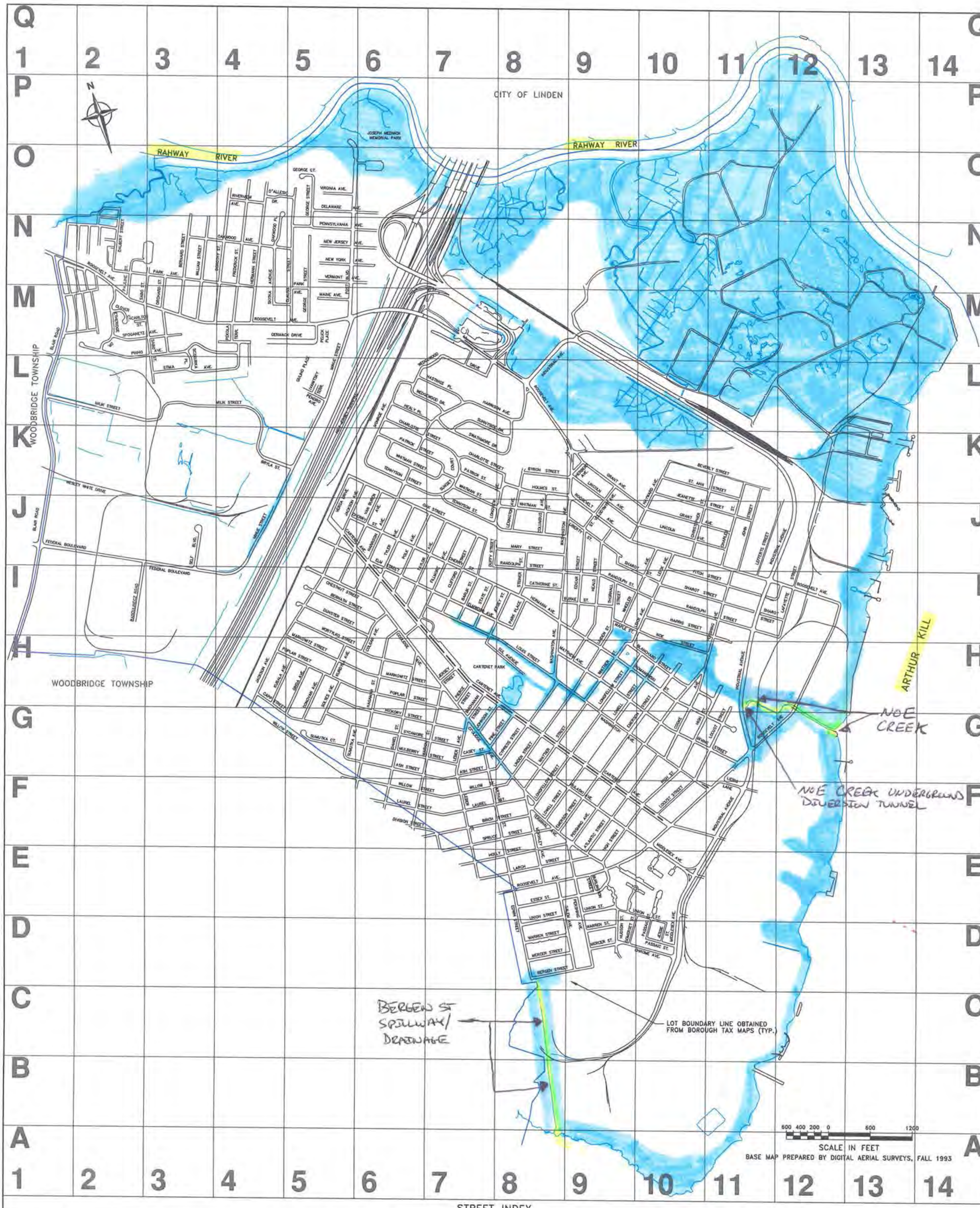
With respect to the damage to Borough buildings, the Borough has made significant repairs/improvements to all the buildings damaged. Where possible, mechanical systems have been raised, and flood proofing is being reviewed. Backup generators are also being investigated for essential Borough buildings. The Borough has worked closely with FEMA throughout this process.

This is an on-going process.

If you need any other information please feel free to contact my office.

Very truly yours,

John P. DuPont, P.E., CME, P.P.
Director
Department of Municipal Engineering and DPW
Borough of Carteret
732-541-3847
dupontj@carteret.net



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TAYLOR AVENUE	J - 6
TENNYSON STREET	J - 7
TERMINAL AVENUE	F - 8
THORNALL STREET	I - 9
TYLER AVENUE	J - 6
U	
UNION STREET	E - 9
V	
VAN BUREN AVENUE	J - 6
VERGA DRIVE	J - 5
VERMONT AVENUE	N - 5
VIRGINIA AVENUE	O - 5
W	
WARREN STREET	D - 8
WASHINGTON AVENUE	G - 9
WEDGEWOOD DRIVE	L - 6
WESLEY WHITE DRIVE	K - 1
WHEELER AVENUE	I - 9
WHITMAN STREET	J - 8
WHITTIER STREET	G - 8
WILLIAM STREET	N - 3
WILLOW STREET	F - 6
WORTYLKO STREET	I - 5
X	
Y	
Z	

Job 282100

B/O 1 | No. 1 | Total 1

BOROUGH OF CARTERET
MIDDLESEX COUNTY - NEW JERSEY

STREET MAP

EKA ASSOCIATES, P.A.
Engineers • Surveyors • Planners
1765 East Second Street, Scotch Plains, N.J. 07076
908-322-2030

Date | Revision

WATERBODY IDENTIFICATION HIGHLIGHT

AREAS OF FLOODING RELATED TO STORM SURGE AND TIDAL ACTION

ATTACHMENT #1
2013-09-05

TOWNSHIP OF SADDLE BROOK
FEEDBACK

1. STAKEHOLDER FEEDBACK VIA COMMENT CARD, MAYOR
2. STAKEHOLDER FEEDBACK VIA COMMENT CARD, BOROUGH CLERK

USACE New York District
New York Bay Reconnaissance Meeting
Paterson, NJ - 7/16/2013

Name Karen A. Chamberlain

Community / Agency Township of Saddle Brook

Title Mayor

E-Mail mayorchamberlain@saddlebrooknj.gov

Telephone 201 294-6816

Comment

Why do studies take so long? Too Long?
Retention Basins along Saddle River,
quite a few parks adjacent to River
as a short-term "to do something
in between" (small project?)
I'm not an engineer, however, is
this possible
Saddle Brook maintains flood
mitigation religiously.

USACE New York District
New York Bay Reconnaissance Meeting
Paterson, NJ - 7/16/2013

Name: Peter Lo Dico

Community / Agency: Twp of Saddle Brook

Title: Twp Clk / Bus. Adm

E-Mail: plodico@saddlebrookNJ.gov

Telephone: 201-675-0290 (cell)
201-587-2909 (office)

Comment

We need to look at short term Solutions as we wait for Studies to be completed
Each town as well as the area may have specific Need to address funding.

Thank you for having meeting

BOROUGH OF RUTHERFORD
FEEDBACK

1. STAKEHOLDER FEEDBACK VIA COMMENT CARD, BOROUGH ADMINISTRATOR

USACE New York District
New York Bay Reconnaissance Meeting
Paterson, NJ - 7/16/2013

Name COREY GALLO

Community / Agency BOROUGH OF RUTHERFORD

Title BOROUGH ADMINISTRATOR

E-Mail cgallo@rutherford-nj.com

Telephone (201) 460-3004

Comment

Rutherford has been impacted with flooding from both the Hackensack and the Passaic Rivers. The river bank along the Passaic ~~along~~ Rutherford shore lines have deteriorated and continues with every tide change. This flooding impacts approximately 250 Homes which should be eligible for either Buyout or elevation so the homes are not flooded. There are several recommendations that have been made for the Passaic to clean up and alleviate flooding. From what I have gathered, these studies have focused on areas south of Kearny + North of the Falls. These studies allocate anywhere from 2.5-3 Billion over 25 years and no of those resources are allocated to Rutherford and assisting Rutherford residents.

Likewise the Hackensack River has surged time and time again where the floodgate has not worked. During Sandy the floodgate malfunctioned and did not allow the water to recede causing millions of dollars of damage to our commercial area. Correcting this floodgate is an immediate solution which will benefit our residents.

CITY OF HOBOKEN
FEEDBACK

1. RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, MAYOR'S OFFICE
2. CITY OF HOBOKEN STRATEGIC RECOVERY PLANNING REPORT
3. MAP DEPICTING STORM SURGE EXTENT
4. FLOODPROOFING STUDY FOR THE CITY OF HOBOKEN (UPLOADED TO SHAREPOINT SITE)

1) **Problem identification for your area:**
   a. *Did your area experience tidal or tidally influenced storm surge?*
      i. Over 70% of the city was impacted directly by tidal or tidally influenced storm surge. On October 29, 2012 at approximately 8:45 p.m. the wave heights of the storm surge were recorded at nearly 14' near the New York battery. For approximately 6 hours, during the high tide cycle, water piled into Hoboken through the Long Slip Canal located immediately to the south of Hoboken and the Weehawken Cove located immediately to the north of Hoboken. As a result, an estimated five hundred-million (500,000,000) gallons of water from the Hudson River breached Hoboken's shoreline and flooded the central and western portions of the city.
   b. *Be specific on particular areas and water bodies within your jurisdiction that experienced storm surge.*
      i. Hoboken is bounded to the east by the Hudson River and the Upper New York Bay, both of which experienced storm surge.[1]
      ii. Hoboken experienced storm surge along it's approximately 2.5 miles of waterfront, as well as surge related flooding in the western and central portions of the city. Waterfront piers, walkways, roads, parks and buildings were inundated with brackish water. A majority of the waterfront is fortified with concrete walkways, piles or piers, with exceptions existing at the intersection of 4th St. and Sinatra Drive, Maxwell Place Park, and portions of the Weehawken Cove. Significant damage occurred at the very South Eastern portion of the city at Lackawanna Terminal, the nexus of NJTransit heavy rail, the Hudson Bergen Light Rail, the NJTransit Bus Terminal, PATH station, and NY Waterways ferry terminal. The western and central portions of the city were flooded from the North and South. Topographically, the city resembles a bowl with high elevations on the eastern and western borders. The outcropping of Castle Point provides the eastern high elevation along the Hudson River, and the Palisades provide the western high elevation. Embankments exist along the southern and northern edges of the city to support the Hoboken Rail Yards, and the Hudson Bergen Light Rail respectively. Historically, the western portions of Hoboken were tidal marshes. As development encroached upon these areas, marshes and tidal streams were filled to accommodate an expanding city. The natural topography, heavy and light rail development, as well as filling of tidal marshes creates a drainage area in the western portion of the city that cannot naturally flow back to the Hudson River/Upper New York Bay during high tide cycles. [2]
   c. *What factors, if any, exacerbated damages from the storm surge?*
      i. Hoboken's electrical substations are at grade in the floodplain. The loss of electricity disabled the North Hudson Sewage Authority, which operates the

[1] City of Hoboken Storm Surge Limits
[2] City of Hoboken Key Topographic and Hydrologic Features Map

combined sewer system throughout Hoboken. A recently installed flood pump (50,000,000 gallons/day) located at the intersection of Observer Highway, and Washington Street, was rendered inoperable, until alternative power could be provided. Flood waters were unable to recede due to low topography (+/- 5' above sea level) throughout the western portion of the city, and a combined sewer system with outfalls below mean high tide. Because of Hoboken's high urban density, many multi-story attached buildings with adjoining basements could not be pumped out until flood waters receded. This led to occupant entrapment, isolation and standing water in many buildings within Hoboken.

ii. Of seven roadway access points, only the 14th Street Viaduct remained relatively accessible to vehicles immediately following the storm surge. All mass transit was out of service. The loss of power and transit effectively reduced Hoboken to its pre-development state as an island alongside the Hudson River. Thousands of residents were unable to evacuate following the storm and tens of thousands of commuters were unable to maintain their daily commute to/from NYC. <u>This is an important point, as Hoboken serves as a critical transportation hub of the NY/NJ region.</u>

iii. Hoboken is one of the most significant transportation hubs in the Northeast corridor. Losing transit access throughout New Jersey, and across the Hudson River had a significant effect on the economies of both NY and NJ. Additionally, local business's in Hoboken struggled to deal with the compounded costs associated with facility repairs, inventory loss, loss of foot traffic and loss of business immediately following the storm and preceding the holidays.

2) Description of damages for your area:

a. *Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities*.

Over 21,000 homes and businesses in the city lost electrical power, representing over 90% of the city. Critical community facilities were flooded and severely damaged, including the Hoboken University Medical Center ("HUMC"), the North Hudson Sewerage Authority's sewage treatment plant, three out of four of Hoboken's Fire Houses, the Ambulance Corps., the city's Department of Public Works ("DPW") garage and the city's Multi-Service Center which houses public health, social service, nutritional and recreation programs for children, seniors, the disabled and low income residents. Many public housing buildings were flooded leaving thousands of residents without potable water or power. All 3 PSEG substations were flooded, and rendered inoperable during the storm.

The city's two major supermarkets were flooded, one sustaining over $1 million in damages. The city's only gasoline stations were also flooded and rendered inoperable. Without power, Hoboken's municipal Police fleet and Fire Department apparatus had to refuel in neighboring communities. Many ground level emergency backup generators were rendered inoperable due to flood waters, and gas shortages limited usefulness of gas/diesel generators. Without electricity, building mechanicals and systems failed, including fire alarms, hallway and stairwell lights and water pumps. Water for both residential consumption and fire suppression did not reach above the third floor of most mid-rise and high-rise structures. Without electricity to operate elevators, emergency lighting or water pumps many residents were trapped in upper floors of high rise buildings without power for 3 or more days.

Communications became a major challenge during the event. Brackish saltwater from the Hudson River damaged underground copper telephone lines. Without electricity, televisions, cable boxes and fiber optic telephone systems did not work. Cell phone antennas did not work without electricity and cell phones were inoperable after a day or two. The repeaters for the Police Department and Fire Department radio systems were powered by emergency back-up generators which needed to be refueled every few hours. Several times during the crisis radio systems failed. In all, it is estimated that Hurricane Sandy caused more than $100 million in property damages to over 1,750 ground level households and businesses which were flooded and over 1,000 private automobiles and vehicles which were destroyed. It took nearly 5 days for the waters to recede throughout the city and a week to 10 days for power and gas to be restored to most areas of the city. Thousands of electrical subpanels and gas meters in residential and commercial buildings were damaged by flood waters and needed to be replaced.

Many of Hoboken's municipal facilities sustained significant damage during Hurricane Sandy. The Fire Headquarters and two Fire Stations were flooded during the event and had to be evacuated until flood waters receded. The Public Works central garage was flooded, evacuated and the city lost 36 municipal vehicles. The city's Multi-service Center which is a community center with space for several non-profits who serve special needs and low-mod income residents was significantly damaged and is still closed for renovations. The Fire Department did not return to its damaged headquarters or fire stations for over 10 days. It took over a month for the municipal DPW garage to become operational and the city's Multi-Service Center is still out of service.

The public library, volunteer ambulance corps, and midtown parking garage were also flooded and suffered significant damage. Finally, Hoboken's municipal parks and recreational facilities were damaged due to the hurricane, including Pier C, the Boys and Girls Club, and Jackson Street Park.

Significant transit related disruptions occurred immediately after the storm. PATH service disruptions lasted into December, as new equipment was fabricated to replace century old technology. NJTransit ran increased bus service to the 42nd Street Port Authority, while ferries ran out of 14th Street and Lackawanna terminal. The HOP intracity bussing system was severely damaged losing 2 of 4 buses to flood waters.

b. *Provide a map depicting the spatial extent of damages.*

Please reference Map 3: Hurricane Sandy: Spatial Extent of Damages[3]

3) Prior related studies or projects (local, state, federal) in the damaged area.

The New Jersey Department of Community Affairs 2013 Community Development Block Grant Disaster Recover Action Plan; the 1999 Strategic Revitalization Plan for the Hudson County Urban Complex; the Hudson County 2002 Master Plan; the Hudson County 2008 Master Plan Reexamination Report; the 2008 Multi-Jurisdictional Pre-Disaster Mitigation All Hazards Plan for

[3] Hurricane Sandy Spatial Extent of Damages

the County of Hudson; the City of Hoboken 2004 Master Plan; the City of Hoboken 2008 Emergency Operations Plan; and the City of Hoboken 2010 Master Plan Reexamination Report.

4) List measures that your jurisdiction has considered to address the problem (for documentation purposes, should there be a follow-on study).

a. Structural: Shoreline Protection, armored levees and flood barriers
b. Non-Structural: Energy Resilience: Micro grid development
c. Non-Structural: Flood Mitigation: Pumping stations
d. Non-Structural: Emergency Notification Systems: Solar powered message boards
e. Nature Based: Stormwater Management: Green Infrastructure & Land Acquisition
f. Policy: Hazard Mitigation Planning: Capital Improvements, Open Space, Recreation
g. Policy: Resilient Building Codes: Overcoming design challenges and code issues
h. Programmatic: Public Information Campaign: City-wide workshop series
i. Programmatic: Resiliency Task Force: Mainstreaming flood risk management into the sustainable development agenda. Community Rating System (NFIP): adopting ABFE's + additional freeboard

a. Shoreline Protection: The City of Hoboken applied to the State of New Jersey for $33 million in Hazard Mitigation Grant Program ("HMGP") funding for the installation of seawalls and flood barriers to keep high tides and storm surges from breaching Hoboken's waterfront in the future. In addition, city officials have met with the Governor's staff, NJ Transit executives and FEMA representatives to formally request the elimination/hardening of the Long Slip Canal where flood waters entered the community. The City will examine the feasibility of incorporating an armored levee or flood barrier into the design of phase II of the 1600 Park Avenue/Hoboken Cove park project at Weehawken Cove. While these infrastructure improvements may be constructed in 3-5 years, they are largely contingent upon funding.

b. Energy Resiliency: The City of Hoboken is working with the U.S. Department of Energy, Sandia National Laboratory, the N.J. Board of Public Utilities and Public Service Electric and Gas ("PSEG") to design a "Micro-grid" which will utilize Energy Surety Design Methodology ("ESDM"). This is the first non-military application of this technology designed for an entire community. In conjunction with PSEG's "Energy Strong" program and the availability of funding, the City of Hoboken will designate critical community facilities to deliver un-interrupted electrical service during disaster events, black-outs and brown-outs. Critical community facilities will include the police headquarters, fire headquarters and fire stations, the Hoboken Volunteer Ambulance Corps., the Hoboken University Medical Center ("HUMC"), the North Hudson Sewerage Authority's sewage treatment plant and flood pumps, city hall, the DPW Central Garage, the Multi-Service Center, shelters, grocery stores and fuel stations, as well as residential buildings with large at-risk populations like seniors and the disabled. Design of the Micro-grid will be completed in the fall of 2013. PSEG has proposed eliminating one of its electrical substations in Hoboken and elevating the two remaining substations to protect them from future flooding. The City has applied to the State of New Jersey for $1.3 million in Hazard Mitigation Grant Program ("HMGP") funding to purchase and install natural gas powered emergency back-up generators for critical municipal facilities. While this project may be constructed in 1-2 years, it is largely contingent upon funding.

c. Flood Mitigation: The City of Hoboken supported the North Hudson Sewerage Authority's ("NHSA") $20 million grant application for Hazard Mitigation funding to construct new wet weather pump stations to alleviate flooding. In addition, the city submitted a Letter of Intent ("LOI") to the New Jersey Environmental Infrastructure Trust for a $9 million low interest loan to install a new wet weather pump station at 11th Street along the waterfront. If funded, the City will pay for the pump station's construction and the NHSA will operate and maintain the pump station in perpetuity. Design of the H-5 pump station is complete and the project is "shovel ready". If funded, this project would be completed in 1-2 years.

d. Emergency Notification: The City of Hoboken has applied to the State of New Jersey for Hazard Mitigation Grant Program funding to purchase programmable, solar-powered, mobile message boards which can be quickly deployed during emergencies and community events to warn motorists of impending hazards or provide residents with information and instructions. This is in addition to the relatively robust emergency notification system the city already employs, including Reverse 911 and Nixle Alerts, as well as Facebook and Twitter updates. If funded, the message boards could be deployed almost immediately.

e. Stormwater Management: The City of Hoboken has applied to the State of New Jersey for $60 million in Hazard Mitigation funding to purchase three tracts of land in the flood hazard area. If funded, the tracts of land will be used for parks and open space with stormwater retention facilities incorporated into the design to reduce stormwater runoff. The City was recently chosen in a national competition by the "Re.InvestInitative.org" to receive $300,000-$500,000 in technical assistance to design and fund sustainable and resilient "green infrastructure" to reduce the effects of climate change and extreme storm events. In addition, the City was chosen by "Together North Jersey" to receive $90,000 in technical assistance to examine the City's combined sewer system and quantify the benefits that green infrastructure will have on reducing flooding and stormwater run-off. Finally, the City received a $20,000 grant from "Sustainable Jersey" to design a rain garden which will be used as a prototype for other sites around the city to absorb and temporarily store stormwater runoff. The City is in active negotiations with the property owners of the aforementioned parcels. Acquisition of the first tract of land is expected to take place by the end of summer 2013. The Together North Jersey Local Demonstration Project and the City's Green Building and Environmental Sustainability master plan element will both be completed in the fall of 2013. Design of the curb extension rain garden is complete and the city expects to go to construction by the fall of 2013. The Re.InvestInititive.org plan is expected to take 1-2 years to prepare.

f. Critical Facilities/Infrastructure: Damage to critical community facilities and municipal infrastructure highlights the need for rational and coherent municipal facilities plans and investment strategies. The City of Hoboken plans to submit a $50,000 grant application to the NJ Department of Community Affairs ("NJ DCA") for Community Development Block Grant Disaster Recovery ("CDBG-DR") funding to prepare a Municipal Hazard Mitigation Plan to supplement the 2008 Hudson County All Hazards Mitigation Plan. Second, the City plans to submit a $50,000 grant application to the NJ DCA for CDBG-DR to prepare an Open Space, Recreation and Historic Preservation Plan to examine the recreational and historic resources of the city in relation to flood hazard mitigation. Finally, the City plans to submit a $30,000 grant application to the NJ DCA for CDBG-DR to prepare a 5 year Capital Improvement Plan that will focus on municipal resiliency and hazard mitigation. If funded, these plans will be completed in one year.

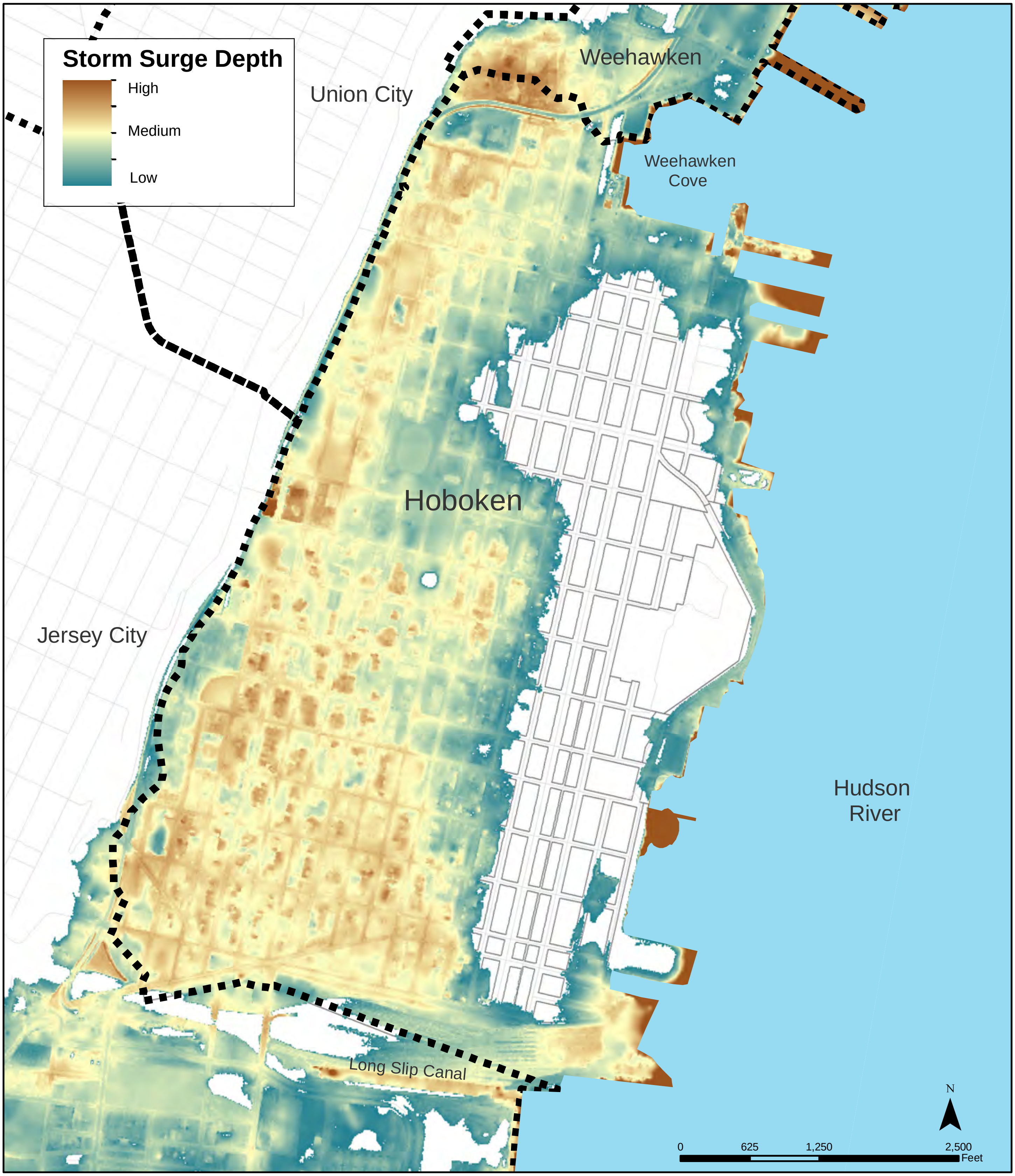
g. Resilient Building Codes: The City of Hoboken is a dense urban landscape with many mid-rise and high-rise residential buildings interspersed with historic brownstones and ground-level retail establishments. It is not feasible for building owners to raise their attached multi-story structures to comply with the Federal Emergency Management Administration ("FEMA") and National Flood

Insurance Program ("NFIP") regulations and requirements. Therefore, the City is working with FEMA, the N.J. Department of Environmental Protection ("NJDEP") and the N.J. Department of Community Affairs ("NJDCA") to reconcile the city's zoning code with state and federal regulations to allow for "wet floodproofing" and "dry flood proofing" of ground level floors located below the Base Flood Elevation ("BFE"). Of particular concern, is the utilization of space on the street level of buildings in the flood hazard area. State and federal regulations prohibit/discourage residential and mixed-use buildings from having usable space on the ground floor if that level is located below the BFE. This would have an adverse impact on street life and community character. If implemented, existing state and federal regulations would discourage urban design which facilitates "eyes on the street" which in turn would adversely impact public safety and security. In addition, state and federal regulations prohibit/discourage elevator mechanicals from being located anywhere below the BFE. Therefore in some areas the lowest level an elevator may be located in is the second floor. This in turn necessitates the construction of elaborate and excessive handicapped ramps to comply with the Americans with Disabilities Act ("ADA"). The City is applying to the NJDCA for $50,000 in Community Development Block Grant Disaster Recovery ("CDBG DR") to update its design standards and another $20,000 to update its stormwater management and floodplain protection zoning ordinances. If funded, these projects would be completed within one year.

h. Public Information: The City of Hoboken has applied to the State of New Jersey for Hazard Mitigation Grant funding to engage in a public information and awareness campaign to advise residents of natural and man-made hazards and recommend that citizens put together preparedness plans. While the City's social media program is relatively robust with over 14,000 followers, the public information campaign could be rolled-out in less than one year.

i. Resiliency Task Force: The Mayor has created a "Resiliency Task Force" within her administration to develop ideas, policies, projects and programs to advance community recovery and resiliency and to oversee the implementation of those projects which are ultimately approved and/or funded. The task force will also be involved with the implementation of a Community Rating System ("CRS") which will ultimately make the City more resilient and reduce homeowners' flood insurance premiums by as much as 45%. The work of the task force is on-going.[4]

[4] City of Hoboken Resilient Improvements Map



Source: FEMA 2013, NJDEP, City of Hoboken

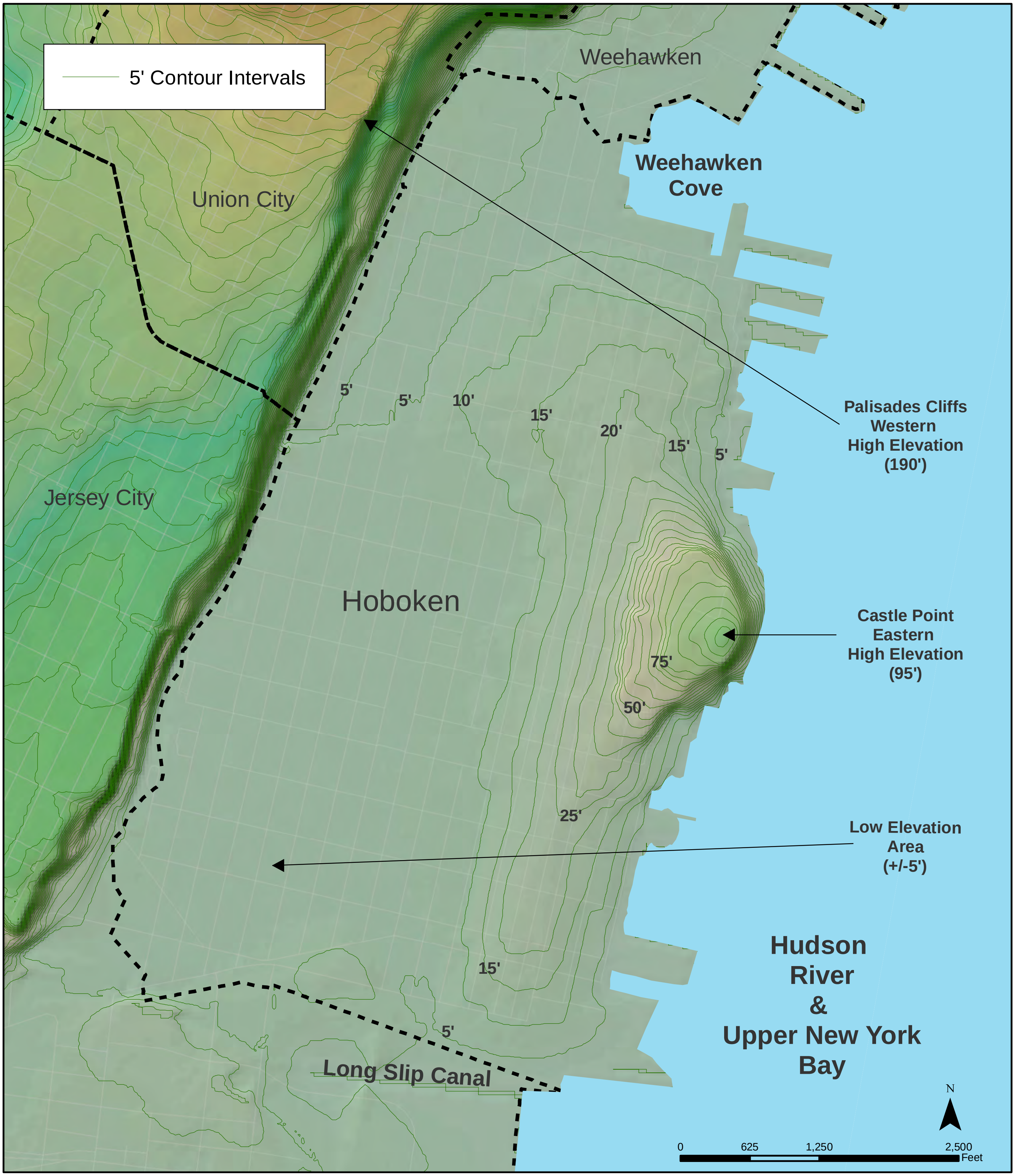
DRAFT

August 27, 2013

Hurricane Sandy: Storm Surge Limits

City of Hoboken

Reference Map 1



Source: FEMA 2013, NJDEP, Rutgers, City of Hoboken

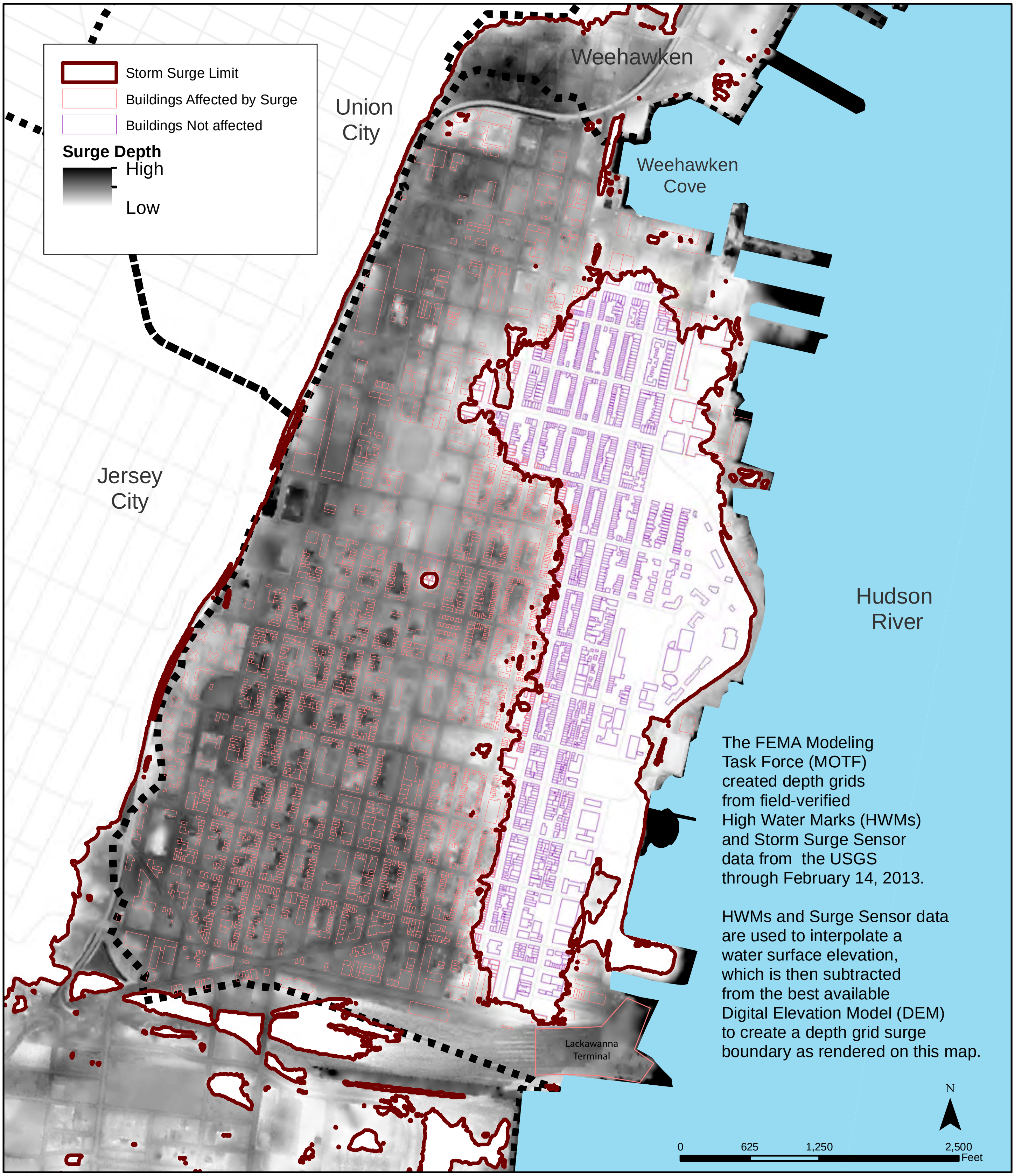
DRAFT

August 27, 2013

Hurricane Sandy: Key Topographic and Hydrologic Features

City of Hoboken

Reference Map 2



Source: FEMA 2013, NJDEP, Rutgers, City of Hoboken

DRAFT

August 27, 2013

Hurricane Sandy: Spatial Extent of Damages

City of Hoboken

Reference Map 3

Source: City of Hoboken, Hudson County

DRAFT

August 30, 2013

Hazard Mitigation Measures

City of Hoboken

This map is a graphic representation of mitigation measures. Specific locations and engineering details are yet to be determined.

Reference Map 4

CITY OF HOBOKEN

Office of the Business Administrator

DAWN ZIMMER
Mayor

QUENTIN WIEST
Business Administrator

STEPHEN D. MARKS, PP, AICP
Assistant Business Administrator

TO: SEAN THOMPSON, NJ DCA, LOCAL PLANNING ASSISTANCE
FROM: STEPHEN MARKS, ASSISTANT BUSINESS ADMINISTRATOR (PP - LICENSE NO. 33LI00568500)
DATE: JULY 1, 2013
RE: STRATEGIC RECOVERY PLANNING REPORT

This Strategic Recovery Planning Report is being preparing in accordance with the New Jersey Department of Community Affairs' Community Development Block Grant Disaster Recovery Action Plan ("CDBG DR") and the Post Sandy Planning Assistance Grant Program Description and Guidelines. The program engages professional planners to evaluate the impacts of the disaster on relevant community features. The evaluation can be broad or narrow but should focus on planning goals, strategies, and priorities leading to actions that are most urgently needed for public safety and economic recovery. The Strategic Recovery Planning Report should serve as a guide for actions taken henceforth not only to recover from the effects of Superstorm Sandy but also to reduce vulnerabilities to future disasters. All reports must contain detailed descriptions of the projects proposed, planned implementation dates, and proposed funding sources for such projects.

<u>Background</u>

The City of Hoboken is located in Hudson County, New Jersey immediately across the Hudson River from mid-town Manhattan (New York City). According to the 2010 U.S. Decennial Census, the community has a population of 50,005 residents. There are 25,041 occupied households in the 1.275 square mile city. This includes over 12,000 condominium units located mostly in mid-rise, high-rise and mixed-use buildings. The city is bounded to the east by the Hudson River and the Upper New York Bay. To the south is New Jersey Transit's Hoboken Rail Yard and the "Downtown" neighborhood of Jersey City, N.J. with Route 78 and the Holland Tunnel. Immediately to the west are the Palisades cliffs, the "Heights" neighborhood of Jersey City, N.J. and the City of Union City, N.J. To the north is the Township of Weehawken with the Route 495 "Helix" leading to the Lincoln Tunnel.

Hoboken's "Castle Point" was originally an island outcrop surrounded by tidal mudflats and coastal wetlands until it was gradually filled-in and developed. The area was settled by Dutch and English colonist between 1633 and 1645. It became a self-governing township in 1849 and was incorporated as a city in 1855. Its grid-like roadway system was laid out in the early 1800s and its sewer system was constructed in the 1880s which still services the city to this day.

Topographically, the city resembles a bowl with higher elevations occurring along Castle Point and the Hudson River to the east and the Palisades Cliffs to the west. To the north and south are man-made structures including the Hoboken Rail Yards and the Hudson Bergen Light Rail tracks and embankment which are built at higher elevations than the center of the city.

Hurricane Sandy

On October 27, 2012 Governor Chris Christie declared a state of emergency for the State of New Jersey in advance of Hurricane Sandy. On October 28, 2012 President Barack Obama issued an emergency declaration for the State of New Jersey and the City of Hoboken issued a mandatory evacuation order for the occupants of all ground level housing units. On October 29, 2012 at approximately 8:45 p.m. the wave heights of the storm surge were recorded at nearly 14' near the New York battery. Water piled into the city through the "Long Slip Canal" located immediately to the south of Hoboken and the "Weehawken Cove" located immediately to the north of Hoboken. As a result, an estimated five-hundred-million (500,000,000) gallons of water from the Hudson River breached Hoboken's shoreline and flooded the central and western portions of the city.

After the storm surge, all three electrical substations in Hoboken were flooded and knocked off-line. Over 21,000 homes and businesses in the city lost electrical power, representing over 90% of the city. Only homes on 11th Street (between Garden St. and Washington St.) and Hudson Street (between 4th St. and 11th St.) did not lose power. Critical community facilities were flooded and severely damaged, including the Hoboken University Medical Center ("HUMC"), the North Hudson Sewerage Authority's sewage treatment plant, three out of four of Hoboken's Fire Houses, the Ambulance Corps., the city's Department of Public Works ("DPW") garage and the city's Multi-Service Center which houses public health, social service, nutritional and recreation programs for children, seniors, the disabled and low-income residents.

The city's two major supermarkets were flooded, one sustaining over $1 million in damages. The city's only gasoline stations were also flooded and rendered inoperable. Without power, Hoboken's municipal Police fleet and Fire Department apparatus had to refuel in neighboring communities. Without electricity, building mechanicals and systems failed, including fire alarms, hallway and stairwell lights and even water pumps. Water for both residential consumption and fire suppression did not reach above the third floor of most mid-rise and high-rise structures.

Communications became a major challenge during the event. Brackish saltwater from the Hudson River damaged underground copper telephone lines. Without electricity, televisions, cable boxes and fiber optic telephone systems did not work. Cell phone antennas did not work without electricity and cell phones were inoperable after a day or two. The repeaters for the Police Department and Fire Department radio systems were powered by emergency back-up generators which needed to be refueled every few hours. Several times during the crisis radio systems failed.

In all, it is estimated that Hurricane Sandy caused more than $100 million in property damages to over 1,750 ground level households and businesses which were flooded and over 1,000 private automobiles and vehicles which were destroyed. It took nearly 5 days for the waters to recede throughout the city and a week to 10 days for power and gas to be restored to most areas of the city. Thousands of electrical subpanels and gas meters in residential and commercial buildings were damaged by flood waters and needed to be replaced.

The Fire Department did not return to its damaged headquarters or fire stations for over 10 days. It took over a month for the municipal DPW garage to become operational and the city's Multi-Service Center is still out of service.

Action Plan

The City of Hoboken has developed the following recovery and resiliency plan to address vulnerabilities and mitigate against future flooding and disaster events.

- Energy Resiliency: The City of Hoboken is working with the U.S. Department of Energy, Sandia National Laboratory, the N.J. Board of Public Utilities and Public Service Electric and Gas ("PSEG") to design a "Micro-grid" which will utilize Energy Surety Design Methodology ("ESDM"). This is the first non-military application of this technology designed for an entire community. In conjunction with PSEG's "Energy Strong" program and the availability of funding, the City of Hoboken will designate critical community facilities to deliver un-interrupted electrical service during disaster events, black-outs and brown-outs. Critical community facilities will include the police headquarters, fire headquarters and fire stations, the Hoboken Volunteer Ambulance Corps., the Hoboken University Medical Center ("HUMC"), the North Hudson Sewerage Authority's sewage treatment plant and flood pumps, city hall, the DPW Central Garage, the Multi-Service Center, shelters, grocery stores and fuel stations, as well as residential buildings with large at-risk populations like seniors and the disabled. Design of the Micro-grid will be completed in the fall of 2013. PSEG has proposed eliminating one of its electrical substations in Hoboken and elevating the two remaining substations to protect them from future flooding. The City has applied to the State of New Jersey for $1.3 million in Hazard Mitigation Grant Program ("HMGP") funding to purchase and install natural gas powered emergency back-up generators for critical municipal facilities. While this project may be constructed in 1-2 years, it is largely contingent upon funding.

- Shoreline Protection: The City of Hoboken applied to the State of New Jersey for $33 million in Hazard Mitigation Grant Program ("HMGP") funding for the installation of seawalls and flood barriers to keep high tides and storm surges from breaching Hoboken's waterfront in the future. In addition, city officials have met with the Governor's staff, NJ Transit executives and FEMA representatives to formally request the elimination/hardening of the Long Slip Canal where flood waters entered the community. City officials also met with the U.S. Army Corps of Engineers to request that the Corps focus on Hoboken's shoreline as part of its $20 million North Atlantic Coast Comprehensive Study. The City will examine the feasibility of incorporating an armored levee or flood barrier into the design of phase II of the 1600 Park Avenue/Hoboken Cove park project at Weehawken Cove. While these infrastructure improvements may be constructed in 3-5 years, they are largely contingent upon funding.

- Flood Mitigation: The City of Hoboken supported the North Hudson Sewerage Authority's ("NHSA") $20 million grant application for Hazard Mitigation funding to construct new wet weather pump stations to alleviate flooding. In addition, the city submitted a Letter of Intent ("LOI") to the New Jersey Environmental Infrastructure Trust for a $9 million low interest loan to install a new wet weather pump station at 11th Street along the waterfront. If funded, the City will pay for the pump station's construction and the NHSA will operate and maintain the pump station in perpetuity. Design of the H-5 pump station is complete and the project is "shovel ready". If funded, this project would be completed in 1-2 years.

- Stormwater Management: The City of Hoboken has applied to the State of New Jersey for $60 million in Hazard Mitigation funding to purchase three tracts of land in the flood hazard area. If funded, the tracts of land will be used for parks and open space with stormwater retention facilities incorporated into the design to reduce stormwater runoff. The City was recently chosen in a national competition by the "Re.InvestInitative.org" to receive $300,000-$500,000 in technical assistance to design and fund sustainable and resilient "green infrastructure" to reduce the effects of climate change and extreme storm events. In addition, the City was chosen by "Together North Jersey" to receive $90,000 in technical assistance to examine the City's combined sewer system and quantify the benefits that green infrastructure will have on reducing flooding and stormwater run-off. Finally, the City received a $20,000 grant from "Sustainable Jersey" to design a rain garden which will be used as a prototype for other sites around the city to absorb and temporarily store stormwater runoff.

  The City is in active negotiations with the property owners of the aforementioned parcels. Acquisition of the first tract of land is expected to take place by the end of summer 2013. The Together North Jersey Local Demonstration Project and the City's Green Building and Environmental Sustainability master plan element will both be completed in the fall of 2013. Design of the curb extension rain garden is complete and the city expects to go to construction by the fall of 2013. The Re.InvestInititive.org plan is expected to take 1-2 years to prepare.

- Critical Facilities/Infrastructure: Many of Hoboken's municipal facilities sustained significant damage during Hurricane Sandy. The Fire Headquarters and two Fire Stations were flooded during the event and had to be evacuated until flood waters receded. The Public Works central garage was flooded, evacuated and the city lost 36 municipal vehicles. The city's Multi-service Center which is a community center with space for several non-profits who serve special needs and low-mod income residents was significantly damaged and is still closed for renovations. The public library, volunteer ambulance corps, and midtown parking garage were also flooded and suffered significant damage. Finally, Hoboken's municipal parks and recreational facilities were damaged due to the hurricane, including Pier C, the Boys and Girls Club, and Jackson Street Park.

Damage to the above critical community facilities and municipal infrastructure highlights the need for rational and coherent municipal facilities plans and investment strategies. The City of Hoboken plans to submit a $50,000 grant application to the NJ Department of Community Affairs ("NJ DCA") for Community Development Block Grant Disaster Recovery ("CDBG-DR") funding to prepare a Municipal Hazard Mitigation Plan to supplement the 2008 Hudson County All Hazards Mitigation Plan. Second, the City plans to submit a $50,000 grant application to the NJ DCA for CDBG-DR to prepare an Open Space, Recreation and Historic Preservation Plan to examine the recreational and historic resources of the city in relation to flood hazard mitigation. Finally, the City plans to submit a $30,000 grant application to the NJ DCA for CDBG-DR to prepare a 5 year Capital Improvement Plan that will focus on municipal resiliency and hazard mitigation. If funded, these plans will be completed in one year.

- Emergency Notification: The City of Hoboken has applied to the State of New Jersey for Hazard Mitigation Grant Program funding to purchase programmable, solar-powered, mobile message boards which can be quickly deployed during emergencies and community events to warn motorists of impending hazards or provide residents with information and instructions. This is in addition to the relatively robust emergency notification system the city already employs, including Reverse 911 and Nixle Alerts, as well as Facebook and Twitter updates. If funded, the message boards could be deployed almost immediately.

- Public Information: The City of Hoboken has applied to the State of New Jersey for Hazard Mitigation Grant funding to engage in a public information and awareness campaign to advise residents of natural and man-made hazards and recommend that citizens put together preparedness plans. While the City's social media program is relatively robust with over 14,000 followers, the public information campaign could be rolled-out in less than one year.

- Resilient Building Codes: The City of Hoboken is a dense urban landscape with many mid-rise and high-rise residential buildings interspersed with historic brownstones and ground-level retail establishments. It is not feasible for building owners to raise their attached multi-story structures to comply with the Federal Emergency Management Administration ("FEMA") and National Flood Insurance Program ("NFIP") regulations and requirements. Therefore, the City is working with FEMA, the N.J. Department of Environmental Protection ("NJDEP") and the N.J. Department of Community Affairs ("NJDCA") to reconcile the city's zoning code with state and federal regulations to allow for "wet floodproofing" and "dry flood proofing" of ground level floors located below the Base Flood Elevation ("BFE"). Of particular concern, is the utilization of space on the street level of buildings in the flood hazard area. State and federal regulations prohibit/discourage residential and mixed-use buildings from having usable space on the ground floor if that level is located below the BFE. This would have an adverse impact on street life and community character. If implemented, existing state and federal regulations would discourage urban design which facilitates "eyes on the street" which in turn would adversely impact public safety and security. In addition, state and federal regulations prohibit/discourage elevator mechanicals from being located anywhere below the BFE. Therefore in some areas the lowest level an elevator may be located in is the second floor. This in turn necessitates the construction of elaborate and excessive handicapped ramps to comply with the Americans with Disabilities Act ("ADA"). The City is applying to the NJDCA for $50,000 in Community Development Block Grant Disaster Recovery ("CDBG DR") to update its design standards and another $20,000 to update its stormwater management and floodplain protection zoning ordinances. If funded, these projects would be completed within one year.

- Resiliency Task Force: The Mayor has created a "Resiliency Task Force" within her administration to develop ideas, policies, projects and programs to advance community recovery and resiliency and to oversee the implementation of those projects which are ultimately approved and/or funded. The task force will also be involved with the implementation of a Community Rating System ("CRS") which will ultimately make the City more resilient and reduce homeowners' flood insurance premiums by as much as 45%. The work of the task force is on-going.

Comparison with Other Plans

This Strategic Recovery Planning Report has been prepared in accordance and is consistent with the New Jersey State Development and Redevelopment Plan (i.e. "The State Plan"); the New Jersey Department of Community Affairs 2013 Community Development Block Grant Disaster Recover Action Plan; the 1999 Strategic Revitalization Plan for the Hudson County Urban Complex; the Hudson County 2002 Master Plan; the Hudson County 2008 Master Plan Reexamination Report; the 2008 Multi-Jurisdictional Pre-Disaster Mitigation All Hazards Plan for the County of Hudson; the City of Hoboken 2004 Master Plan; the City of Hoboken 2008 Emergency Operations Plan; and the City of Hoboken 2010 Master Plan Reexamination Report.

Certification

The original of this report was signed and sealed in accordance with N.J.S.A. 45:14A-1, et seq. and N.J.A.C. 13:41-1.1, et seq.

Signature: ______________________________ Date: ___________________

Stephen D. Marks, PP, AICP, CFM
P.P. # 4916 & N.J. License No. 33L100568500

Stephen D. Marks
Professional Planner
State Of New Jersey
License No. 33L100568500

City of Hoboken – Critical Community Facilities
FEMA Preliminary Floodmap (June 2013)

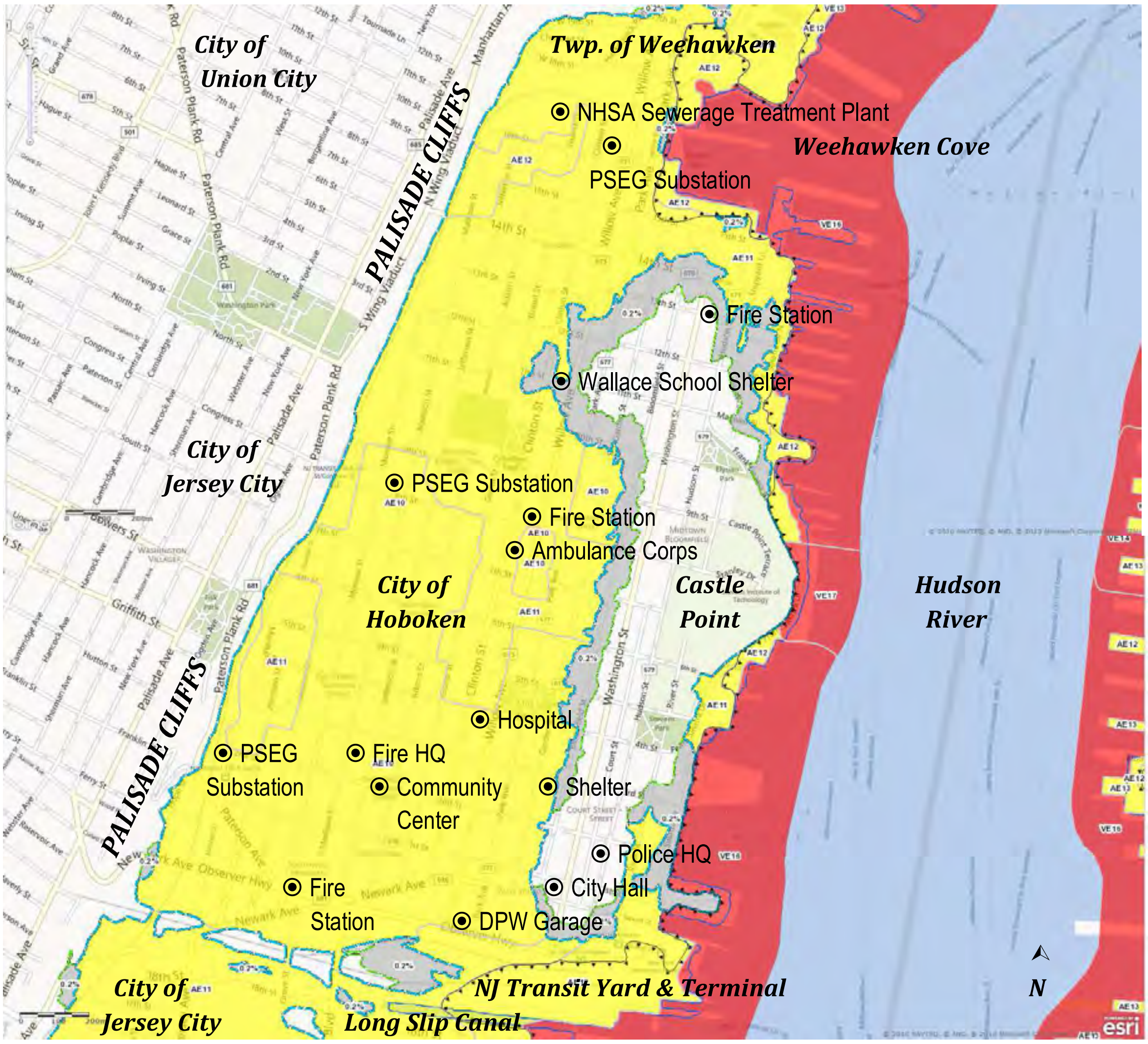


Figure 1 - FEMA Preliminary Flood Map with Critical Community Facilities (June 2013)


Storm Surge
Flood Elevations
Hoboken City, NJ
Municipalities
Hoboken City Surge Heights in Ft.
0-4
4-8
8-15.7
HOBOKEN CITY
0
0.09
0.18
0.27
0.36
0.45
Miles
N

CITY OF JERSEY CITY
FEEDBACK

1. RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, MAYOR'S OFFICE
2. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, OFFICE OF EMERGENCY MANAGEMENT
3. MAP DEPICTING STORM SURGE EXTENT
4. QUESTIONNAIRE FROM NEW JERSEY URBAN MAYORS ASSOCIATION
5. FUTURE PROJECTS DOCUMENTATION (UPLOADED TO SHAREPOINT)
6. STORMWATER MANAGEMENT PLAN (UPLOADED TO SHAREPOINT)
7. DIVISION OF ENGINEERING ASSESSMENT (UPLOADED TO SHAREPOINT)
8. JERSEY CITY BOARD OF EDUCATION ASSESSMENT (UPLOADED TO SHAREPOINT)
9. JERSEY CITY FIRE DEPARTMENT POST SANDY RESPONSE DATA (UPLOADED TO SHAREPOINT)

City of Jersey City -- September 11, 2013

This is a rough outline prepared on short notice in response to a request for information from the US Army Corps of Engineers for the North Atlantic Coast Comprehensive Study

The information contained herein was compiled by Douglas Greenfeld, AICP/PP (douglas@jcnj.org) and David Donnelly, Mayor's Office (DonnellyD@jcnj.org)

Please also see companion documents provided by Greg Kierce, director of Jersey City Office of Emergency Management.

Feedback requested:

1. Problem identification for your area:
Did your area experience tidal or tidally influenced storm surge?
Specify particular areas and water bodies within your jurisdiction that experienced storm surge.
What factors, if any, exacerbated damages from storm surge?

2. Description of damages for your area:
Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.
Provide a map depicting the spatial extent of damages.

3. Prior related studies or projects (local, state, federal) in the damaged area.

4. Measures that your jurisdiction has considered to address the problem

1. Problem Identification
    a. New York Bay, Hudson River, Tidewater Basin, Mill Creek, Newark Bay, Hackensack River
    b. Location Data
        i. OEM delineation on Google maps
        ii. Signal Controller damage data
        iii. Jersey City Fire Department – 10 Days Post sandy response data
    c. Geographic features
        i. GIS data on land use plan, zoning, historic districts, parcel layer, buildings layer, transportation infrastructure (roads, passenger rail lines (Commuter rail, light rail, PATH), freight rail lines)
    d. Exacerbating factors
        i. Storm surge water inundation via combined storm / sanitary sewers outfalls
        ii. Contaminated soil (brownfields),

iii. Critical facilities located in part within flood hazard areas (hospital, fire stations, shelters, etc.)
iv. Critical care populations
v. Loss of communications
vi. Loss of power resulting in loss of heat, traffic signals, communications, street lights, etc.
vii. Erosion impacts unknown
viii. Logistics industry storage, manufacturing facilities, port, freight rail infrastructure within flood hazard area.
ix. Hudson Bergen Light Rail within flood hazard area.

2. Description of damages
   a. Jersey City Housing Authority:
      i. Gloria Robinson corner building on Route 1 & 9 and Duncan got basement flooded – shorted out electric panels.
      ii. Lafayette Senior Center at 463 Pacific had first floor flooded. Glennview and Woodward Townhouses along Woodward had first floors flooded
      iii. Booker t. Basements all flooded, sinkholes,, etc
   b. See attached data from Jersey City OEM, Jersey City Board of Education, and Jersey City Engineering.

3. Prior studies
   a. See Jersey City Municipal Utility Authority attachments

4. Flood Hazard Mitigation measures

   a. Engineered barriers – Redundancy and tiered approach
      i. Harbor based mitigation (Upper New
      ii. Land based mitigation – neighborhood level protection
      iii. Mitigation for critical facilities and public buildings -- back up power, back up locations, dry flood proofing, wet flood proofing, flood gates.
      iv. Mitigation for private buildings – dry flood proofing, wet flood proofing, flood gates.
   b. Stormwater Management Plan -- See attached documents from Jersey City Municipal Utilities Authority and Jersey City OEM.
      i. Detention tank at MUA site / Phillips Drive.
      ii. Outfall pumps
      iii. EPA Consent Decree – see attached e-mail from Rajiv Prakash / MUA
      iv. Data on sewer flows – available from Rajiv Prakash / MUA

c. City / neighborhood level barrier -- Stitch together a combination of the following to provide an area wide protective barrier:

   i. Raise elevation of land through redevelopment (Liberty Harbor North, Grand Jersey, Bayfront, Newport, Western Waterfront, Harborside, etc.)
   ii. Harden existing modern structures along the waterfront
   iii. Raise elevation of streets in strategic locations
      1. Route 440/1&9T -- See boulevard study at http://www.cityofjerseycity.com/hedc.aspx?id=8314
      2. Kellogg Street
      3. Evaluate locations along Hudson River side of Jersey City (potentally portions of Grand Street, Washington Boulevard, etc.)
   iv. Potentially raise elevation of portions of Hudson River waterfront walkway
   v. Install land based flood gates in public right of ways between natural uplands, newly created uplands, and hardened structures.
   vi. Install pumping systems to remove water in the event of overtopping of flood barriers.

d. The Stevens Institute of Technology has been awarded a $50,000 NOAA Sea Grant Community Climate Adaptation Initiative for *Collaborative Climate Adaptation Planning for Urban Coastal Flooding* to do the following:

The Principal Investigators at the Center for Maritime Systems at the Stevens Institute of Technology have laid out an exciting and important research project to study how large scale harbor modifications, large scale green/soft engineering attenuation of storm surge, as well as smaller neighborhood-scale hard engineering flood protections, or even specific building - or block-scale flood protection techniques can influence flooding risk in vulnerable neighborhoods in Jersey City. The outcomes of the project will be the findings on the level of effectiveness of various flood protection techniques, selection of a priority strategy or strategies, a conference, and the formation of a Jersey City Climate Change Task Force to oversee implementation.

This project will be a collaborative effort. City staff will provide data, take part in organizing and participating in the stakeholder meetings, preparing the implementation strategy section, final review of outcomes, and collaborate on workshops and seminars presenting the various findings, as described in the proposal. The City will meet the in-kind match grant requirement of $50,000 through the cost of staff time to participate in the abovementioned activities.

Douglas Greenfeld

From: Walter Kierce [WKierce@NJJCPS.ORG]
Sent: Friday, September 06, 2013 5:29 PM
To: croomgl@cdsmith.com
Cc: Douglas Greenfeld; David Donnelly
Subject: NACCS Study
Attachments: 2013_09_06_17_24_09.pdf

Good afternoon Ginger.

Please review the following information as it relates to NACCS study

1. **Problem identification for your area:**

   Did your area experience tidal or tidally influencesd storm surge:

A. Jersey City experienced significant flooding in the downtown area emanating from wind driven storm surge from the Hudson River on the East Side as well as Big Basin tertiary waterway on the south side. This was also the case in the southern(Greenville) section of the city as result of similar activity on the Hackensack River located on the Westside of the city.

B. At the time of the onset of Hurricane Sandy the waterways were experiencing high tides preventing release of flood waters based on blocked outflows to both bodies of water.

C. Principle waterways contributing to flooding conditions were the Hudson River, Hackensack River.

D. Excessive winds, wind driven storm surge in addition to overtaxed “Combined Sewer System”.

2. **Description of damages for your area:**

A. Damages from moderate to severe were prevalent throughout the Downtown and Greenville sections of the city. Approximately 80% of the “Country Village” residential housing development consisting of one and two family homes located in the Greenville Section of the city sustained significant water damage to critical infrastructure (i.e. Electrical/Heating systems as result of surging flood waters emanating from the Hackensack river. The Pt. Liberte residential housing development located on the Hudson River at Chapel Avenue also experienced significant damage to the electrical infrastructure system as result of storm surge.
Residential and commercial high-rise structures located on the Hudson River waterfront as well as hundreds of single and multiple family residential and commercial structures located in the downtown area sustained damages to critical infrastructure as result of storm surge emanating from the Hudson River. Fortunately there were no storm related fatalities and injuries were minimal.

B. (See Attached)

3. **Prior related studies or projects (local, state, federal) in the damaged area.**

   Hudson County Multi-Jurisdictional Pre-Disaster Mitigation All Hazards Plan (Tetra-Tech September 2008)

4. **List measures that your jurisdiction has considered to address the problem**

Current storm related Mitigation Projects submitted to FEMA for consideration

JERSEY CITY M.U.A.: $61,200,000.00
(Projects may also be eligible under "406 Mitigation" program)

Instillation of storm water pumps at netting facilities:

- Essex Street $ 2,000,000.00
- Country Village $ 3,000,000.00
- 18th Street $ 5,000,000.00
- Clendenny Avenue $ 6,000,000.00
- Sip Avenue $ 3,000,000.00
- Mill Creek $ 3,000,000.00
- Claremont & Carteret Avenue(s) $ 6,000,000.00

Jersey City M.U.A. Upgrade sediment tanks to water storage vessels:

- East Side Plant $ 30,000,000.00
- Emergency generator $ 1,200,000.00

JERSEY CITY O.E.M./HOMELAND SECURITY: TOTAL $ 3,500,000.00

Emergency Generators for critical city-wide assets

- Fire H.Q.
- Police H.Q.
- North District
- South District
- East District
- West District
- City Hall
- DPW/JCIA Complex
- Consolidated Fire House
- Eng. Co # 2
- Eng. Co # 10
- Eng. Co # 8
- Battalion 2/ Eng. Co # 19
- Eng. Co # 15
- Eng. Co # 22
- Eng. Co # 11
- Battalion 4/ Eng. Co # 9
- Eng. Co # 15/ Ladder Co # 9
- Rescue # 1
- OEM/Logistics Support Building

PUBLIC WORKS/ENGINEERING: TOTAL: $525,000.00

Emergency power to traffic signals

- Scope of project is to retrofit traffic signals at 35 intersections with solar and or generator power connections @ $15,000.00 per intersections. Locations to be determined.

JERSEY CITY HOUSING AUTHORITY: Berry Gardens, Booker T. Washington, Marion Gardens, Holland Gardens: TOTAL: $ 22,020,000.00

(Projects may also be eligible under "406 Mitigation" program)

- Berry Gardens: Replacement of storm damaged façade & restoration $ 5,025,000.00
- Elevation project for Holland Gardens & Booker T. Washington $ 4,235,000.00
- Flood control project Holland Gardens & Booker T. Washington $ 9,350,000.00
- Elevation project Marion Gardens $ 3,410,000.00

The grand total of all proposed 404 Mitigation projects is $87,245,000.00,

Should you require additional information please don't hesitate to contact my office.

Yours truly,

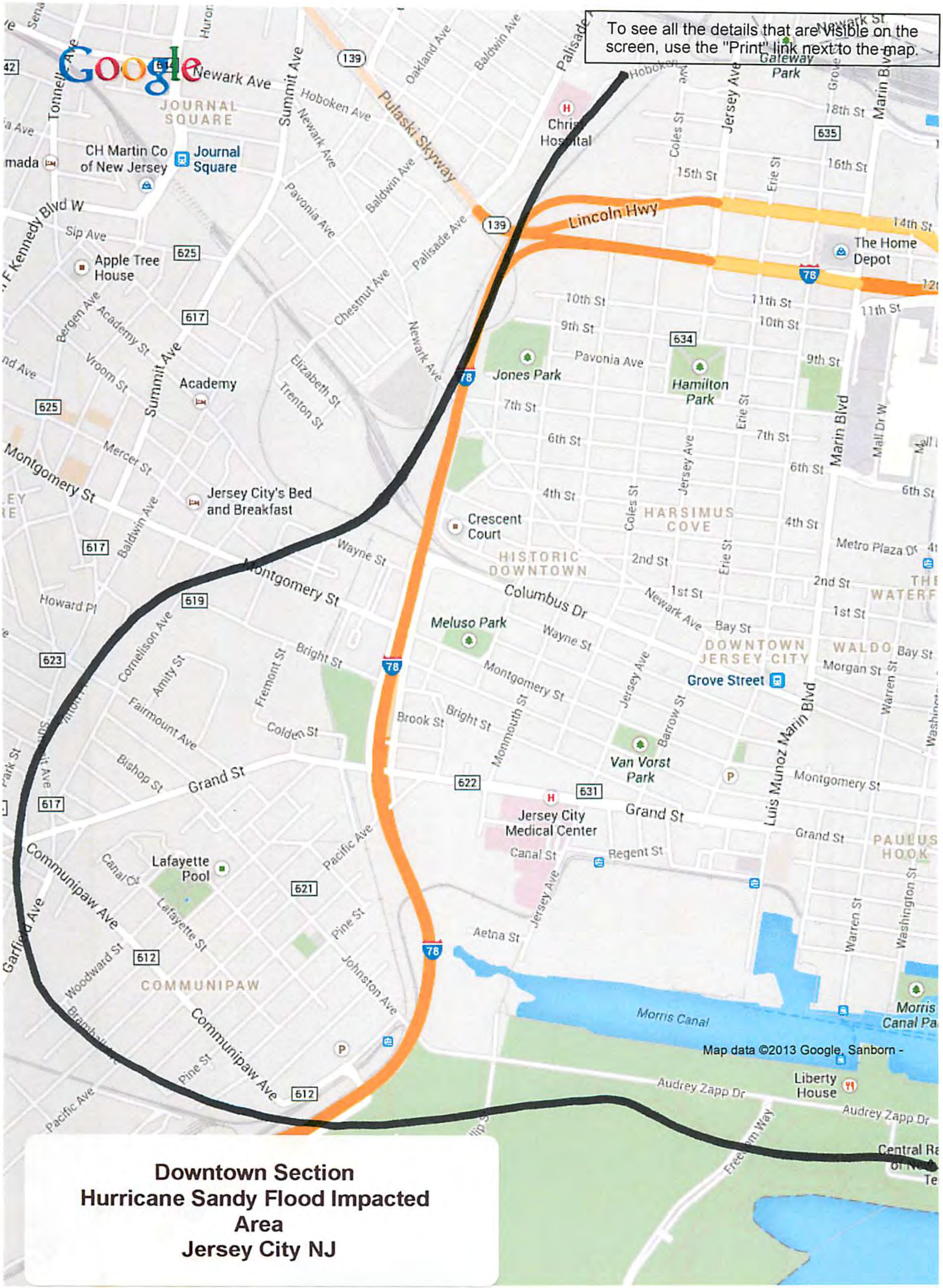
W.Greg Kierce, Director
City of Jersey City
Office of Emergency Management & Homeland Security
715 Summit Avenue
Jersey City, NJ 07306
Office: 201 547-5681
Cell: 201 201-424-8625
Fax: 201-547-5999

Google Address **Jersey City, NJ**

Country Village Residential Housing Development Greenville Section Jersey City NJ

To see all the details that are visible on the screen, use the "Print" link next to the map.

Port LiberteResidential Housing Development
Greenville Section
Jersey City NJ


To see all the details that are visible on the screen, use the "Print" link next to the map.
Downtown Section
Hurricane Sandy Flood Impacted Area
Jersey City NJ
Map data ©2013 Google, Sanborn -
JOURNAL SQUARE
Journal Square
CH Martin Co of New Jersey
Apple Tree House
Academy
Jersey City's Bed and Breakfast
Lincoln Hwy
Pulaski Skyway
Jones Park
Hamilton Park
HARSIMUS COVE
HISTORIC DOWNTOWN
Crescent Court
Meluso Park
DOWNTOWN JERSEY CITY
Grove Street
WALDO
Van Vorst Park
Jersey City Medical Center
PAULUS HOOK
Lafayette Pool
COMMUNIPAW
Morris Canal
Morris Canal Pa
Liberty House
The Home Depot
Christ Hospital
Gateway Park
Montgomery St
Columbus Dr
Grand St
Communipaw Ave
Newark Ave
Audrey Zapp Dr
Luis Munoz Marin Blvd
Marin Blvd

NJUMA HURRICANE SANDY ASSESSMENT

GENERAL INFORMATION

1. Municipality Name: _Jersey City____
2. Population: ___ 254,441 ____
3. County:______Hudson____

DAMAGES

Please mark only ONE of the given options for each question.

4. What percentage of your municipality was impacted by Sandy?
   - ☐ None of the areas were impacted
   - ☐ Less than 25% of area impacted
   - ☐ Between 25- 50% of area impacted
   - ☐ Between 50-75% of area impacted
   - **X** Over 75% of area impacted

5. What has been the impact of Sandy on property (houses, buildings)?
   - ☐ No Impact
   - ☐ Less
   - **X** Moderate -- **356**
   - **X** Severe --**171**
   - **X** Extremely Severe -- **263**

   Approximately 4,000 property owners and 10,442 renters filed for FEMA Sandy Recovery assistance.

   1,800 received between 0 and $1,000
   187 received between $10-$20,000
   50 received between $$20-$30,000
   13 received between $30,000+

6. What has been the impact of Sandy on infrastructure (transit, roads, bridges, etc.)?

☐ No Impact
☐ Less
☐ Moderate
☐ Severe
X Extremely Severe -- **PATH trains and Hudson Bergen Light Rail systems were damaged and closed. Loss of power to traffic signals necessitated an emergency driving ban.**

7. What was the impact of Sandy on health & safety?

☐ Health & safety were not impacted

☐ Few injuries / no fatalities

☐ Many injuries/ no fatalities

X Fatalities occurred **– as a result of power failure.**

☐ Other, please describe ______________________________

8. What has been the impact on parks and environmental resources?

☐ No Impact
☐ Less
X Moderate
☐ Severe
☐ Extremely Severe

9. What has been the impact on water, waste and sewer?

☐ No Impact
☐ Less
X Moderate
☐ Severe
☐ Extremely Severe

10. What has been the impact on utilities-gas and electric?

☐ No Impact
☐ Less
☐ Moderate
X Severe **-- Major damage to PSE&G Substations**

☐ Extremely Severe

11. What has been the impact on schools?

☐ No Impact
☐ Less
X Moderate
☐ Severe
☐ Extremely Severe

12. What has been the impact on labor?

☐ No Impact
☐ Less
X Moderate
☐ Severe
☐ Extremely Severe

13. Please indicate the utilities that were affected by Sandy.

- **Jersey City Municipal Utilities Authority (Storm and sanitary sewers)**
- **PSE&G Substations at 63rd Street, Marion, and Grand Street.**

14. What is the total estimated cost of damages/ biggest issues caused by Sandy?

Housing: **Approximately $5 million**

Business: **100% of Jersey City businesses were impacted due to power outages.**

Health: **Approx. $2 million -- Flooding at Jersey City Medical Center, and power outages at Christ Hospital**

Labor: **Approx. $2 million – Businesses impacted as a result of Sandy Damage and power outages.**

Schools: **Approx. $1 million**

Transit, Roads and Bridges: **Unknown – PATH train damage and Hudson Bergen Light Rail damage.**

Parks and Environment: **Approx $1 million**

Waste, Water and Sewer: **Approx $20 million**

Utilities-Gas and Electric: **Unknown – private provider is PSE&G**

Additionally, the total loss of tax ratable property was $12,337,900.

CURRENT PROJECTS AS A RESULT OF SANDY

15. What kind of projects are you currently undertaking?

☐ Repairing the damages
☐ Infrastructure Rebuilding
X Both
Details: **Repairs to the basement of City Hall, parks, and municipal sewer infrastructure.**

16. List ongoing projects, their estimated costs, source of funding, and estimated completion time.

Name of Project	Estimated Cost	Source of Funding	Estimated Completion Time
Cleanup and repairs to City Hall basement.	$1.8 million	Jersey City Hurricane Sandy Bond Fund	Ongoing
Evaluation of Storm Damaged Electrical System in City Hall	$1 million		Ongoing
Repairs to JC MUA sewer infrastructure	$20 million	MUA	Ongoing
Replacement of pedestrian and bicycle bridge to Liberty State Park	$800,000	Jersey City Hurricane Sandy Bond Fund	Completed
** NOTE: All of the above projects are awaiting approval from FEMA for reimbursement funding.			

DREAM PROJECTS

17. List the projects you would like to undertake which would protect your city from future natural catastrophes such hurricanes. Also, state their estimated cost and completion time?

Name of Project	Estimated Cost	Estimated Completion time
Emergency Generator for critical Jersey City assets.	$20 million	Awaiting section 406 FEMA mitigation funding
Flood barriers at flood prone critical assets	Approximately $1.5 million per square mile	Awaiting input from FEMA / US Army Corp of Engineers

18. What steps were taken prior to/during/following Sandy in terms of emergency response?

    The Office of Emergency Management pre-staged critical equipment related to shelter operations, issued evacuation orders to flood prone locations throughout the city, ensured proper staffing levels of emergency personnel, prepared emergency response equipment, monitored and tracked storm as it approached, and provided storm updates to mayor and senior staff.

19. What steps should be taken to improve the efficiency of emergency response management?
    a. **Revisit disaster preparation planning processes.**
    b. **Develop framework for quarterly disaster preparation self examination among municipal officials and community stakeholders.**
        i. **Use CERT team members to assist as needed.**
        ii. **Develop a disaster preparation plan that utilizes a community volunteer base**
    c. **Enhance communications capabilities, especially for when power outages occur and normal communications technologies are not available.**
        i. **Expand use of social media, and municipal alert system**
        ii. **Establish satellite information centers for distribution of information and intake of citizen complaints.**
    d. **Update the registry of residents who have special needs.**

CITY OF ELIZABETH

FEEDBACK

1. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, CITY ENGINEER
2. THIRD AVENUE FLOOD STUDY (UPLOADED TO SHAREPOINT)
3. FIVE (5) DAMAGE SURVEY ASSESSMENTS PERFORMED BY ENVAR (UPLOADED TO SHAREPOINT)
4. FOUR (4) FEMA ENGINEERING REPORTS PERFORMED BY HATCH MOTT MACDONALD (UPLOADED TO SHAREPOINT)

Bui, Frances

From: Daniel J. Loomis [dloomis@elizabethnj.org]
Sent: Friday, August 30, 2013 2:49 PM
To: Croom, Ginger
Cc: Bui, Frances; Steve Rinaldi; Camille Madorma
Subject: USACE - North Atlantic Coast Comprehensive Study (NACCS)
Attachments: NYBTJB_RLA_letter.pdf

Dear Ms. Croom,

In response to the attached Army Corps of Engineers letter dated August 23, 2013. Below, please find the requested information for the North Atlantic Coast Comprehensive Study.

Feedback responses

1.a. They City of Elizabeth experienced a tidal/tidally influenced storm surge.
1.b. The surge pushed up the Arthur Kill and Kill Van Kull into Newark Bay and up the Elizabeth River. (The Arthur Kill, Newark Bay and Elizabeth River are within the City's Jurisdiction). The entire Elizabeth waterfront was affected by the surge as well as inland properties adjacent to the Elizabeth River.
1.c. We are unaware of any factors the exacerbated the damages from the storm surge other than our location at the confluence of the Arthur Kill and Kill Van Kull.

2.a. The City had extensive damage to its waterfront parks and recreation areas, three (3) pumping stations and two (2) combined sewer netting facilities as a result of the surge. (Damage assessments for these facilities were transmitted via FTP)
2.b. Maps depicting the damaged facilities are included in the damage assessments provided.

3. As a combined sewer community in a tidally influenced area, our collection systems are heavily influenced by the tides. We have included with the other files transmitted to you a Feasibility Study for a sewer project in the area affected by the tide and storm surge. The first phase of the project was recently been completed.

4. Currently we are reviewing a number of mitigation measures for our pumping stations (flood proofing the buildings) and waterfront areas (hold down measures for timber structures and additional erosion protection).

Please contact me should you have any questions. Also, please confirm receipt of the documents provided via FTP.

Thank you,

Dan

Daniel J. Loomis, PE
City Engineer
City of Elizabeth
50 Winfield Scott Plaza
Elizabeth, NJ 07201
Phone: (908) 820-4269
Fax: (908) 820-4087
Email: dloomis@elizabethnj.org

TOWN OF CORTLANDT
FEEDBACK

1. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, MAYOR'S OFFICE
2. MAP DEPICTING STORM SURGE EXTENT

Bui, Frances

From: Croom, Ginger
Sent: Friday, September 06, 2013 3:14 PM
To: Bui, Frances
Subject: Fwd: NACCS -NY Bay, Its Tributaries and Jamaica Bay Reconnaissance Level Analysis - COORDINATION (UNCLASSIFIED)
Attachments: NYBTJB_RLA_letter.pdf; ATT00001.htm; Town of Cortlandt.pdf; ATT00002.htm

Sent from my iPhone

Begin forwarded message:

From: "Jeff Coleman" <JeffC@townofcortlandt.com>
To: "Croom, Ginger" <CroomGL@cdmsmith.com>
Subject: FW: NACCS -NY Bay, Its Tributaries and Jamaica Bay Reconnaissance Level Analysis - COORDINATION (UNCLASSIFIED)

Ms. Croom

In response to your request for information the Town of Cortlandt, NY offers the following:

1. a) The Town of Cortlandt experienced tidal storm surge along the areas adjacent to the Hudson River and its tributaries.
b) Areas along the banks of the Hudson River, Annsville Creek, Sprout Brook and Lake Meahagh.
c) Power outages, downed utility poles and downed trees cut off areas of the Town and made emergency response and evacuation difficult

2. a) The Town experienced the following.
- Route 6 was impassable in the Annsville creek area due to tidal storm surge.
- Trailer park on the banks of the Hudson River experienced tidal storm surge, sustained damage to mobile homes, and had to be evacuated.
- Kings Ferry Road was made impassible due to flooding. Other roads were impassible at the time, thereby cutting off the Hamlet of Verplanck from the rest of the Town.
b) Map showing extent of impacted area is attached.

3. No recent studies or projects have been completed.

4. The Town has not experienced flooding of this magnitude in recent history.

If we can be of any additional assistance please contact us.

Thank you,
Jeffrey Coleman

Jeffrey C. Coleman, PE

Director, Department of Environmental Services

Town of Cortlandt

914-737-0100

914-737-1655 (fax)

Jeffc@townofcortlandt.com

-----Original Message-----
From: Cresitello, Donald E NAN02 [mailto:Donald.E.Cresitello@usace.army.mil]
Sent: Friday, August 23, 2013 7:09 AM
To: csanders@piermont-ny.org; supervisor@orangetown.com; mayor@hastingsgov.org; bsmith@irvingtonny.gov; mblau@tarrytowngov.com; jmaybury@mtpleasantny.com; jtp2@westchestergov.com; eeb6@westchestergov.com; mayorconnett@dobbsferry.com; lwiegman@crotononhudson-ny.gov; aruggiero@cityofpeekskill.com; Smurray@villageofbuchanan.com; hanauer@villageofossining.org; pzegarelli@briarcliffmanor.org; agiaccio@villageofsleepyhollow.org; Linda Puglisi; laura.sager@ccswcd.org; dutch@dutchessswcd.org; jeff@gcswcd.com; joel@gcswcd.com; kevin.sumner@ocsoil.org; lauri.taylor@putnamcountyny.gov; envcomm@alpinenj.org; jfussa@baynj.org; kcavanagh@bellevillenj.org; rmccarthy@bloomfieldtwpnj.com; mayor@bogotaonline.org; zoningdept@carlstadtnj.us; oem@carteret.net; szoklu@cliffsideparknj.gov; administrator.boro@cresskillboro.org; mayor@eastbrunswick.org; boroughofeastnewark@verizon.net; cityadmin@ci.east-orange.nj.us; DPW@EastRutherfordNJ.net; info@edgewaternj.org; mayorricigliano@edisonnj.org; DLoomis@ElizabethNJ.org; frankhuttle@englewoodmayor.com; dtesta@fairviewborough.com; mayor@fortleenj.org; apavlica@garfieldnj.org; townclerk@myguttenberg.com; adib@hackensack.org; mlgravinese@harrisontwp.us; Mayor@hasbrouck-heights.nj.us; minkoffhp@gmail.com; qwiest@hobokennj.org; rbyrne@jcnj.org; mayor@kearnynj.org; jterhune@leonianj.gov; rbanks@linden-nj.org; mayor@littleferrynj.org; recruitment@emergencysquad.com; MaywoodMayor@aol.com; weboerth@metuchen.com; tciannamea@moonachie.us; gpatterson@cityofnewbrunswick.org; cdemiris@newmilfordboro.com; ramosa@ci.newark.nj.us; pmassa@northarlington.org; jcraviolo@northbergen.org; mayorpetracco@nutleynj.org; Mayor@oldbridge.com; mayor@oradell.org; borohall@palisadesparknj.us; BoroClerk@paramusborough.org; mayor@cityofpassaicnj.gov; lmartinez@perthamboynj.org; mceder@piscatawaynj.org; mayorproctor@cityofrahway.com; rpdeputy@nj.rr.com; ddondiego@bor.river-edge.nj.us; clerk@rockleigh.org; acacciatore@rutherford-nj.com; terry@sayreville.com; mgonnelli@secaucus.net; mayor@southamboynj.gov; poconnor@southrivernj.org; Npoliseno@spotswoodboro.com; jevelina@teanecknj.gov; phale@tenafly.net; senstack@njleg.org; v.baginski@verizon.net; roladahboul@tow-nj.net; gpope@westnewyorknj.org; WBMAYOR@twp.woodbridge.nj.us; erica.betti@co.middlesex.nj.us; engineering@co.middlesex.nj.us; ettiere@ucnj.org; jgraziano@ucnj.org; joedi@admin.essexcountynj.org; svarghese@essexcountynj.org; gjaramillo@hcnj.us; mferrara@hcnj.us; countyexecutive@co.bergen.nj.us; TCasey@co.bergen.nj.us
Cc: Cackler, Olivia N NAN02; Bui, Frances; Croom, Ginger
Subject: NACCS -NY Bay, Its Tributaries and Jamaica Bay Reconnaissance Level Analysis - COORDINATION (UNCLASSIFIED)
Importance: High

Classification: UNCLASSIFIED
Caveats: NONE

Dear Stakeholder,

Please see attached letter regarding the North Atlantic Coast Comprehensive Study NY Bay, Its

Tributaries and Jamaica Bay Reconnaissance Level Analysis. We are looking to coordinate with you to gain input to the Study, no later than September 6, 2013.

As stated in the letter, please coordinate directly with Ginger Croom (contractor) and Roman Rakoczy (USACE), both copied on this email.

Thanks,
Donald E. Cresitello
Coastal Planning Regional
Technical Specialist
26 Federal Plaza, Room 2145
New York, NY 10278
917-790-8608

Classification: UNCLASSIFIED
Caveats: NONE

Extent of Damages

TOWN OF CORTLANDT NEW YORK

LEGEND

Parcels

Disclaimer: "The information contained in this data is NOT to be construed as a "legal description". The Town and its consultants do NOT provide any guarantee of accuracy or completeness and will NOT be held liable for any damages or losses due to its use."

Scale: 1 " = 8,000 '

0 4,000 8,000 16,000 Feet

TOWN OF STONY POINT

FEEDBACK

1. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY
2. MAP DEPICTING STORM SURGE EXTENT

Bui, Frances

From: Croom, Ginger
Sent: Thursday, September 19, 2013 4:10 PM
To: Bui, Frances
Subject: FW: USACE NACC Study - Stony Point Potential Projects
Attachments: Stony Point Aerial v4_FloodZone.pdf; Stony Point Aerial v4.pdf

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From: Durfee, Daniel
Sent: Thursday, September 19, 2013 4:04 PM
To: Croom, Ginger
Cc: Vignola-Henry, Nanette; Chris Robbins; Cesanek, William
Subject: RE: USACE NACC Study - Stony Point Potential Projects

Ginger, sorry I didn't frame the response back in the format you requested. I was simply rushing to at least get you some info on Stony Point and missed your attachment. Unfortunately, we just sat down w/ the community 2 weeks ago and are in the very early stages of understanding the damage and the path forward. Based on a meeting we had with the NYR Community Committee last night and in response to your questions to date, here's what we know:

1. You can list the source of initial information below as the Town of Stony Point - New York Rising Community Committee, 9/18/13. The Committee would like the preliminary measures listed in the report.
2. The Town of Stony Point experienced tidally influenced storm surge from Sandy throughout the Hudson River shoreline and bay area. The surge from Sandy was reported to crest at ELEV 10.25 in the Town.
3. In addition to the storm surge, 10 -15 ft waves were also experienced as the storm passed through the area which caused further damage to housing, boats, marinas, docks, sea walls, breakwater structures, etc.
4. We'll need to follow-up w/ a more comprehensive narrative of damages. But dozens of houses, mobile homes and structures were completely wiped out and families have been displaced.
5. See map of flood zones and storm surge zones.
6. As you know the Town has just begun preparing a NY Rising Community Plan. The outcome of this effort is to develop a plan that will guide the community in becoming more resilient to extreme natural events. Another outcome will be a specific list of short, medium and long-term strategies, programs and actions that can be funded by the NYRC program, FEMA hazard mitigation funding, CDBG-DR, USACE or other sources.

Let's keep the communication lines open as we move forward as there seems to be a need for considerable input and interaction on each program we are working on.

Thanks~

Dan

Daniel D. Durfee, P.E, BCEE | Associate | CDM Smith | 11 British American Boulevard, Suite 200 | Latham, NY 12110
T: 518.782.4506 | C: 518.275.9527 | F: 518.786.3810 | durfeedd@cdmsmith.com | cdmsmith.com

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From: Durfee, Daniel
Sent: Thursday, September 19, 2013 1:51 PM
To: Vignola-Henry, Nanette
Subject: USACE NACC Study - Stony Point Potential Projects

Nanette, at our NYSCR Committee Mtg yesterday I mentioned the above study and requested feedback on potential projects from the Committee. The projects below were quickly identified and discussed:

1. **21-in Cedar Pond Brook Sewer Line Replacement** - Approximately 800-1,000 LF of the existing sewer is on wooden piles and has been washed out by previous storms including Iren, Lee and Sandy. The pipeline replacement project has been designed and a joint permit submitted to NYSDEC and USACE but permit has not been finalized.
2. **Stony Point Battlefield Ferry Landing** – Registered Historic site along Hudson in Stony Point that is now owned by NYSDEC. Ferry Landing was washed out by Sandy and needs to be protected to preserve historic site.
3. **Refortify Sea Walls, Jetties and Breakwater Protection** – In addition to storm surge during Sandy, waves off Hudson along Stony Point shoreline were reported at over 10-15 ft by residents. Sea wall along River Rd and Beach Rd has been severely undermined and needs to be rebuilt, Jetties along River Road were damaged and need to be reinforced and breakwater structure in front of bay was damaged and needs to be repaired.
4. **Dredging Navigational Channels reconnecting Stony Point marinas, boat launches and bay to Hudson River**
5. **WWTP Upgrades** – Raze and/or protect critical structures including pumps, controls & emergency power. Over $1M in damage occurred to WWTP as a result of Sandy storm surge.

I'm sure there will be many other projects that will surface over the next few months but these were the main projects that were identified in a brief discussion with the Committee. Let me know what add'l information is required by USACE to support Stony Point projects within the NACC study.

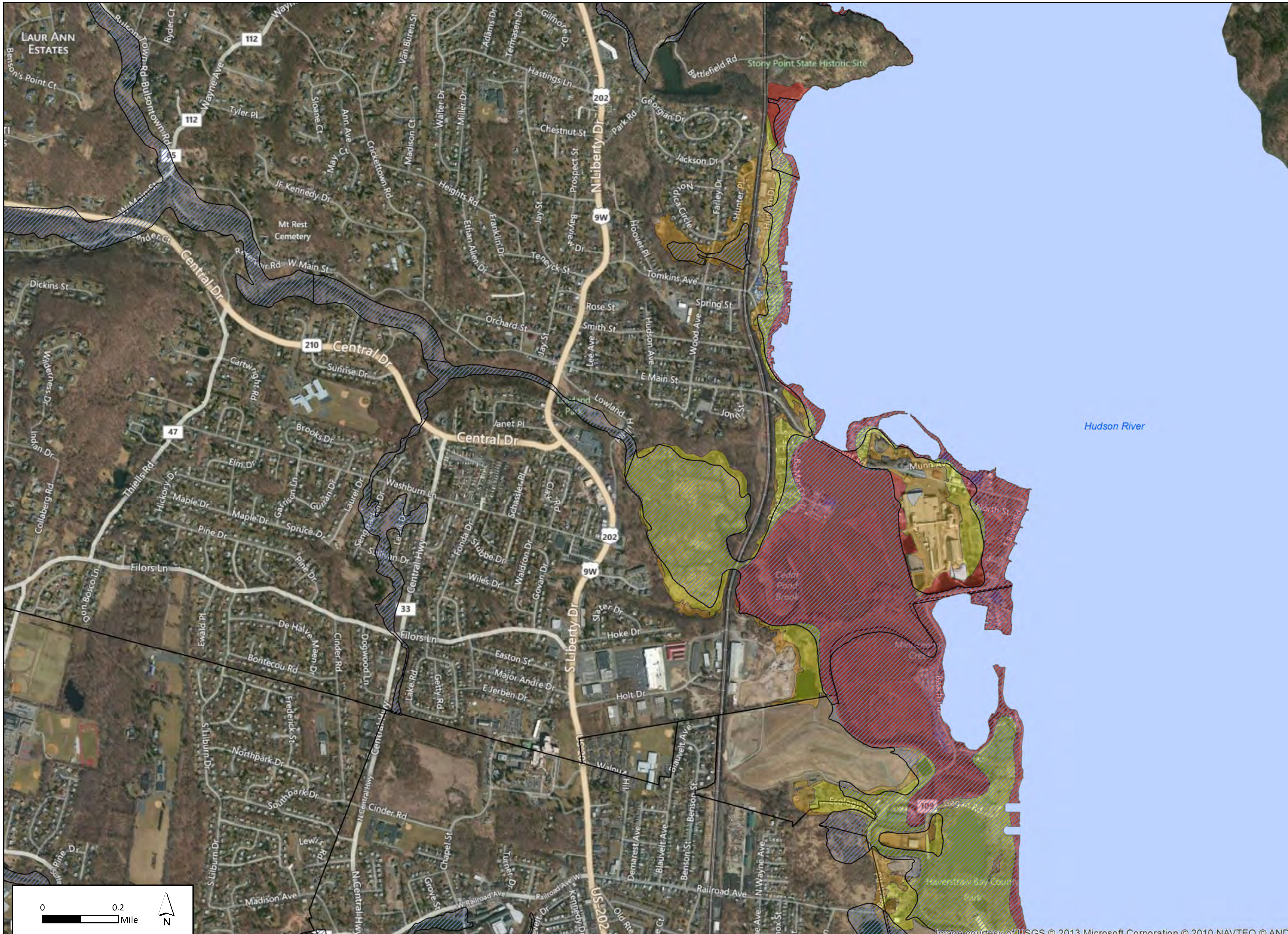
Thanks~

Dan

Daniel D. Durfee, P.E, BCEE | Associate | CDM Smith | 11 British American Boulevard, Suite 200 | Latham, NY 12110
T: 518.782.4506 | C: 518.275.9527 | F: 518.786.3810 | durfeedd@cdmsmith.com | cdmsmith.com

Rockland County
Town of Stony Point
FEMA Flood Zones and NYS Storm Surge Zones

September 2013



Hudson River

FEMA 100 Year Flood Hazard Area

FEMA Flood Zones

ZONE

A - Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage.

Shaded X - Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods.

V - Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves

Rockland County Town Boundaries

ESRI - roads, railroads, water bodies
NOAA - coastline
US Census - towns, places, counties

Devinneyrg C:\NYS_CRZ\RocklandCounty\Tabloid Landscape_rd_Aerial.mxd 9/18/2013

NEW YORK CITY

FEEDBACK

1. LETTER RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, DIRECTOR OF RESILIENCY
2. EXCERPTS FROM SPECIAL INITIATIVE FOR REBUILDING AND RESILIENCY REPORT

The City of New York

OFFICE OF THE MAYOR
253 Broadway - 10th Floor
New York, New York 10007
www.nyc.gov/planyc2030

September 6, 2013

Mr. Donald E. Cresitello
New York District, US Army Corps of Engineers
Jacob K. Javits Federal Building
New York, NY 10278-0090

Re: USACE Reconnaissance-Level Analysis for New York Bay, Its Tributaries and Jamaica Bay

Dear Mr. Cresitello:

Thank you for the opportunity to comment on the proposed Reconnaissance-Level Analysis (RLA) for New York Bay, Its Tributaries, and Jamaica Bay. As you know, New York City and its surrounding region were hit hard by Sandy. New York City responded by setting up the Special Initiative for Rebuilding and Resiliency (SIRR) to identify the impacts of Sandy, evaluate the future climate risks our city faces, and propose recommendations to minimize these risks and rebuild a stronger, more resilient New York. The conclusion was clear that steps must be taken to ensure that this type of damage be avoided or reduced in the future.

By any measure, Sandy was an unprecedented event for New York City, causing nearly $19 billion in damages, inundating nearly 90,000 buildings, and disrupting critical infrastructure and services. To improve our coastal defenses, SIRR's plan, *A Stronger, More Resilient New York,* identified 37 first phase initiatives to address coastal risks and other long-term measures to improve the city's coastal resiliency. These initiatives are described on pages 58-65, including the maps on pages 51-52 and 59-60. These coastal defenses make up the first line of the city's multiple lines of defense approach, which also improves the resiliency of our city's infrastructure, buildings and neighborhoods.

Should you need a copy of the report, please visit:

http://www.nyc.gov/html/sirr/html/report/report.shtml

We look forward to answering any follow-up questions in person on September 11th and continuing our collaboration with you in this vital effort.

Sincerely,

Daniel A. Zarrilli
Director of Resiliency

CC: Ginger Croom
Roman Rakoczy
Michael Marrella

Strategy: Increase coastal edge elevations

Beach Nourishment

In several parts of the city, beach sand served as a key line of defense when Sandy hit. During the storm, however, large quantities of this sand were washed away. To close the defensive breach created by this loss, the City will support the work of the USACE to complete emergency beach nourishments—replacing not only sand lost during Sandy, but also sand lost since earlier USACE nourishment of these beaches, in some cases many years ago. DPR will ensure that this work makes effective use of existing Federal appropriations and enhances protection during the 2013 hurricane season and beyond. The City also will work with the USACE to develop a plan for ongoing beach maintenance, so that a sand restoration plan is in place in anticipation of future storms.

Initiative 1

Continue to work with the USACE to complete emergency beach nourishment in Coney Island

The City will support the work of the USACE to complete emergency beach nourishment from Corbin Place to West 37th Street, expected to include 1 million cubic yards of sand. This project will start in July 2013, with completion targeted for December 2013.

Initiative 2

Continue to work with the USACE to complete emergency beach nourishment on the Rockaway Peninsula

The City will support the work of the USACE to complete emergency beach nourishment from Beach 19th Street to Beach 149th Street, expected to include 3.6 million cubic yards of sand. This project will start in June 2013, with completion targeted for December 2013.

Initiative 3

Complete short-term beach nourishment, dune construction, and shoreline protection on Staten Island

The loss of sand in Staten Island has left several neighborhoods exposed and vulnerable to future storms. The City, therefore, will complete interim beach nourishment and short-term dune improvements in Staten Island, including beach nourishment in South Beach, Crescent Beach, and Tottenville; dune construction from New Dorp Beach to Oakwood Beach; and shoreline stabilization to close the breach at Wolfe's Pond Park. DPR will ensure that this work, which began in May 2013 and will end by October 2013, makes effective use of existing Federal appropriations and enhances protection during the 2013 hurricane season and beyond.

Initiative 4

Install armor stone shoreline protection (revetments) in Coney Island

Coney Island Creek provides a pathway for the "backdoor flooding" of much of Southern Brooklyn. Subject to available funding, the City, therefore will raise the Creek's lowest edge elevations to a consistent grade with revetments to reduce the risk of flooding and erosion at low spots bordering the Creek. The Mayor's Office of Long-Term Planning and Sustainability (OLTPS) will work with the New York City Economic Development Corporation (NYCEDC) to complete this project. The goal is to begin design work in 2013 and complete the project in three years.

Initiative 5

Install armor stone shoreline protection (revetments) on Staten Island

The South Shore of Staten Island continues to be at risk for future erosion of its beaches and bluffs. Subject to available funding, the City, therefore will implement shoreline protection using revetments in vulnerable locations on the South Shore of Staten Island, such as Annadale. OLTPS will work with NYCEDC to complete this project. The goal is to begin design work in 2013, with completion within three years.

Initiative 6

Raise bulkheads in low-lying neighborhoods across the city to minimize inland tidal flooding

Eight percent of the city's shoreline will be at risk of daily tidal flooding by 2050. Subject to available funding, the City, therefore, will implement a program to raise bulkheads and other shoreline structures to minimize the risk of regular flooding in targeted neighborhoods, including the bayside of the Rockaway Peninsula, Broad Channel and Howard Beach in Queens, West Midtown in Manhattan, Locust Point in the Bronx, Greenpoint in Brooklyn, the North Shore of Staten Island, and other low-lying locations. OLTPS will work with NYCEDC and other agencies to implement this program in conjunction with a new citywide waterfront inspections program that will assess needs throughout the five boroughs. The goal is to begin the first phase of evaluations in 2013.

Initiative 7

Complete emergency bulkhead repairs adjacent to the Belt Parkway in Southern Brooklyn

The failure of bulkheads adjacent to the Belt Parkway has left several portions of this vital roadway exposed and vulnerable to future storms. The City, therefore, will complete bulkhead repairs in areas damaged during Sandy, including at 14th Avenue, 17th Avenue, and 95th Street. DPR will complete this work by December 2013, making effective use of existing Federal appropriations and enhancing protection during the 2013 hurricane season and beyond.

Beach Restoration for Summer 2013

Following Sandy, Mayor Bloomberg made a commitment to open New York City's eight public beaches in time for Memorial Day weekend 2013. However, several key facilities necessary to meet this goal—including bathrooms, lifeguard stations, maintenance and operations offices, and concessions—had been completely destroyed or significantly damaged in the storm. In a coordinated interagency effort led by the Department of Parks & Recreation, with the Department of Design and Construction and other City, State and Federal partners, the City invested over $270 million that not only removed debris, corrected hazardous conditions, restored beach access and renovated damaged buildings, but also replaced the key facilities that were destroyed with new facilities designed to withstand future storms. These 35 prefabricated modular buildings will be used as bathrooms and lifeguard stations on the Rockaway Peninsula, Coney Island, and Staten Island and were designed and constructed to a height ranging from 7 to 14 feet above the existing grade to ensure maximum resiliency. Having met the Memorial Day opening date, the City, State, and Federal governments are now working to restore sand and other protective elements on the beaches .

Comprehensive Coastal Protection Plan | Phase 1 Initiatives

Increase Coastal Edge Elevations

Beach Nourishment
1 Coney Island, Brooklyn
2 Rockaway Peninsula, Queens
3 East and South Shores, Staten Island

Armor Stone (Revetments)
4 Coney Island Creek, Brooklyn
5 Annadale, Staten Island

Bulkheads
6 Citywide Program
7 Belt Parkway, Brooklyn
8 Beach Channel Drive, Queens

Tide Gates / Drainage Devices
9 Oakwood Beach, Staten Island
10 Flushing Meadows, Queens

Minimize Upland Wave Zones

Dunes
11 Rockaway Peninsula, Queens
12 Breezy Point, Queens

Offshore Breakwaters
13 Great Kills Harbor, Staten Island

Wetlands, Living Shorelines and Reefs
14 Howard Beach, Queens
15 Tottenville, Staten Island
16 Plumb Beach, Brooklyn
17 Brant Point, Queens

Groins
18 Sea Gate, Brooklyn

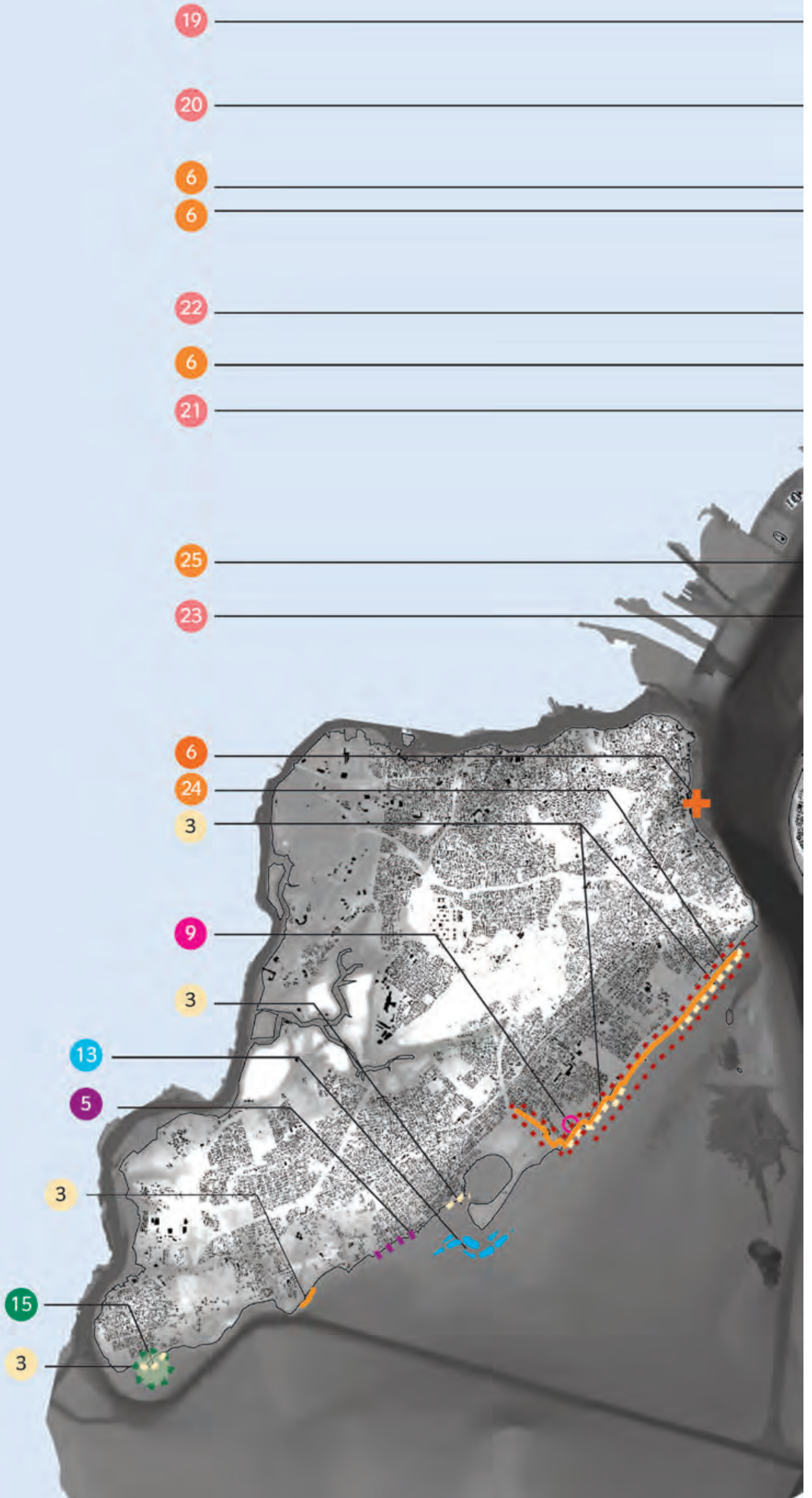
Protect Against Storm Surge

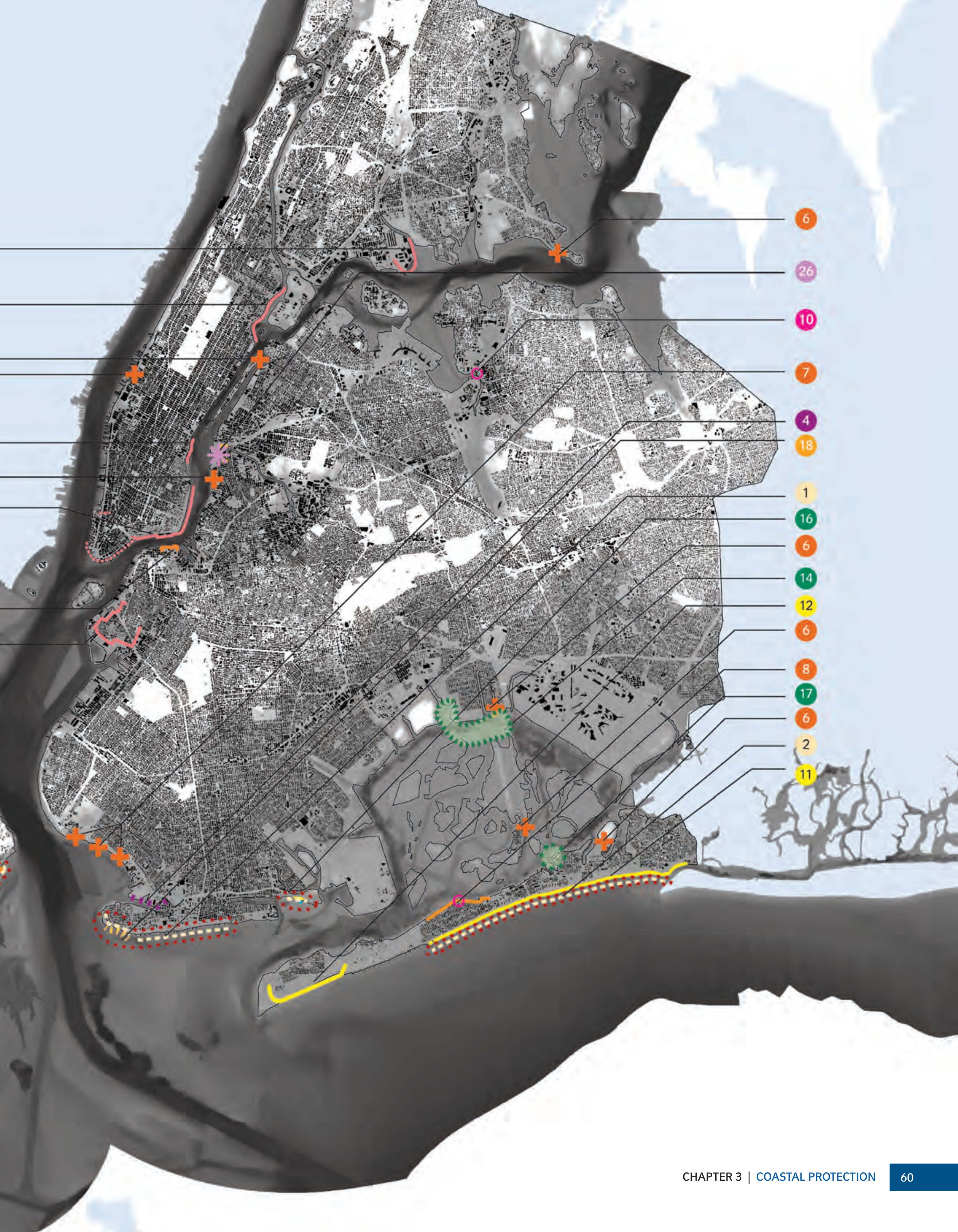
Integrated Flood Protection System
19 Hunts Point, Bronx
20 East Harlem, Manhattan
21 Lower Manhattan / Lower East Side
22 Hospital Row, Manhattan
23 Red Hook, Brooklyn

Floodwalls / Levees
24 East Shore, Staten Island
25 Farragut Substation, Brooklyn

Local Storm Surge Barrier
26 Newtown Creek

Current US Army Corps of Engineers Study and Project Areas




6
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Post-storm flooding and erosion along Coney Island Creek, Brooklyn

Credit: Charles Denson/Coney Island History Project

Initiative 8

Complete bulkhead repairs and roadway drainage improvements adjacent to Beach Channel Drive on the Rockaway Peninsula

The flooding of neighborhoods along Beach Channel Drive on the Rockaway Peninsula exposed additional vulnerabilities along several portions of this vital roadway. The City, therefore, will complete bulkhead repairs from Beach 143rd Street to Beach 116th Street and install duckbill tide gates within a portion of the roadway drainage network in that area, reducing the risk of "backdoor" flooding. NYCEDC will ensure that this work, which began in 2011 and will be completed in 2014, will make effective use of existing funding and enhance protection during the 2013 hurricane season and beyond.

Initiative 9

Continue to work with the USACE to complete emergency floodgate repairs at Oakwood Beach, Staten Island

The failure of a floodgate in Oakwood Beach on Staten Island has left this neighborhood vulnerable to future storms. OLTPS, therefore, will call upon the USACE to complete floodgate repairs at this location, ensuring that this work, which is expected to begin in June 2013 and end by December 2013, makes effective use of existing Federal appropriations and enhances protection during the 2013 hurricane season and beyond.

Initiative 10

Complete tide gate repair study at Flushing Meadows Corona Park, Queens

The malfunction of a tide gate system within Flushing Meadows Corona Park in Queens has left this important public asset vulnerable to future storms and impacts from sea level rise. Subject to available funding, the City, through DPR, therefore will complete a tide gate repair study at this location to identify options to reduce the risk of future flooding. The goal is to complete this study in 2014.

Strategy: Minimize upland wave zones

Initiative 11

Continue to work with the USACE to complete existing studies of the Rockaway Peninsula and implement coastal protection projects

The entire Rockaway Peninsula faces continued risk of floods and wave action. The City, therefore, will call on the USACE to complete the Rockaway reformulation study started in 2003. This authorized study offers an expedited path to rethinking and improving the current flood protections on the Rockaway Peninsula. DPR will ensure that this work makes effective use of existing Federal appropriations to advance meaningful flood protection projects. It is expected that the reformulation study will be completed by 2015. The goal is to complete this project within four years of completing the USACE study. Consistent with this study, the City also will call upon the USACE to implement further beach nourishment and dune construction projects in the area, working with DPR to complement its future boardwalk restoration plans. DPR also will work with the USACE to determine the feasibility and effectiveness of expanding or strengthening the existing groin fields on the Rockaway Peninsula. In the interim, DPR will complete short-term dune improvements on the Rockaway Peninsula from Beach 9th Street to Beach 149th Street in 2013, using low-cost and readily available solutions to mitigate the effects of storm waves on adjacent neighborhoods during the 2013 hurricane season and beyond.

Initiative 12

Call on and work with the USACE to study and install primary and secondary dune systems in vulnerable Rockaway peninsula neighborhoods (such as Breezy Point)

Neighborhoods such as Breezy Point suffered devastating damage from Sandy and remain exposed to extreme weather events, particularly along the ocean. Subject to available funding, the City, therefore will call on the USACE to study and construct a dune project to protect this neighborhood and to demonstrate the general effectiveness of primary and secondary dune systems as a defense against storm waves and flooding. OLTPS will oversee these efforts. The goal is to complete this project within four years of completing the USACE study.

Any such project would, if federal funding is involved, require public access to impacted areas. Accordingly, before this project could advance, the Breezy Point Cooperative would have to agree to that condition.

Initiative 13

Call on and work with the USACE to study and install offshore breakwaters adjacent to and south of Great Kills Harbor

The area of Staten Island adjacent to and south of Great Kills Harbor faces an increasing risk of wave action and erosion during extreme weather events that could undermine the shoreline bluffs and damage homes. Subject to available funding, the City, therefore will call on the USACE to study and construct a demonstration offshore wave attenuation project in this area, both to offer a first line of protection and to test the effectiveness of such a system. OLTPS will oversee these efforts. The goal is to complete this project within four years of completing the USACE study.

Initiative 14

Call on and work with the USACE to study and install wetlands for wave attenuation in Howard Beach and to study further flood protection improvements within Jamaica Bay

Howard Beach and Hamilton Beach, two Queens communities along the northern coastline of Jamaica Bay, are highly exposed, low-lying neighborhoods. Subject to available funding, the City, therefore will call on the USACE to implement a wetlands restoration project designed to attenuate waves. This project will build upon the existing work of the Hudson-Raritan Estuary Comprehensive Restoration Plan and leverage planning work done by the Nature Conservancy. It will not only protect the two aforementioned neighborhoods, but also will allow the effectiveness of such wetland restorations to be tested. DPR will oversee these efforts. The goal is to complete this project within four years of completing the USACE study.

Subject to available funding, the City also will call upon the USACE, simultaneous with the Howard Beach-Hamilton Beach wetlands restoration, to restart existing studies of the Rockaway Peninsula and of Jamaica Bay. These authorized studies offer an expedited path to project completion. Following completion of these studies, the USACE should implement coastal protection projects to provide flood protection and reconstitute some of the city's most important historic protective wetlands and marsh islands. DPR will ensure that this project makes effective use of existing Federal appropriations to advance combined flood protection and ecosystem restoration projects. If restarted now, this study should be completed by 2016 and would expedite restoration of Jamaica Bay wetlands, improvements to bulkheads in low-lying neighborhoods, and implementation of a local storm surge barrier for Rockaway Inlet.

Initiative 15

Call on and work with the USACE to study and install living shorelines for wave attenuation in Tottenville

Tottenville, the southernmost community in Staten Island, remains vulnerable to wave action in future extreme weather events. Subject to available funding, the City, through DPR, therefore will call on the USACE to develop and implement a living shoreline project, both to protect the neighborhood and to demonstrate the effectiveness of this approach to wave attenuation on the open Lower Bay. This living shoreline project, consisting of oyster reef breakwaters, beach nourishment, and maritime forest enhancements, will be located in an area adjacent to Conference House Park in Tottenville. The goal is to complete this project within four years of completing the USACE study.

Initiative 16

Continue to work with the USACE to complete its Plumb Beach breakwater and beach nourishment project in Southern Brooklyn

During Sandy, the first phase of the Plumb Beach nourishment project along the Belt Parkway in Southern Brooklyn likely prevented a breach of the adjacent highway, thus protecting a vital transportation link. The City will, therefore, call on the USACE to complete the second phase of this project, including the installation of offshore breakwater and additional beach nourishment components. DPR will ensure that this project makes use of existing Federal appropriations to provide meaningful protection to this critical asset. This project will be completed in 2014.

Initiative 17

Complete living shorelines and floating breakwaters for wave attenuation in Brant Point, Queens

Brant Point, on the eastern edge of the Rockaway Peninsula in Jamaica Bay, is a low-lying natural area that faces potential impacts from sea level rise and, during coastal storms, wave action. Subject to available funding, the City, through the Department of Environmental Protection (DEP), therefore will construct and evaluate living shorelines and floating breakwaters in Jamaica Bay. In addition to providing protection to Brant Point, this project will demonstrate that floating breakwaters can attenuate waves during non-storm conditions, protecting existing wetlands and marsh islands from the erosive forces of waves associated with sea level rise. The goal is to complete this project in 2014.

Initiative 18

Continue to work with the USACE to complete its Sea Gate project in Southern Brooklyn

The neighborhood of Sea Gate remains vulnerable to waves and flooding during extreme weather events. The City will, therefore, call upon the USACE to complete its existing groin project to protect this neighborhood. These groins, and associated beach nourishment, are primarily intended to protect the terminal groin at West 37th Street, but will also provide a first line of protection to the neighborhood against wave action. DPR will monitor this project so that it makes use of existing Federal appropriations to provide meaningful protection to an exposed neighborhood. This project will be completed in 2014.

Strategy: Protect against storm surge

Integrated Flood Protection Systems

In several parts of the city, flood risk associated with extreme weather events remains high. Yet, in these areas, existing conditions and land uses preclude the deployment of traditional measures such as levees or permanent floodwalls to reduce this risk. To address this challenge, the City proposes installing integrated flood protection systems.

These systems have been demonstrated to be effective at reducing flood risk around the world, including in the Netherlands, the United Kingdom, and parts of the Midwestern United States. To ensure that the systems constructed in New York City follow the best and latest practices and ideas, and subject to available funding, OLTPS will work with NYCEDC to conduct a global design competition that will seek partners to design these systems to be as efficient and cost-effective as possible. The goal is to launch the competition in 2013, and upon designation of winning ideas, will proceed into design and construction in 2014.

Initiative 19

Install an integrated flood protection system in Hunts Point

Hunts Point in the Bronx is home to the Hunts Point Food Distribution Center, an important part of the city's food supply chain, and is at risk of flooding during extreme weather events. Subject to available funding, the City, therefore will install an integrated flood protection system in Hunts Point. OLTPS will work with multiple agencies to design and construct this project. The expected alignment will be along the future Hunts Point greenway and along the water's edge between the New Fulton Fish Market and the Hunts Point Produce Market and may be designed to protect other adjacent city infrastructure, subject to available funding, include other adjacent City infrastructure. The goal is to complete design in 2014 with project completion by 2016.

Initiative 20

Install an integrated flood protection system in East Harlem

East Harlem is at risk for flooding during extreme weather events. Subject to available funding, the City, therefore will install an integrated flood protection system in East Harlem. OLTPS will work with multiple agencies to design and construct this project. The expected alignment will be along the Franklin D. Roosevelt East River (FDR) Drive esplanade between East 90th Street and East 127th Street, or could potentially follow the highway dividing wall. The goal is to complete design in 2014 with project completion by 2016.

Initiative 21

Install an integrated flood protection system in Lower Manhattan, including the Lower East Side

The Lower East Side includes not just a very large residential population, but also one that lives at among the highest densities in the United States. The area is also home to among the largest numbers of low and moderate income households in Southern Manhattan, with many housing NYCHA housing units alone located in the floodplain. This neighborhood, meanwhile, is the location of critical infrastructure that, if compromised, could have citywide impacts. These include support structures for the subway system, Con Edison substations, a DEP pumping station, and the FDR Drive. Subject to available funding, the City, therefore will install the first phase in the Lower East Side and Chinatown of what is intended eventually to be an integrated flood protection system for all of Southern Manhattan. The protection would be designed to produce only a minimal impact on, and generally support, neighborhood fabric during non-storm conditions. The expected alignment of this first phase would start north of the Brooklyn Bridge and continue north to approximately East 14th Street. The goal is for design work on this first phase to begin in 2014, with completion in 2016.

In addition to the foregoing, the City also will consider extending the first phase of this integrated flood protection system south from the alignment described above to Lower Manhattan, including the Financial District. This is because, though the area contains a smaller and less economically vulnerable residential population and is less densely-populated than the Lower East Side and Chinatown, it is a major hub of commercial activity for the region and, like the Lower East Side and Chinatown, contains vital infrastructure. Accordingly, the City will work with the local community, including the local business community and property owners, to explore alternative, private financing sources for the aforementioned southern extension that could be leveraged to secure new sources of public financing. By way of example, such private sources could include a modest per-square-foot assessment on commercial space that would be protected by this extension. When completed, the expected alignment of this extension would start at the southern end of the system proposed for the Lower East Side and Chinatown and would run south along South Street to Battery Park, with a small section running across West Street, north of Battery Park City. If funding were identified, the timing for the southern extension could be consistent with the schedule above.

Initiative 22

Install an integrated flood protection system at Hospital Row

Bellevue Hospital and its neighboring healthcare facilities flooded during Sandy and remain at risk of flooding during extreme weather events. Subject to available funding, the City, therefore will install an integrated flood protection system at Hospital Row north of 23rd Street in Manhattan. OLTPS will work with multiple agencies to design and construct this project. The expected alignment will be along the service road of the FDR Drive, utilizing floodwalls and other localized measures where appropriate to integrate the system. The system will specifically enhance protection to Bellevue Hospital, a critical trauma facility, and could potentially integrate with existing plans by neighboring facilities operated by New York University and the Veterans Administration. The goal is to complete design in 2014 with project completion by 2016.

Initiative 23

Install an integrated flood protection system in Red Hook

Red Hook is prone to coastal flooding and is home to vulnerable populations at risk during extreme weather events. Subject to available funding, the City, therefore will install an integrated flood protection system in Red Hook. OLTPS will work with multiple agencies to design and construct this project. The expected alignment will use a portion of the Brooklyn Waterfront Greenway and otherwise likely will follow the first mapped street inland of the waterfront. The goal is to complete design in 2014 with project completion by 2016.

Initiative 24

Continue to work with the USACE to complete existing studies on Staten Island and implement coastal protection projects

Sandy demonstrated the significant flood and wave risk on the East and South Shores of Staten Island, where much of the damage to structures and loss of life in the city occurred during the storm. Without additional protective action, those coastal communities remain vulnerable to future storms. The City will, therefore, call on the USACE to expedite the completion and implementation of its flood risk reduction study applicable to the East Shore of Staten Island, authorized by Congress in 1993.

DEP and DPR will work with the USACE to ensure that this work will make effective use of existing Federal appropriations to advance meaningful flood protection and inland drainage projects. It is expected that the first phase of this study will be completed in 2014 and will recommend elements such as buried levees and floodwalls between Fort Wadsworth and Great Kills. The City will work with the USACE to determine the approach and specific location for these protections. As part of this initiative, the City will call on the USACE to develop a plan for ongoing beach nourishment to restore sand rapidly after extreme weather events. The second phase of this study is expected to be completed in 2016, recommending the installation of flood protection projects between Great Kills and Tottenville. The City will call upon the USACE to implement recommended projects along the South Shore of Staten Island. The goal is to complete these projects within four years of completing the USACE studies.

Initiative 25

Call on and work with Con Edison to protect the Farragut substation

Con Edison's Farragut substation came close to flooding during Sandy. This vital element of the city's power distribution network, serving almost 500,000 customers (or approximately 1.25 million people), sits in an area of growing risk from storm surge. The City, therefore, will call on Con Edison to protect this vital electrical substation from the impacts of storm surge. To accomplish this, Con Edison could consider floodwalls along the perimeter of the facility or other measures to meet a higher design standard for flood protection. This project could be incorporated into Con Edison's upcoming rate case at the State's Public Service Commission. OLTPS will monitor and support with technical assistance the rapid implementation of this project.

Initiative 26

Call on and work with the USACE to study and install local storm surge barriers at Newtown Creek

Newtown Creek was the source of extensive flooding during Sandy, providing a prime example of the significant "backdoor flooding" risk posed by inlets and waterways citywide. Subject to available funding, the City, through OLTPS, therefore will call on USACE to implement a project that will minimize damage within Newtown Creek during storm events through the installation of a local storm surge barrier with gates and connecting levees at the mouth of Newtown Creek. These gates will close in advance of an extreme weather event to keep flood waters from flowing into Newtown Creek and its adjacent neighborhoods. As Newtown Creek is a Superfund site, proper coordination with the Environmental Protection Agency and others will be required to ensure successful project implementation. DEP will assist in the evaluation of potential water quality impacts. The goal is to complete this project within six years of completing the USACE studies.

Strategy: Improve coastal design and governance

Initiative 27

Continue to work with the USACE to complete its comprehensive flood protection study of New York Harbor

The USACE is required by statute to conduct a comprehensive study to address the flood risks of vulnerable coastal populations in areas that were affected by Sandy. This study is a unique opportunity to guide Federal investment designed to reduce the future risks of climate change to the region. The recent experience in Louisiana has shown this type of study requires robust local partnership to ensure success. To this end, the City will call on the USACE to: expedite its comprehensive study of flood protection in New York City; adopt this report's goals, strategies, and initiatives for New York City as a key element of its own comprehensive study; and ensure that the comprehensive study translates into projects ready for Congressional authorization. To ensure that all of the foregoing measures are taken, OLTPS, working with DCP, DPR, NYCEDC, DEP, and the New York City Department of Transportation (NYCDOT), will lead the City's collaboration with the USACE in the development of its study. By statute, the USACE must deliver this comprehensive study to Congress by January 2015.

Initiative 28

Implement the WAVES Action Agenda

Although Sandy exposed vulnerabilities on the city's waterfront, the storm did not diminish the City's resolve to continue using this waterfront for a variety of recreational, commercial, and natural purposes. In fact, the City's prior policy objectives on the waterfront, highlighted in *Vision 2020: The NYC Comprehensive Waterfront Plan*, remain critical to the city's future, emphasizing and building upon the coastal resiliency elements contained in PlaNYC. The City will, therefore, redouble its commitment to implementing the entire WAVES Action Agenda, completing several particularly relevant projects in 2013, including the Urban Waterfront Adaptive Strategies study, and revisions to the City's Waterfront Revitalization Program to address sea level rise.

Initiative 29

Implement citywide waterfront inspections to better manage the City's waterfront and coastal assets

The City currently conducts waterfront inspections in a decentralized manner, and according to inconsistent standards. Subject to available funding, the City, therefore will implement a centralized waterfront inspection program for its entire portfolio of coastal and waterfront assets. This program, managed by NYCEDC, will improve safety for the public, apply a consistent set of standards for all inspections, and allow for more cost-effective procurement of inspection contracts. It also will lead to better understanding of the state-of-good-repair of City assets, more effectively maintained waterfront assets, and reduced life-cycle costs. As part of the program, NYCEDC will update the inventory of the City's coastal and waterfront assets and will also update the inspection guidelines manual to incorporate inspection procedures for new asset types, such as beaches, wetlands, integrated flood protection systems, and boardwalks. Funding for subsequent repair and rehabilitation work will be assessed based on the inspection program's findings. The goal is to begin the first round of inspections in 2014.

Initiative 30

Study design guidelines for waterfront and coastal assets to better mitigate the effects of flooding

While Sandy exposed many areas of vulnerability within the city, it also identified effective protections that should be incorporated elsewhere. Subject to available funding, the City, through DPR, therefore will study the cost-effectiveness of new waterfront and coastal asset design guidelines for open spaces and natural areas, assessing whether and how best to use these areas to protect adjacent neighborhoods, to improve landscaping to direct and store excess floodwaters, to ensure that new open space and park designs allow for maximum resiliency of parkland after an extreme weather event, and to build upon existing DPR high-performance landscape guidelines. These projects will improve the predictability of regulatory permitting and provide for better habitat considerations in future designs. The goal is to complete the study in 2014.

Initiative 31

Evaluate soft infrastructure as flood protection and study innovative coastal protection techniques

In the course of developing this comprehensive coastal protection plan, several new and innovative coastal protection ideas emerged that warrant further long-term study to determine whether they could be cost-effective and successful in New York City. Subject to available funding, the City, therefore will partner with academic institutions, the planned the Science and Jamaica Bay Science and Resilience Center, and other interested organizations to evaluate innovative coastal protection techniques, such as employing sand engines (a means of nourishing beaches and supplementing dunes by utilizing natural ocean currents) in areas such as the Rockaway Peninsula, and "shallowing" (reducing the depth of) bays, such as Jamaica Bay, for flood and wave risk reduction. These partnerships, led by OLTPS, working with DEP and DPR, will develop or identify appropriate scientific procedures to evaluate the effectiveness of these and other soft infrastructure investments for flood protection and wave attenuation and will advance other innovative coastal protection ideas. The goal is begin the study in 2013.

Initiative 32

Evaluate the city's vulnerability to drainage pipe flooding and identify appropriate solutions to minimize those risks

Many of the coastal protection measures proposed herein include barriers against storm surges. In connection with these initiatives, existing or proposed drainage infrastructure will be reviewed on a project-by-project basis to evaluate whether tide gates, valves, or other backflow prevention devices could help to reduce the possibility of flood exposure, without impeding stormwater drainage from upland areas. Subject to available funding, the City, through OLTPS and working with DEP, NYCEDC, and NYCDOT, therefore will study how those site-specific pipe networks are likely to perform during extreme surge events and will seek to identify a range of cost-effective proposals to address identified risks. Current plans to install “duckbill” tide gates on existing roadway drainage networks, such as along Beach Channel Drive on the Rockaway Peninsula, also will be monitored to evaluate their effectiveness as protection against storm surge. The goal is to complete these evaluations concurrent with the design of these coastal protection projects.

Initiative 33

Evaluate strategies to fund wetland restoration and explore the feasibility of wetland mitigation banking structures

As discussed earlier in this chapter, wetlands can act as a natural buffer to protect upland communities by retaining some floodwaters and attenuating waves during storm conditions. New York City has thousands of acres of degraded wetlands that could provide increased coastal resiliency if they were restored and expanded. Financing for such projects, however, has proved challenging. Subject to available funding, the City, therefore will work with State and Federal agencies to examine the feasibility of wetland mitigation banking in New York City—an approach to ecosystem restoration that offers greater ecologies and economies of scale than traditional approaches to mitigation. If feasible, the City will pilot a mitigation bank to help fund a restoration project at Saw Mill Creek in Staten Island. The goal is for the first pilot project to be implemented by NYCEDC in 2014.

Initiative 34

Work with agency partners to improve the in-water permitting process

The current waterfront permitting system in New York City requires those seeking permits to navigate an often-confusing series of requirements from multiple agencies. The process to obtain proper permits can stretch for years and is costly, leading, among other things, to delays in the repair and development of waterfront infrastructure necessary for flood protection. The City will, therefore, work with State agency partners to explore development of a one-stop waterfront permitting website that will help applicants better understand the process, answer specific application questions, and facilitate approval of worthy applications. NYCEDC will provide support in the technical development of the website, which is expected to be managed subsequently by the State. The site will launch in 2014.

Initiative 35

Enhance waterfront construction oversight by strengthening the City's waterfront permit and dockmaster units

The City's waterfront permit and dockmaster units oversee waterfront structures that, in addition to their other functions, play an important role in flood protection during both storm and non-storm conditions. The City will explore options to enhance waterfront permitting and strengthen this function. SBS will update its fee schedule in 2014 to offset some of the costs of providing these services. The City also will explore moving waterfront permitting and dockmaster responsibilities from SBS to another agency with a more closely aligned mission.

Initiative 36

Identify a lead entity for overseeing the collaboration on the USACE comprehensive study and for overseeing the implementation of coastal flood protection projects

Without an appropriate investment in governance and oversight, the risk is high that coastal investments requiring long planning and implementation schedules will lose momentum and will not be completed on schedule or in concert with the City's resiliency goals. Therefore, OLTPS will assume the coordination role on coastal protection projects immediately.

Initiative 37

Call on and work with the USACE and FEMA to collaborate more closely on flood protection project standards

Federal investments in coastal protection typically are implemented by the USACE, while the National Flood Insurance Program is managed by FEMA. In certain instances, Federal investments in flood protection projects have not resulted in revised flood maps nor have they reduced the cost of flood insurance for property owners in newly protected areas. The City, therefore, will call on the USACE and FEMA to collaborate more closely on flood protection project standards to ensure that Federal investments that meet appropriate risk-reduction standards, produce a corresponding reduction in flood insurance rates in affected areas. OLTPS, working with DCP, will also call for closer project development coordination between these two Federal agencies to ensure improved project outcomes for those in affected areas. Additionally, OLTPS will call upon FEMA to recognize a variety of effective, yet temporary, deployable floodwall systems in future revisions to FIRMs.

PORT AUTHORITY OF NY AND NJ FEEDBACK

1. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, OFFICE OF ENVIRONMENTAL & ENERGY PROGRAMS
2. REPORT DOCUMENTING IMPACTS, DAMAGES, RESPONSE, AND RESILIENCY

Bui, Frances

From: Croom, Ginger
Sent: Friday, September 06, 2013 4:16 PM
To: Bui, Frances
Subject: Fwd: USACE NACCS Reconnaissance-Level Analysis
Attachments: 2013-09-05 PANYNJ Hurricane Sandy Impacts, Damages and Response and Resiliency.docx; ATT00001.htm

Sent from my iPhone

Begin forwarded message:

From: "Malione, Bernice" <bmalione@panynj.gov>
Date: September 6, 2013 4:14:45 PM EDT
To: "'Croom, Ginger'" <CroomGL@cdmsmith.com>
Cc: "'Cresitello, Donald E NAN02'" <Donald.E.Cresitello@usace.army.mil>, "Zeppie, Christopher" <czeppie@panynj.gov>
Subject: USACE NACCS Reconnaissance-Level Analysis

Ginger,
The Port Authority of NY & NJ herewith provide its response to the USACE request, dated 8/23/13, for information regarding Hurricane Sandy impacts. The following information was by September 6, 2013:

1) Problem Identification for the Port Authority of NY & NJ (PA) region:
Eighteen of 22 PA facilities were damaged by Hurricane Sandy. The *2012 Port Map* shows each PA facility and adjacent water bodies (copies have been sent via USPS mail to you and D. Cresitello).

2) Description of Damages for the PA Area:
The attachment: *Port Authority of NY & NJ Superstorm Sandy USACE NACCS – Reconnaissance-Level Analysis (RLA) Response – 9/5/13*, provides a narrative of infrastructure damages, building damages and operational impacts.

3) Prior related studies:
Case Study: Assessment of the Vulnerability of Port Authority of NY & NJ Facilities to the Impacts of Climate Change, available at http://www.panynj.gov/about/pdf/Eng-Climate-Change-Article.pdf

Report 11-18 Response to Climate Change in New York State (ClimAID), available at

http://www.nyserda.ny.gov/climaid

PlaNYC 2011 Chapter on Climate Change, available at

http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_2011_climate_change.pdf

4) Measures the PA has considered to address the problem:
The attachment: *Port Authority of NY & NJ Superstorm Sandy USACE NACCS – Reconnaissance-Level Analysis (RLA) Response – 9/5/13*, provides a narrative of restoration actions undertaken, planned priority protective measures and resiliency efforts under consideration.

Please do not hesitate to call me if you have any questions.

Bernice

Bernice R. Malione
Assistant Director, Environmental Initiatives
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Port Authority of NY & NJ
225 Park Ave. South - 12th floor
New York, NY 10003
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PORT AUTHORITY OF NY & NJ
SUPERSTORM SANDY
USACE NACCS – Reconnaissance-Level Analysis (RLA) Response – 9/5/13

Impacts of the Storm

1. Preparation for Superstorm Sandy included large-scale sandbag placements as well as other preparedness measures: placement of jersey barriers in low-lying areas such as entrances to the Holland Tunnel, placement of pumps in strategic areas, clearing storm drains and building of berms at the Port facilities.
    a. Note that the Port Authority conducts exercises and drills throughout the year for all types of hazards, including major weather events through its Office of Emergency Management (OEM).
    b. As a result of Sandy, the Port Authority staff has revised all hurricane preparedness plans, including updating protocols to ensure future operational resiliency.

To prepare, the Port Authority began a shutdown of PATH operations the Sunday at midnight (October 28) prior to Superstorm Sandy. Staff worked to secure trains and stations to minimize

2. Damage from high winds and water and facility staff were held over to address issues as they arose.

3. The Emergency Operations Center (EOC) was opened from Sunday, October 28 and was open 24 hours a day for two weeks after the storm to coordinate a centralized response.

4. Prior to Sandy, the Port Authority shut down operations at 19 of the 22 facilities (this represents 86% of facilities). Stewart Airport, Lincoln Tunnel and the Port Authority Bus Terminal (PABT) were the only facilities that did not close during or after Sandy.

5. In preparation for the storm, 34,000 gallons of fuel were delivered from October 26 through October 28 to Port Authority fuel sites at Newark Liberty, JFK Airport, LGA Airport, Lincoln Tunnel, Holland Tunnel and George Washington Bridge to maintain operational continuity where possible.

6. Port Authority service at the various airports, tunnels & bridges, port and PATH facilities were affected post-Sandy. 18 out of 22 (82%) of overall facilities suffered some type of damage, including flooding and debris fields. The 18 affected facilities were: PATH Rail Transit System, LaGuardia Airport (LGA), John F. Kennedy International Airport (JFK), Newark Liberty International Airport (EWR), Teterboro Airport, Port Newark Marine Terminal (PNMT), Elizabeth Port Authority Marine Terminal (EPAMT), Port Jersey Marine Terminal, Howland Hook Marine Terminal (HHMT), Brooklyn Marine Terminal (BMT), Automarine Terminal, George Washington Bridge (GWB), Goethals Bridge (GB), Outerbridge Crossing (OBX), Bayonne Bridge, Holland Tunnel (HT), Teleport and the World Trade Center.

7. Given that Port Authority facilities opened at different times, the following shows the estimated number of people <u>directly</u> affected by disruption in service.

a. Aviation: Total estimated number of passengers affected due to closure of airports (whose flights were scheduled to arrive/depart at the airports under normal circumstances) was 950,552. Airlines cancelled more than 10,000 flights.
b. Port Commerce: The total direct impact due to cargo and ship diversion due to closure of the ports for six days is $14.28 million. Studies note that each day the ports are closed result in $1 billion total economic impacts, including indirect costs.
c. PATH: For the 9 days (October 29 to November 6), the estimated PATH ridership affected was 2,049,040(this represents the period where PATH service was completely shutdown).
d. Holland Tunnel: Sandy affected an estimated 408,000 vehicle trips that typically would have been made through the Holland Tunnel from October 28 to November 7 (when all vehicles were allowed through). Overall regional transportation network demand was off for the period through November 7, with total eastbound vehicular traffic at all Port Authority bridges and tunnels down by over 1.2 million vehicles. Total traffic, across all facilities, was down by roughly 42% during the period between the storm and when the Holland Tunnel fully reopened.
e. Port Authority Bus Terminal (PABT): In the weeks following Sandy, the PABT saw 350-400 additional daily bus movements, which represents a 4.8-5.5% increase, primarily due to shutdown of PATH. These increased movements served approximately 30,000-40,000 additional customers. Note that the PABT serves an average 200,000 passengers on a regular day.

Immediate Response

1. Twenty of the 22, or 90% of all Port Authority facilities were affected by Superstorm Sandy. These facilities were impacted by flooding, widespread power outages and debris. Over half of all facilities experienced issues with commercial power service for more than 72 hours.

2. As of July 2013, Port Authority staff and contractors removed 20,281 cubic yards of debris throughout all facilities. New York Marine Terminal (NYMT) had the most debris removal with 6,479 cubic yards, however most of the debris was vegetative. The top three facilities in terms of debris that needed to be removed were NYMT, JFK Airport and the Staten Island Bridges.

3. Four days after Sandy, 60% of Port Authority facilities, 13 out of 22 facilities, were back online.
    a. All airports returned to service three days after Sandy. Flights resumed at JFK two days after the storm.
    b. Four out of the five Airports suffered flooding and debris, including 100 million gallons of seawater at LaGuardia Airport. The water inundated the airfield and almost flooded the terminals.
    c. JFK AirTrain was back with limited service four days post-Sandy, with some shuttle bus service. Limited EWR AirTrain was available two days post-Sandy, then 100% operational on day three. Restoring public transit access to airports was critical. Of the ten thousand people who work at LaGuardia, nearly half use public transportation. At JFK, the numbers are even greater: 55 percent of the workforce or more than 35,000 people rely on mass transit to get to work.

d. The George Washington Bridge and the three Staten Island Bridges opened hours after Sandy, once necessary clean up operations were completed.
e. The Holland Tunnel reopened to commuter buses four days after Sandy, after pumping out an approximate 20 million gallons of water.
f. PATH facilities resumed partial service on November 6 (Journal Square to 33rd Street in Manhattan) and additional service in January 2013. PATH had the longest service outage out of all of the facilities. Note that the PATH system is still experiencing some outages of service and future outages are expected as repairs continue.
g. The World Trade Center had over 125 million gallons of water in the 16-acre site. Construction resumed seven days after Sandy (November 5).
h. The New York Harbor was opened by the US Coast Guard on November 4, six days after Sandy, which allowed for Port operations to commence. New York Marine Terminals saw damage to pump stations, electrical infrastructure, and Pier 9A piles. Approximately 200 cars were damaged at the Brooklyn Cruise Terminal and more than 15,000 imported cars were damaged at the New Jersey Marine Terminal.

4. From October 30 through November 7, an additional 181,000 gallons of fuel were delivered to support restoration of operations at our facilities. This emergency fuel purchase was to power emergency generators to ensure that facilities could operate in a timely manner.

Airports

1. Superstorm Sandy directly affected an estimated 950,552 passengers due to flight cancellations and airport closures.
    a. 334,625 from LGA, 356,573 from JFK, and 259,344 from EWR.
    b. The Port Authority provided food, cots, pillows and blankets to more than 2,000 passengers who were stranded at the three major airports.
    c. In total, 3,166 flights departed on the first day all airport service was restored.

2. Debris was cleared and extensive pumping occurred to restore airport operations, especially at LGA.

3. As noted previously, Stewart Airport did not close because of Superstorm Sandy although airlines did suspend flights. Stewart Airport was able to facilitate the transport of electrical crews and heavy equipment from outside the region to provide storm relief. By October 31 hourly flights of C-17 military aircraft streamed in, delivering relief workers and equipment from California and Georgia to assist Con Edison.

4. Since the storm, JFK airfield lighting has had a 15% failure rate compared to the 1% annual failure rate in years prior to the storm. Of the 10,800 light fixtures that make up 800 illuminated airfield signs at JFK, about 5,000 light fixtures and 530 airfield illuminated signs have been replaced due to latent damage.

5. JFK, LGA, and EWR are all suffering from electrical systems failures due to saltwater infiltration during the flood event. These latent damages are still undergoing study and the

full extent of the damage will not be known until the Latent Damage Assessment is complete.

6. At JFK, approximately 20,000 feet of electrical cable has been replaced.

PATH

1. PATH Rail Transit System was the hardest hit system of all the Port Authority facilities:
   a. Power, signal, and communications systems suffered extensive damage due to the corrosive saltwater. A major repair and replacement effort centers around the functionality at Caissons 1, 2 and 3 in the PATH system. The caissons govern the interlocking between two tunnels, each which allow for bi-directionality of rail service, either going towards the World Trade Center or Hoboken Stations. These include components involving cable, cable connections, batteries, relays, circuit breakers and other sensitive equipment located in the tunnels as well as in the signal cases at Caisson 2 and the signal system main control room at Caisson 3.
   b. Out of the 44.94 miles of track, 7.28 miles were flooded. This represents 22% of the system.
   c. There was visual evidence that the corrosive effect of saltwater will cause premature failure of certain track components. There was also evidence of silt and other fine particles deposited throughout the track system.

2. Out of the 352 sectionalizing switches of the system about 100 to 120 will need to be replaced due to flood damage. PATH is continuing to replace these switches.

3. Fifty-seven revenue railcars stored in the Harrison Car Maintenance Facility were submerged and suffered damage. 32 of these railcars have been repaired and the rest require some rebuild of the undercarriage, which holds critical electrical and mechanical components.

4. Six of the eight PATH substations were compromised. These old electrical substations were temporarily restored with remaining spare parts.

5. From November 26, 2013 to January 25, 2013: The signal system suffered significant damage and the system operated on a manual block with personnel communicating by radio to mark trains passing stations.

6. The signal failure rate is estimated to be higher than prior to Superstorm Sandy.
   a. The overall on-time performance rate on a 24-hour basis, however, is still currently very high: Pre-Sandy for 24-hour period was 98.30%; Post-Sandy (2012) for a 24-hour period was 97.84%. Year To Date – June 2013 for a 24-hour period is 97.94%.

This is through the implementation of various efforts such as preventative and corrective maintenance and field inspections to keep the signals as free from failure as possible.

Tunnels, Bridges and Terminals (TB&T)

1. Impact to the Holland Tunnel resulted in major disruption of this critical Hudson crossing. An estimated 20 million gallons of water flooded the Holland Tunnel.

2. TB&T is in the process of enhancing its customer communication capabilities at the PABT, given the amount of overflow from passengers looking for alternative modes of transportation.
    a. Eight automated information kiosks will be added to the terminal and wayfinding signage is being replaced.
    b. The Port Authority is also exploring ways to run the Terminal on emergency generator power. During Sandy, the PABT did not lose commercial power, however the loss of power for this critical asset would have resulted in no alternative for commuters to travel to and from Manhattan.

Port Commerce

1. For New York Marine Terminals:
    a. Howland Hook in Staten Island was without power for approximately five days and was impacted by debris.
    b. Brooklyn Piers sustained little damage with the exception of Phoenix Beverage, which sustained about $14M in damages to product and systems within their leasehold. Note that Brooklyn Piers lost 14 containers during Sandy.
    c. Damage at Red Hook Container Terminal are in three general categories: electrical which includes conduit, the main substation and two satellite substations; mechanical which includes crane motors, reach stackers, tractors forklifts and related yard equipment; and structural which includes damage to the administrative offices as well as paving repairs. The Port Authority kept Red Hook operational despite a damaged substation with two 2,000kw generators.

2. Cross Harbor Freight operations suffered significant damage when Greenville Yard Lift Bridge Section 11 was damaged beyond repair due to the storm surge. In order to restore operations for this freight connection, the lift bridge had to be demolished and a temporary lift bridge was brought into service January 2013. In addition, a car float was destroyed as well as the entire trailer operations compound.

3. In total, approximately 6–10 tons of debris was cleared from the ports in Brooklyn and Staten Island.

World Trade Center

1. The WTC took less than a week to dewater the site of over 125 million gallons of saltwater, with 24/7 pumping operations to complete the task. Damage was across the entire site, including 1 WTC, the Transportation Hub, the Vehicular Security Center (which is where most of the water entered from during Sandy), below-grade retail spaces, and the September 11th Memorial and Museum.

2. While there was very limited structural damage, significant repair and replacement will be needed for electrical-mechanical systems in the buildings at the site.

3. Over 1,600 pieces of equipment will need to be replaced, including specialty construction equipment and other long lead items. This includes the Power Distribution Center, electrical equipment such as multitude of wiring and fire alarm system panels already installed as well as HVAC equipment.

Restoration to "State of Good Repair"

1. Debris clearance, emergency repairs and hook up of emergency power were major steps to re-opening all affected facilities. After initial clean up, staff developed assessments and began to undergo immediate repairs. Early coordination with FTA and FEMA took place and joint assessments began.

2. To ensure further state of good repair, intermediate and medium-term permanent repairs must take place to rehabilitate or replace assets. The examples listed below are projects completed within the first 8 months post-Sandy. Repairs are still ongoing.
   a. Some major works includes rehabilitation of the Instrument Landing System Pier at LGA Airport, repairing pumps and pump controllers at the Holland Tunnel.
   b. At PATH some major works included restoration of vertical transportation and replacement of high usage turnstiles. All 8 PATH substations are in service now with refurbished or replaced equipment.
   c. Brooklyn Marine Terminal substation repairs are ongoing to date and should be completed by October 2013. Other repairs include electrical system repairs and other fence/gate repairs.

3. Longer-term permanent repairs must undergo further scope refinement, design and construction.

Resiliency Efforts: Port Authority Priority Protective Measures

1. To prepare for upcoming storm seasons, the Port Authority is embarking on the installation of 85 protective measure projects across all facilities, at an estimated cost of $59 million. These are short-term measures to protect assets and allow facilities to weather another storm with minimal service interruption or damage.

2. Standard hurricane protection measures are already in place for the beginning of every hurricane season, including updating certain standard operating procedures as necessary.

3. New flood protection projects will utilize metal panels, temporary concrete barriers and water-filled jersey barriers to protect doorways in buildings and station entrances. (Note: LF = Linear Feet)

Flood Protection Measure Quantities (LF)						
	CONCRETE BIN BLOCKS	FLOOD BARRIER LOGS (STOP LOGS)	WATER FILLED BARRIERS	CONCRETE BARRIERS	SAND FILLED BINS (HESCO)	AQUA FENCE
PORTS	-	1,005	-	455	-	-
TBT	-	2,288	-	660	-	-
AVIATION	800	-	-	-	-	72
PATH	1,750	2,153	320	1,950	150	
WTC					6,400	980
Total FPMs (LF)	**2,550**	**5,446**	**320**	**3,065**	**6,550**	**1,052**
Total FPMs (Miles)	**0.5**	**1.0**	**0.1**	**0.4**	**1.2**	**0.2**

4. New operational continuity projects include procuring portable and permanent generators as well as purchasing additional fuel supplies. The Port Authority will also employ the use of additional permanent and mobile pumps to keep critical assets dry and functional.

5. Estimated dollar amount for major components of the Priority Protective Measures Program:
    a. $8.3 million to purchase approximately 90 generators
    b. $400,000 for generator accessories
    c. $1.1 million for flood barriers and pumps

Resiliency Efforts: Long- Term Initiatives

1. The Port Authority has submitted Letters of Intent (LOIs) for 21 projects in New York and 11 in New Jersey for long-term mitigation as part of the FEMA Section 404 Hazard Mitigation Grant Program, in addition to FTA grant awards for repair and mitigation measures totaling $1.36 billion to date. Additionally, the Port Authority is currently working on over 110 FEMA project worksheets, which include Section 406 mitigation measures, with a current total in excess of $250 million

2. Given the competitive grant process and the capital budget, the Port Authority will embark on priority projects in the next two years in areas such as aviation, tunnels, and bridges.

Latent Damage Considerations as part of Long-Term Initiatives

1. The Port Authority has embarked on a major agency-wide assessment of saltwater infiltration and its corrosive effects on critical infrastructure at our facilities. The interim report thus far shows that latent effects of saltwater infiltration are extensive.

2. Of the 12,863 total inspection points to be made, 4,502 records have been recorded to date. Of the inspection points collected to date, the presence of salt residue has been found 99% of the time. This will necessitate a program that includes certain capital projects to account for the expedited shortening of an asset's useful life.
    a. Of these, approximately 66% exhibited signs of corrosion.
    b. It is expected that the presence of salt and/or the signs of accelerated corrosion will be a cause of failure at some point in the future.
3. The Port Authority will actively work to prevent longer-term affects of saltwater infiltration but there is concern that some of the damage will produce latent impacts.

The Port Authority of NY & NJ Press Release of May 29, 2013: Port Authority Continues Aggressive Efforts To Rebuild Facilities Following Superstorm Sandy And To Prepare For Upcoming Hurricane Season, provides a summary of Superstorm Sandy damages, response, resiliency and costs (copy attached) and available at: http://www.panynj.gov/press-room/press-item.cfm?headLine_id=1794

NEW JERSEY MEADOWLANDS COMMISSION FEEDBACK

1. EMAIL RESPONSE TO STAKEHOLDER FEEDBACK INQUIRY, EXECUTIVE DIRECTOR
2. SUMMARY OF NJMC PUBLIC ASSISTANCE PROJECTS
3. SUMMARY OF NJMC FLOOD MITIGATION PROJECTS
4. USACE 1989 HACKENSACK RIVER BASIN NJ FLOOD CONTROL STUDY RECONNAISSANCE REPORT (UPLOADED TO SHAREPOINT)
5. PRESENTATION ON WATER LEVEL OBSERVATIONS DURING SUPERSTORM SANDY (UPLOADED TO SHAREPOINT)

Secure reply thread: melissa.nichols@njmeadowlands.gov

2 total replies , 1 unread reply

Reply number

Re: Secure delivery of package: USACE North Atlantic Coast Comprehensive Study File Transfer #2

By: BuiFA@cdmsmith.com Date: 09/16/2013 04:14 PM

Melissa,

Your documents have been received. Thank you.

-Frannie

Re: Secure delivery of package: USACE North Atlantic Coast Comprehensive Study File Transfer #1

By: melissa.nichols@njmeadowlands.gov Date: 09/16/2013 04:12 PM

Dear Ms. Croom:

This letter is to provide you with information for the North Atlantic Coast Comprehensive Study (NACCS) of the New York Bay and its tributaries. Mr. Cresitello of the USACE requested that we send you information on four specific points. Under those four headings restated below, I am indicating sources that provide answers to those questions that were presented. I have also attached some supporting documentation.

1. Problem identification for your area

The New Jersey Meadowlands Commission (NJMC or the Commission) is an independent authority established by the State Legislature in 1968 in but not of the Department of Community Affairs. It exercises jurisdiction over a 30.4-square-mile area known as the Hackensack Meadowlands District (District). The District is composed of parts of 14 municipalities in Bergen and Hudson counties (Carlstadt, East Rutherford, Jersey City, Kearny, Little Ferry, Lyndhurst, Moonachie, North Arlington, North Bergen, Ridgefield, Rutherford, Secaucus, South Hackensack, and Teterboro).

Its enabling legislation charges the NJMC with a three-fold mandate: to protect the delicate balance of nature; to provide for the orderly commercial, industrial and residential development of the region; and to provide for the disposal of solid waste. Today, the NJMC also focuses on promoting alternative energy projects, encouraging economic development, and promoting the District's environmental resources through ecotourism and education.

HUD provides "Sandy Damage Estimates by Block Group" on their web pages (http://www.huduser.org/maps/map_sandy_blockgroup.html) that clearly shows the most significant damage in the District was in the northern municipalities. Please also see the last slide of the attached PowerPoint presentation.

Carlstadt, Moonachie and Little Ferry are three District municipalities located about 28 miles from the Verrazano Bridge up river from Newark Bay. Most of the area of these towns lies within a 3,000 acre sub-basin with a natural elevation of roughly only 1.5 feet above sea level (NADV88). During the early 1900's the primary mosquito control strategy was to prevent the occurrence of standing water to discourage mosquitos from breeding. As depicted by historical maps, the area was heavily ditched and 5 foot earthen berms were built around most of the low lying basin as a way to drain rain water and prevent the high tides from reaching the meadows near the river. During Hurricane Sandy the water level surged to 8.5 feet and remained above 7 feet for more than six hours overtopping all earth berms and tide gate control structures. As a result more than 70% of the residences and businesses in the towns of Moonachie and Little Ferry were flooded. The attached PowerPoint presentation by Dr. Francisco Artigas, Director of the NJMC Meadowlands Environmental Research Institute, entitled Water Level Observations During Super Storm Sandy focuses on those hard-hit communities. It shows the real time water elevation measurements during Hurricane Sandy at different locations within this sub-basin. It also indicates the general elevation of the area as well as the elevation and location of existing berms and tide gates. Finally, there are maps and animations using detailed digital elevation models (2009 LiDAR) that show the timing and extent of the flooding in Moonachie and Little Ferry. This is according to the recorded real-time water elevation and confirmed by physical water marks that were left on building and nearby structures.

2. Description of damages for your area

Please find attached a detailed report on the damage sustained to NJMC property. The NJMC does not have a summary of damages sustained by individual District municipalities.

3. Prior related studies or projects in the damaged area

The attached USACE NY District 1989 study Hackensack River Basin Flood Control Study Reconnaissance Report provides some background on reoccurring tidal or fluvial flooding in the area. USACE prepared a similar 1993 report. FEMA has the 2005 Flood Insurance Study for Bergen County which includes the Hackensack Meadowlands Commission's Meadowlands District encompassing that part of the Hudson County.

4. List measures that your jurisdiction has considered to address the problem

The New Jersey Meadowlands Commission participates in the FEMA Community Rating System (CRS) on behalf of the 14 municipalities within the Hackensack Meadowlands District. This program is voluntary and recognizes and encourages community floodplain management activities that exceed the minimum National Flood Insurance Program (NFIP) requirements. Property owners and tenants in the Hackensack Meadowlands District currently enjoy a flood insurance rate discount due to the continued efforts by the NJMC to exceed the program requirements. In 2005, the NJMC prepared the Hackensack Meadowlands Floodplain Management Plan, under CRS guidelines, with the goal of identifying measures to address the District's potential vulnerability to flooding. Several of the projects listed in the report were completed as funding became available. The remaining projects listed in the report are still critical to mitigate the impact of flooding in the District. The report can be found on the NJMC website at the link below:
http://www.njmeadowlands.gov/eg/flood/docs/Hackensack%20Meadowlands%20Floodplain%20Management%20Plan.pdf

The NJMC has also submitted potential flood mitigation projects to NJ OEM consideration (attached).

I hope you find this information useful. As experts on the Meadowlands, the NJMC's professional staff welcomes any opportunity to engage in a technical discussion on ways to reduce the risk of flooding in the District. Please do not hesitate to contact me with questions or requests for additional information.

Sincerely,

Marcia A. Karrow
Executive Director

Melissa D. Nichols
Special Assistant to the Executive Director
New Jersey Meadowlands Commission
One DeKorte Park Plaza, Lyndhurst, NJ 07071
Telephone: 201-460-4692
Fax: 201-804-9620

File name	Date Created	Size
Artigas_Water Level Observations During Super Storm Sandy Aug 28, 2013.pptx	09/16/2013 04:12 PM	48.7 MB
USACE 1989 Hackensack River Basin NJ_Flood control study reconnaissance report.pdf	09/16/2013 04:12 PM	12.7 MB
summary.njmc.flood.mitigation.projects.pdf	09/16/2013 04:12 PM	81.1 KB
njmc.summary of sandy damage.public.assistance.pdf	09/16/2013 04:12 PM	431.0 KB

Download

Items 1 to 2 of 2

Reply securely

Summary of NJMC FEMA Mitigation Projects * (Attachment 3)

Project Name	Description	Location	Cost	Assumptions
Ditch Dredging	Dredging of 14 Miles of Ditches	District-wide	$15,000,000.00	Easements Available, Permits Granted but Not Included in Price, No Mitigation
Replacement of Peach Island Tide Gate	Replace Structure & Gates on Peach Island Creek to Protect Upstream Properties	Carlstadt	$3,000,000.00	No Piles, Permits Granted but Not Included in Price, No Mitigation
Berm Enhancement	Elevating, Replacing or Adding Berms to an Elevation to Prevent Regular Flooding (16 miles in length to an average of 6 ft high)	Select Towns	$5,000,000.00	Minimal Clearing/Grubbing, No Mitigation, Permit Not Included, No Property Acquisitions
District-Wide Flood Control/Maintenance Equipment	Camera Truck, Vac Truck, Airboat, GPS		$600,000.00	
Purchase Generators	Trailer Mounted or Permanent Generators to Allow for Continued Operations During Storm Events	NJMC	$400,000.00	
Aerial Survey	Fly District Using LIDAR and Other Technology to Determine Topography and Other Data	District-wide	$50,000.00	Able to Use Existing Ground Control
Upgrade Hardware and Gates on Existing Tide Gates	Replace Flapgates and Hardware with Stainless Steel	District-wide	$400,000.00	All Existing Pipes are Standard Size, Easements Available
Culvert Repair at Cayuga Dike	Replace Culvert Pipes and Structure	Kearny	$400,000.00	No Chromium Issues
Mitigation Improvements at NJMC Facilities	Improvements to Mitigate Future Storm Damage to NJMC Complex, School & Landfill	NJMC	$1,500,000.00	
		Total	**$26,350,000.00**	

*** Please see attached NJMC Letter of Intent submitted to the State of New Jersey OEM on 2/4/13**

~~DEBATED COVERAGE~~

INS COVERAGE

NEW JERSEY MEADOWLANDS COMMISSION
Superstorm Sandy
Summary of Damage Assessments
as of 12/3/2012

Location #1
NJMC Buildings and Grounds
1 DeKorte Park Plaza
Lyndhurst, NJ

			ANTICIPATED COVERED COST	Cause	Type
Loc #1 A	Building Foundations/Foam		$68,544.00	Flood	Ground
Loc #1 B	Utilities Underground Lines		$2,025.00	Flood	Buried Wires
Loc #1 C	Two Victor Curve Benches		$600.00	Flood	Outdoor - Metal
Loc #1 D	Surfaces - Stairs to Employee Entrance		$4,050.00	Flood	Surface Pavers
Loc #1 E	Surfaces - Walkway with Seating area		$10,500.00	Flood	Surface Pavers
Loc #1 F	Engineering		$3,000.00	Flood	General
Loc #1 G	WTC - Deck		$72,000.00	Flood	Surface - Wooden Boardwalk
Loc #1 H	WTC - Cable Railing		$480.00	Flood	Surface
Loc #1 I	WTC - Benches		$972.00	Flood	Outdoor - Metal
Loc #1 J	WTC - Dedication Plague		$240.00	Flood	Outdoor - Bronze
Loc #1 K	WTC - Skyline Sculpture		$360.00	Flood	Outdoor - Metal
Loc #1 L	WTC - Surface Pavers		$900.00	Flood	Surface
Loc #1 M	WTC - Gravel		$4,500.00	Flood	Surface
Loc #1 N	WTC - Alumium Edging		$432.00	Flood	Surface
Loc #1 O	WTC - Plantings		$10,800.00	Flood	Surface
Loc #1 P	Paid Expenses and Estimates for clean up,	THIS IS ALL ONE	$27,191.00	Flood	Landscape Debris
Loc #1 Q	safety and operations, and damages	DESCRIPTION	(included in above)	Flood	Landscape Debris
Loc #1 R	LTI (Debris cleanup) paid		$18,300.00	Flood	Landscape Debris
Loc #1 S	Bergen Fence (Safety measures) paid		$2,615.00	Flood	Temp Fence
Loc #1 T	Rapid Pump (Septic Pumps and Problems) paid		$531.25	Flood	Building
Loc #1 U	Vic's Tree (Tree and Debris removal) paid		$3,600.00	Flood	Debris Cleanup
Loc #1 V	Liberty Electric (Electric Repairs) paid		$4,470.00	Flood	Building
Loc #1 W	Carrier (HVAC Repairs) paid		$3,081.92	Wind	Building
Loc #1 X	United Elevator (Elevator Repairs) paid		$3,900.00	General	Building - Power Surge
Loc #1 Y	Waste Management (Container Rentals/hauling debris) paid		$3,537.28	Flood	Debris Removal
Loc #1 Z	Nick's Towing (crane rental/operator removal of docks) Estimate		$7,200.00	Flood	Dock Removal
Loc #1 X	Windows (2 window replacements) Estimate		$5,393.00	Wind	Building
Loc #1 Y	Cleaninig of catch basins/manholes - Estimate		$5,000.00	Flood	Surface Drains
Loc #1 Z	Lyndhurst Nature Reserve - Structures - Remove Bird Blind Debris		$3,000.00	Flood & Wind	at Trails
Loc #1 AA	Lyndhurst Nature Reserve - Structures - Rebuild Bird Blind in kind		$13,500.00	Flood	at Trails
Loc #1 BB	Lyndhurst Nature Reserve - Structures - Bridge #1 - Culvert - New - On Grade - No Rail		$12,285.00	Flood	at Trails
Loc #1 CC	Lyndhurst Nature Reserve - Structures - Bridge #2 - Wetland - New - On Grade - No Rail		$26,325.00	Flood	at Trails
Loc #1 DD	Lyndhurst Nature Reserve - Structures - Elevated Boardwalk - demolish, building new w/ rail		$27,000.00	Flood	at Trails
Loc #1 EE	Lyndhurst Nature Reserve - Furnishings - Purchase & Install new wooden benches		$27,000.00	Flood	at Trails
Loc #1 FF	Lyndhurst Nature Reserve - Furnishings - Purchase & Install new wooden benches		$12,000.00	Flood	at Trails
Loc #1 GG	Lyndhurst Nature Reserve - Furnishings - Purchase & Install new trash receptacles		$3,375.00	Flood	at Trails
Loc #1 HH	Lyndhurst Nature Reserve - Interpretive Signs - Replacement Signs (20" x 30")		$1,800.00	Flood	at Trails
Loc #1 I I	Lyndhurst Nature Reserve -Remove and reset viewscopes		$1,500.00	Flood	at Trails
Loc #1 JJ	Marsh Discovery Trail - Remove and replace front end - approx 300 LF x 7' (Superdeck on floats)		$283,500.00	Flood	at Trails
Loc #1 KK	Marsh Discovery Trail - Remove and replace rope guide - approx 400 LF w/ support posts, 1 side		$2,850.00	Flood	at Trails
Loc #1 LL	Marsh Discovery Trail - Remove and replace Study dock no. 1 - approx 770 SF (Superdeck on floats)		$103,950.00	Flood	at Trails
Loc #1 MM	Marsh Discovery Trail - Repair and relocate dip-netting pier - approx 175 LF x 7' (Superdeck on floats)		$165,375.00	Flood	at Trails
Loc #1 NN	Marsh Discovery Trail - Remove and replace weather monitoring dock - approxi 200 SF (wood on floats)		$19,500.00	Flood	at Trails
Loc #1 OO	Marsh Discovery Trail - Remove and replace study dock no. 2 - approx 515 SF		$69,525.00	Flood	at Trails
Loc #1 PP	Marsh Discovery Trail - Furnishings - Remove, store and reinstall benches		$300.00	Flood	at Trails
Loc #1 QQ	Marsh Discovery Trail - Furnishings - Remove, store and reinstall signs		$300.00	Flood	at Trails
Loc #1 RR	Marsh Discovery Trail - Planting - Front entrance, marsh fringe - prepare bed & plants w/ herbaceous plugs		$18,000.00	Flood	at Trails
Loc #1 SS	Plaza - Skywalk pile cap veneer - reface with stone		$1,500.00	Flood	Surface
Loc #1 TT	Plaza - Water - Irrigation - Heads and Valves		$6,000.00	Flood	Underground
Loc #1 UU	Plaza - Surfaces - Relay concrete paving		$27,000.00	Flood	Surface

Loc #1 VV	Plaza - Surfaces - Reset catch basins				$1,500.00	Flood	Surface
Loc #1 WW	Plaza - Reinstall sign (for art project)				$300.00	Flood	Sign
Loc #1 XX	Shorewalk Structures - Retaining wal under entrance to emergency egrees - gabions & stone				$2,700.00	Flood	Surface
Loc #1 YY	Shorewalk - Structures - Backfill & Filter Fabric				$4,500.00	Flood	Landscape
Loc #1 ZZ	Shorewalk - Utilities - Electric Light Bollards				$6,000.00	Flood	Exterior Lights
Loc #1 AAA	Shorewalk - Surfaces - New concrete pavers at entrance to emergency egress				$6,750.00	Flood	Surface
Loc #1 BBB	Visitors Center - Demolition - remove old elevated structure over water				$6,000.00	Wind	Deck walkway over Water
Loc #1 CCC	Visitors Center - Structures - Remove and replace wooden deck and framing - approx 260 LF x 8' (treated)*				$276,750.00	Wind	Deck walkway over Water
Loc #1 DDD	Visitors Center - Structures - Pavilion structure/roof				$18,975.00	Wind	Shingles/Deck Attachment
Loc #1 EEE	Visitors Center - Utilities - Remove and replace low-voltage lighting - approx 300 LF x 2 sides				$8,250.00	Wind	Attached to Deck Walkway over water
Loc #1 FFF	Visitors Center - Furnishings - Remove, store and reinstall benches				$1,200.00	Flood	Outdoor
Loc #1 GGG	Visitors Center - Furnishings - Remove, store and reinstall custom railing - aprox 75 LF				$1,500.00	Wind	Deck over water
Loc #1 HHH	Visitors Center - FurnishingsStructural inspection and assessment				$1,500.00	Flood	General
Loc #1 III	Transco Trail - Benches - Columbia Cascade Arbor Series				$12,750.00	Flood	Trail Bench
Loc #1 JJJ	Transco Trail - Concrete Footings				$3,600.00	Flood	Ground
Loc #1 KKK	Transco Trail - Gravel - Red Argylite				$337.50	Flood	Ground
Loc #1 LLL	Transco Trail - Signage - Exhibit base, single pedestal				$562.50	Flood	Ground
Loc #1 MMM	Transco Trail - Center - Footing				$300.00	Flood	Ground
Loc #1 NNN	Maintenance Bldg. - Remove and replace vinyl covering				$7,260.00	Wind	Wind Damage
Loc #1 OOO	Maintenance Bldg. - Maintenance Bldg.Replace electrical				$2,786.00	Wind	Wind Damage
Loc #1 PPP	Weather Station - CR3000 Microdataloggers	$3,062.00		3	$9,186.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 QQQ	Weather Station - NL115 Ethernet Inferface &		THIS IS ALL		(included in below)	Flood	Weather Station in Marsh on Floating Dock
Loc #1 RRR	Weather Station - CompactFlsh Module	$274.00	ONE ITEM	3	$822.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 SSS	Weather Station - CR1000 Microdatalogger	$1,440.00		3	$4,320.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 TTT	Weather Station - Licor 7500 (CL2 sensor and control box)	$13,000.00		1	$13,000.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 UUU	Weather Station - 13 Inch Dual Purpose 12 V Battery	$219.00		4	$876.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 VVV	Weather Station - 10 Inch Dual Purpose 12 V Battery	$200.00		1	$200.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 WWW	Weather Station - Water level monitoring support structure	$2,300.00	THIS IS ALL	2	$4,600.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 XXX	Weather Station - Temperature and humidity sensor		ONE ITEM		(included in above)	Flood	Weather Station in Marsh on Floating Dock
Loc #1 YYY	Weather Station - (HMP45AC) + Shield	$600.00		1	$600.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 ZZZ	Weather Station - Solar radiation sensor (Li200XL) + Stand	$530.00		1	$530.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 AAAA	Weather Station - Barometric pressur sensor (CS106)	$600.00		1	$600.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 BBBB	Weather Station - Wind sensor (MG Young 05-106L) + Mount	$1,228.00		1	$1,228.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 CCCC	Weather Station - Rain gage (TES-25WS-L)	$385.00		1	$385.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 DDDD	Weather Station - Cable		$1.5 per foot	75	$113.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 EEEE	Weather Station - Solar Panel (BP 365 U)	$600.00		1	$600.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 FFFF	Weather Station - Raven Modem (V2227) DC Power	$650.00		3	$1,950.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 GGGG	Weather Station - Sunsaver 12 volt 10 amp, SS10 & SS10L	$50.00		4	$200.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 HHHH	Weather Station - Labor costs to replace and reassemble units				$26,478.00	Flood	Weather Station in Marsh on Floating Dock
Loc #1 IIII	Maintenance Bldg. - Power Supply to Maintenance Bldg. burned due to Transformer damage				$35,000.00	Other	Parking Lot - underground
Loc #1 JJJJ	Parking Lot Solar Canopy Inverter (equipment and labor for removal and installation)				$64,190.00	Flood	Utility
					$1,618,206.45		

Subject to FDK Limit ($15,622 not covered by Ins.)

Location #2
Harrier Meadow Facility
Lyndhurst, NJ

		ANTICIPATED COVERED COST		
Loc #2 A	Re-set Bird Blind (crane/construct new base)	$7,500.00	Flood	Bird Blind in March
Loc #2 B	LTI Landscaping (debris removal)	$25,700.00	Flood	Landscape Debris
Loc #2 C	Waste Management (container rental/hauling debris)	$8,000.00	Flood	Landscape Debris
		$41,200.00		

Location #3
Marsh Creek facility, Secucus, New Jersey
Lyndhurst, NJ

		ANTICIPATED COVERED COST		
Loc #3 A	LTI Landscaping (debris removal)	$4,660.00	Flood	Landscape Debris
Loc #3 B	Waste Management (container rental/hauling debris)	$1,800.00	Flood	Landscape Debris
		$6,460.00		

Location #4

	River Barge Park 262 Outwater Lane					ANTICIPATED COVERED COST		
Loc #4 A	Facility Damage		DUPLICATE - THIS IS THE SAME AS ITEMS #4F THRU #4V AND #4Z			~~$70,320.00~~	Flood	Building Value High
Loc #4 B	LTI (Debris Removal)		REMOVE -			$4,660.00	Flood	Landscape Debris
Loc #4 C	Vic's Tree (Tree/Debris Removal)		THIS DOES NOT BELONG UNDER LOCATION # 4			$1,800.00	Flood	Landscape Debris
Loc #4 D	Vegetation Repalcement (110 trees lost)		THIS SHOULD BE LISTED UNDER			$13,200.00	Flood	Landscape
Loc #4 E	Trail repair - see attached map: Estimate		LOCATION # 3			$150,000.00	Flood	Trail
Loc #4 F	Clean up w/ rack Removal - Equipment					$9,540.00	Flood	?
Loc #4 G	Clean up w/ rack Removal - Hand					$17,100.00	Flood	?
Loc #4 H	Placing Sign Kiosks					$750.00	Wind	Exterior
Loc #4 I	Building	Wet Vac/Clean				$1,500.00	Flood	Clean up
Loc #4 J	Repair Rowing dock Gang Way Plate		Rowing dock gangway plate			$9,000.00	Flood	Dock
Loc #4 K	Repair Rowing dock Gang Way Railing		Rowing dock gangway railing			$3,000.00	Flood	Dock
Loc #4 L	Repair Rowing dock Gang Way Adjust		Rowing dock gangway adjust			$1,500.00	Flood	Dock
Loc #4 M	Repair Rowing dock Gang Way Deck		Rowing dock decking			$750.00	Flood	Dock
Loc #4 N	Dumpster Enclosure *Hardware & Stops		Replace & Install			$750.00	Flood	Fence
Loc #4 O	Wooden Enclosure *Gates		Repair hardware, end pickets			$450.00	Flood	Fence
Loc #4 P	Fence Repairs 8' ht panels		Replace & Install			$1,650.00	Flood	Fence
Loc #4 Q	Bldg wall light *		Replace & Install			$1,125.00	Flood	Building
Loc #4 R	Utilities *		Electric/HVAC Compressors			$4,500.00	Flood	Under Ground
Loc #4 S	Trash Install trash receptacle					$300.00	Flood	In parking Lot
Loc #4 T	Fabricate and install wheel stops					$2,250.00	Flood	Surface
Loc #4 U	Surfaces Remove and install (top & base) promenade stonescape					$405.00	Flood	Surface
Loc #4 V	SurfacesRemove and install promenade cobbles					$8,250.00	Flood	Surface
Loc #4 W	Planting					to be determined	Flood	Landscape
Loc #4 X	Planting Reposition plaza trees					$375.00	Flood	Landscape
Loc #4 Y	Planting Mulch					$2,625.00	Flood	Landscape
Loc #4 Z	Miscellaneous Loss of antique wood timbers					$7,500.00	Flood	Landscape
Loc #4 AA	Desk	Right return		5	$269.55	$1,347.75	Flood	Office Furniture
Loc #4 BB		Left return		3	$269.55	$808.65	Flood	Office Furniture
Loc #4 CC		Single		11	$3,335.70	$3,692.70	Flood	Office Furniture
Loc #4 DD	File Cabinets 2 drawer oak			4	$323.19	$1,292.76	Flood	Office Furniture
Loc #4 EE	Cabinet	2 door		2	$307.80	$615.60	Flood	Office Furniture
Loc #4 FF	Tables	36" Round		3	$187.00	$561.00	Flood	Office Furniture
Loc #4 GG		42" Round		1	$377.00	$377.00	Flood	Office Furniture
Loc #4 HH		42" Round		2	$528.29	$1,056.58	Flood	Office Furniture
Loc #4 II	Cubicles	Work stations		8	$1,955.00	$15,640.00	Flood	Office Furniture
Loc #4 JJ		Reception station		1	$2,747.92	$2,747.92	Flood	Office Furniture
Loc #4 KK	Bookcase			1	$255.15	$255.15	Flood	Office Furniture
Loc #4 LL	Hutches	Large		2	$165.33	$330.66	Flood	Office Furniture
Loc #4 MM		Small		2	$284.13	$568.28	Flood	Office Furniture
Loc #4 NN	Projection Screen			2	$159.00	$318.00	Flood	Office Furniture
Loc #4 OO	Surveillance cameras		n/a			$3,668.00	Flood	Office Furniture
						$346,580.05		

	SITE #6 Erie Landfill North Arlington, NJ	ANTICIPATED COVERED COST		
Loc #6 A	Debris in road- 18 containers x $400 each	$7,200.00	Flood	Landscape Debris
Loc #6 B	Debris in road - Labor	$24,000.00	Flood	
		$31,200.00		

	SITE #7 1E Landfill Kearnyn, NJ	ANTICIPATED COVERED COST		
Loc #7 A	Berm repair/debris removal	$107,500.00	Flood	Landscape Debris

SITE #8

Loc #8 A	1E Landfill Kearny, NJ Debris clean up	ANTICIPATED COVERED COST $21,400.00	Flood	Landscape Debris
Loc #9 A	SITE #9 Moonachie Tide Gate Structure Moonachie, NJ Debris removal from trash rack and within culvert	ANTICIPATED COVERED COST $5,000.00	Flood	Landscape Debris
Loc #10 A	SITE #10 Bashes Creek Tide Gate Structure Carlstadt, NJ Debris removal from trash rack and within culvert	ANTICIPATED COVERED COST $5,000.00	Flood	Landscape Debris
Loc #11 A	SITE #11 West Riser Tide Gate Structure Carlstadt, NJ Debris removal	ANTICIPATED COVERED COST $15,000.00	Flood	Landscape Debris
Loc #12 A	SITE #12 Rutherford Tide Gate Structure & Trash Rack Rutherford, NJ Debris removal from trash rack	ANTICIPATED COVERED COST $5,000.00	Flood	Landscape Debris
Loc #13 A	SITE #13 East Rutherford Tide Gate Structure & Trash Rack East Rutherford, NJ Debris removal from trash rack	ANTICIPATED COVERED COST $5,000.00	Flood	Landscape Debris
Loc #14A	Location #14 LEL Meter Shed Harrison Avenue Kearny, NJ Shed Repairs and replacements	ANTICIPATED COVERED COST $11,300.00	Flood	Building

METROPOLITAN TRANSIT AUTHORITY INFORMATION

1. MAY 23, 2013 PRESS RELEASE DOCUMENTING DAMAGES AND POTENTIAL RESILIENCY PROJECTS

Fix&Fortify SANDY RECOVERY WORK

KEY DATES

May 23, 2013 March 29, 2013 March 21, 2013 Transit Museum Relief

Governor Cuomo Announces Additional Federal Sandy Recovery Funds

May 23, 2013

On May 23rd, Governor Andrew Cuomo announced that the Federal Transit Administration (FTA) has allocated an additional $2.6 billion in disaster relief funds to the Metropolitan Transportation Authority (MTA) for Superstorm Sandy recovery efforts, bringing the total allocation to $3.79 billion dollars.

The funds, made available through the Federal Transit Administration's (FTA) Emergency Relief Program, includes nearly $898 million set aside to help the MTA with resiliency projects to help ensure transit assets are better able to withstand future disasters. These resiliency projects are aimed at protecting everything from trains and buses to stations, tunnels, and rail yards from storm surges and flooding.

"We continue to work collaboratively with our federal partners to secure all available resources to rebuild New York's transit infrastructure which drives the entire region's economy," Governor Cuomo said. "But it's more than just rebuilding. We need to dedicate ourselves to building a stronger, more resilient system that can withstand future storms and provide 8.5 million daily customers with a robust public transportation network that can deliver the service they depend on every day."

"We are grateful for the federal assistance we have received in order to move forward with vital projects to keep the subways safe and reliable for years to come," said MTA Interim Executive Director, Thomas F. Prendergast. "This funding will be incorporated into our upcoming Capital Program Amendment that will outline how we will make best use of these funds to rebuild and fortify our entire transit network."

Today's announcement of $2.6 billion in disaster assistance brings the total dollars allocated for Sandy-related activities to $3.79 billion, vital resources to support the ongoing recovery. The MTA had previously received nearly $1.2 billion in funding from the Federal Transit Administration (FTA) for repair and disaster relief work initiated by New York City Transit, Metro-North Railroad, Long Island Rail Road and other MTA divisions, as well as $3 million from the Federal Emergency Management Agency (FEMA) for MTA Bridges and Tunnels.

Sandy recovery and resiliency funding as of May 23, 2013 for the MTA is as follows:

Initial Allocation	$193,893,898
3/29 Allocation	$1,000,415,662
Today's Recovery Allocation	$1,702,462,214
Today's Resiliency Allocation	$897,848,194
Total Funds Allocated Today	$2,600,310,408
TOTAL FUNDS TO DATE	$3,794,619,968

Last week, Gov. Cuomo announced that service on the storm-damaged Rockaway A line will resume May 30 after a six-month effort to rebuild 1,500 feet of washed-out tracks, replace miles of signal, power and communications wires, and rehabilitate two stations that were completely flooded.

MTA New York City Transit has already established a new Sandy Recovery and Resiliency Division dedicated to launching, advancing and managing the rebuilding from Sandy, which will require years of construction and careful oversight of billions of dollars in federal aid. Plans will call for protecting stations, fan plants, under-river tubes, tunnels, ground-level tracks, signals, train shops and yards, traction power substations, circuit breaker houses, bus depots, train towers and public areas. The goal is to protect all points where the subway system could be flooded during a storm.

MTA Metro-North Railroad and MTA Long Island Rail Road also suffered extensive damage from Superstorm Sandy, and work continues at both railroads to harden their track, signal and power systems to guard against high water levels in future storms. MTA Bridges and Tunnels is studying how to better protect crucial elements as well, and is replacing equipment and materials that are at higher risk of failure in the Hugh L. Carey and Queens Midtown tunnels, which both flooded during the storm. In addition, Bridges and Tunnels will conduct a study, in keeping with recommendations by the NYS 2100 Commission, to examine what is needed to keep both Rockaway bridges in the highest state of good repair, particularly during extreme weather events. The Marine Parkway-Gil Hodges Memorial and Cross Bay Veterans Memorial bridges were both heavily affected by high winds during Hurricane Irene and Superstorm Sandy and by flooding during Sandy.

While temporary repairs have kept most of the MTA network running, it will take years to design and implement permanent recovery measures. The MTA system suffered an estimated $4.755 billion worth of damage as railroad and subway lines, vehicular tunnels, subway stations and power and signal equipment were inundated with corrosive salt water during Sandy.

Before submitting grant applications for the newly announced funds, the MTA will be required to develop a list of eligible projects and work with FTA to meet eligibility requirements. The FTA will allocate additional funds in the coming months.

NEW JERSEY TRANSIT CORPORATION INFORMATION

1. AUGUST 26, 2013 PRESS RELEASE DOCUMENTING RESILIENCY PROJECTS
2. SEPTEMBER 2013 WEBSITE CAPTURE DOCUMENTING HURRICANE SANDY STORM DAMAGES

Making NJ TRANSIT Stronger And More Resilient

In Partnership With The Obama Administration, Governor Christie Announces NJ TRANSITGRID, A First-Of-Its Kind, Storm Resilient Power Infrastructure To Keep The Garden State On The Move

Acting on his commitment to rebuild New Jersey stronger after Superstorm Sandy, Governor Christie today announced a partnership with the Obama Administration to make the state's infrastructure more resilient for future disasters. The State of New Jersey is collaborating with the U.S. Department of Energy to design NJ TransitGrid - a first-of-its-kind electrical microgrid capable of supplying highly-reliable power during storms or other times when the traditional centralized grid is compromised.

MAKING NJ TRANSIT MORE RESILIENT IN THE FACE OF FUTURE DISASTERS

Events such as Superstorm Sandy demonstrate the clear need to develop a fully-resilient baseload-powered electric infrastructure designed to fortify the public transportation network. Electrical microgrids can supply highly-reliable power during storms or other times when the traditional centralized grid is compromised. A power network of this kind would not only alleviate the social and economic impact of a major transit infrastructure-related power disruption but is also critical to facilitate emergency evacuation-related activities. This has particular value to NJ TRANSIT, which is dependent on outside grids to keep hundreds of thousands of customers on the move each day.

A memorandum of understanding has been signed between the United States Department of Energy, NJ TRANSIT and the New Jersey Board of Public Utilities to collaborate with Sandia National Laboratories to study and design a ground-breaking microgrid, entitled the NJ TRANSITGRID.

The proposed NJ TRANSITGRID could potentially increase the resiliency and reliability of NJ TRANSIT's electrical systems. This could be accomplished via:

- The design, construction and operation of self-generation power facilities;
- The design, construction and operation of a new, dedicated power grid;
- The distribution of self-generated power to NJ TRANSIT's overhead catenary wire network;
- The distribution of self-generated power to key NJ TRANSIT facilities.

NJ TRANSIT could make use of existing railroad rights-of-way to transmit this power between the generation site(s), facilities and rail lines in Jersey City, Kearny, Secaucus, Hoboken, Harrison and Newark. Railroad facilities and lines in these communities represent the most crucial – and the most vulnerable corridor within the agency's rail system. It is anticipated that such a power network could potentially increase the resiliency and reliability of NJ TRANSIT's electrical systems.

NJ TRANSIT IS ALREADY STRENGTHENING ITS CRITICAL INFRASTRUCTURE

NJ TRANSIT is *the nation's third-largest transportation system* and serves *nearly 900,000 passengers each day*, and is dependent on outside electrical grids to remain operational. NJ TRANSIT is currently moving forward with a comprehensive Sandy recovery plan designed to strengthen critical infrastructure, including:

- Raising of critical power substations;
- Installing nearly 600 steel catenary power poles;
- Fortifying power production and delivery is the next step needed to support these important resiliency efforts.

NJ TRANSIT continues to inspect facilities, infrastructure and equipment across all regions of New Jersey in the wake of Hurricane Sandy, as part of an intensive effort to restore the state's public transportation network to normal operations. Hurricane Sandy caused major damage throughout the state, leaving behind long-term mechanical and operational challenges that NJ TRANSIT is working tirelessly to overcome. This will take time, and the blow delivered by Hurricane Sandy will continue to impact customers for days to come.

NJ TRANSIT cancelled all service on Sunday in advance of the storm, which enabled the agency to ensure the safety of customers and employees and also allowed transit personnel to move locomotives, train cars, buses and other equipment to locations where they could be protected as much as possible from the elements. Since the storm subsided on Tuesday morning, crews have worked around the clock to inspect more than 500 miles of track, equipment yards, buses and trains sets, making repairs or clean-ups where necessary as the first step toward restoring the NJ TRANSIT network to normal operations. However, storm damage in many areas was severe, and residual impacts from Hurricane Sandy will cause many bus, rail, light rail and Access Link customers to continue to experience service suspensions, delays and cancellations on their lines.

NJ TRANSIT Rail System Highlights

- NJ TRANSIT's Rail Operations Center-the central nervous system of the railroad-is engulfed in water, which has damaged backup power supply systems, the emergency generator, and the computer system that controls the movement of trains and power supply.
- There are numerous downed trees across the rail system, which have caused damage to overhead wires and signal wires.
- There are rail washouts across the system, including on the North Jersey Coast Line and Atlantic City Rail Line.
- Several rail stations are flooded, including Hoboken Terminal.
- Morgan Drawbridge on the North Jersey Coast Line in South Amboy sustained damage from boats and a trailer that collided into the bridge.

NJ TRANSIT Bus System Highlights

- Power outages in local communities have resulted in the loss of traffic control devices critical to safe operation.
- Downed tree limbs and power lines continue to make many roads impassable.
- Nine of NJ TRANSIT's bus garages continue to operate on back-up generator power.

NJ TRANSIT Light Rail System Highlights

- Newark Light Rail sustained flooding in Newark Penn Station, as well as major debris damage between Newark Penn and Branch Brook Park stations.
- Hudson-Bergen Light Rail experienced track washouts at Port Imperial and West Side Avenue stations, as well as trees in the overhead wire in Weehawken and flooding in Hoboken.
- River Line sustained no significant damage to equipment or infrastructure; however, due to a loss of commercial power in downtown Camden, there is no power to operate the signals and switches.

AMTRAK

INFORMATION

1. DECEMBER 12, 2012 PRESS RELEASE DOCUMENTING DAMAGES AND RESILIENCY PROJECTS

News Release

FOR IMMEDIATE RELEASE
December 6, 2012

ATK-12-127
Contact: Media Relations
202 906.3860

AMTRAK: INVEST AND BUILD MORE RAIL CAPACITY AND RESILIENCE IN NEW YORK REGION

Requests $336 million for key Northeast Corridor infrastructure upgrades and to cover operating losses following Hurricane Sandy

WASHINGTON – Amtrak President and CEO Joe Boardman told a U.S. Senate committee today the New York region needs to strengthen rail capacity and resiliency in order to create "a better ability to resist damage, recover from an event and return the rail system to service" following major disasters.

To address these critical needs, and to compensate Amtrak for increased costs and revenue lost during Hurricane Sandy, Amtrak is requesting $336 million in emergency federal funding. Of this amount, $276 million would be for measures that provide enhanced protection and improved recovery capability of Penn Station New York and its tunnels against flooding or emergency disruptions, and to begin design and construction of elements of the capacity increasing Gateway Program. The additional $60 million would be to cover estimated operating losses incurred as a result of the storm.

Boardman said the hurricane exposed "the fragility of century old structures and the challenges that come when we're confronted with weather and conditions the designers never anticipated." He highlighted three projects that illustrate how key investments can buy both capacity and resilience in the Northeast Corridor rail network.

First, is designing a high density signaling system to provide greater operational flexibility in the four East River Tunnels used by Amtrak and Long Island Railroad. Two of these four tunnels flooded, received extensive damage and while re-opened have not yet returned to full service. If high density signaling was installed, the two undamaged tunnels could today handle a heavier traffic load and provide higher service levels. The two North River Tunnels used by Amtrak and New Jersey Transit have high density signaling system in place.

Second, a major electrical substation at Kearny, N.J., that supplies power to the North

- more -

River Tunnels and Penn Station New York needs to be rebuilt atop a platform that will be above the high water line and large enough so that more electrical capacity can be added at some point in the future to support plans for additional track capacity and more passenger trains into and out of New York. This substation was completely flooded during the storm, its outage hampered service recovery and has been restored to full service.

And third, in order to provide permanent and substantial new levels of flood prevention, redundancy, and capacity, Amtrak would advance design and early construction elements of the Gateway Program, including for two new Hudson River tunnels between New York and New Jersey. The two existing tunnels flooded during the hurricane and vividly demonstrated the need for more tunnel capacity that could have aided in service recovery.

"We need a system that's robust enough to support our operational needs not just on good days, but every day," Boardman emphasized.

He also stated that another aspect of the Amtrak recovery effort was "the work we didn't have to do." Over the last decade, Congress has invested in the Amtrak capital program to improve the resilience of its system in New York and those improvements provided for a faster restoration of service reducing the recovery period by days and perhaps weeks.

For example, fire and life safety improvements made to the tunnels provided better access points for quicker inspection for assessment of damage, pumps were connected to new standpipe systems to help remove the flood waters and an expanded ventilation system assisted in a speedier drying out of the tunnels. In addition, federal funds in recent years were used to clean and clear the right-of-way of trees that could topple in strong winds and get tangled in the overhead wires as well as for the repair of culverts and ditches to improve drainage and reduce the potential for track washouts.

A copy of the full written testimony is attached and can be found here. It contains a detailed description of Amtrak Hurricane Sandy preparation, response, recovery and damage.

About Amtrak®:
Amtrak is America's Railroad®, the nation's intercity passenger rail service and its high-speed rail operator. A record 31.2 million passengers traveled on Amtrak in FY 2012 on more than 300 daily trains – at speeds up to 150 mph (241 kph) – that connect 46 states, the District of Columbia and three Canadian Provinces. Amtrak operates intercity trains in partnership with 15 states and contracts with 13 commuter rail agencies to provide a variety of services. Enjoy the journey® at Amtrak.com or call 800-USA-RAIL for schedules, fares and more information. Join us on facebook.com/Amtrak and follow us at twitter.com/Amtrak.

# # #

TESTIMONY

OF

JOSEPH H. BOARDMAN

PRESIDENT AND CHIEF EXECUTIVE OFFICER

AMTRAK

60 MASSACHUSETTS AVENUE, NE

WASHINGTON, DC 20002

(202) 906-3960

BEFORE THE

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION SUBCOMMITEE ON SURFACE TRANSPORTATION AND MERCHANT MARINE INFRASTRUCTURE, SAFETY, AND SECURITY

HEARING

"SUPERSTORM SANDY: THE DEVASTING IMPACT ON THE NATION'S LARGEST TRANSPORTATION SYSTEMS"

THURSDAY, DECEMBER 6, 2012

10:30 A.M.

RUSSELL SENATE OFFICE BUILDING, ROOM 253

Good morning, Mr. Chairman, and thank you for the invitation to testify today.

As you know, Hurricane Sandy was a sudden and unprecedented event, leaving us no more than a couple of days to plan and prepare for impact and recovery. I think we came through it well, and I'd like to pay tribute up front to the men and women of Amtrak and to our partner carriers. All of these folks really came together and pooled their resources very effectively to prepare for the storm and get service restored once it had hit. They helped us and we helped them, and that cooperation was a very important part of the larger effort to get the region moving again in the aftermath of the storm.

While we didn't get much time to prepare, I think we made good use of the time we had. Our Engineering staff began planning on October 25th, while the center of the storm was still south of Florida. We fueled vehicles, and we positioned them along with materials and equipment to address likely problems with the electric traction and signal systems. We inspected areas that were known to be at risk for flooding, and we disabled several of the remotely controlled signal and switch complexes – what we call "interlockings" – that were at risk from high water. On the 26th and 27th we positioned 22 repair crews for our electrical system at strategic spots, we removed critical equipment from low-lying areas, and we brought in generators and other equipment to ensure we had pumping capacity and backup power capacity at likely spots. We manned all of our communication centers to ensure that we were tracking events and coordinating the inspection teams that we dispatched to monitor the system's condition. In coordination with the other NEC commuter railroads, we made a deliberate decision to shut down the railroad on Monday, October 29, and this allowed us to bring equipment into the yards and park it, and kept us from having to deal with stranded trains and passengers.

While I'm going to speak to the damage we had to deal with and our efforts to address it, I do want to stop before I go any further to highlight a couple of key points that I'm sure many of the other people here today will testify to. One is that we had an absolutely tremendous amount of cooperation and assistance from our partner railroads who were also affected – this includes Long Island Railroad, Norfolk Southern, CSXT Transportation, of course, and Metro-North and New Jersey Transit, and we worked with other carriers up and down the Eastern Seaboard. But the cooperation and teamwork in the New York area played a big part in the speedy restoration of service, and before I talk about the sterling work our folks did, I want to make sure that you know that our partners were with us every step of the way, and we appreciate all of their help.

And we needed it, because Sandy lived up to billing. The storm surge in lower Manhattan inundated the West Side Yard and flowed back toward Penn Station. When it came to the Manhattan end of the North River tunnels it flowed down into them – ultimately some 3.25 million gallons of water flowed down into those two tunnels. The track damage was minor, but the signal system and the electrically-powered sump pumps were basically destroyed and required complete replacement. The East River Tunnels were more heavily damaged, with more significant track damage and a much higher degree of immersion, since they were nearly full – they had more than 7 million gallons of water in them, although the two parallel tunnels which are operated by the Long Island Railroad were fortunately not flooded.

The Con-Ed power outages in Long Island deprived Penn Station and Sunnyside Yard in Queens of electrical power, freezing trains in place; other outages disabled the electrical system at various points south of Wilmington. The electrical and signal systems suffered damage both from high winds, which blew debris into wires and ripped down lines, and from water infiltration, which caused electrical shorts and other problems. The Kearny electrical substation that provides power to a section of the NEC Leading to the Hudson River tunnels was totally flooded. High winds damaged crossing gates and blew debris such as metal roofing onto the tracks. Debris also clogged drains, leading to pooling of water and requiring immediate cleaning to avert further damage. In some places, track and roadbed structure was flooded or eroded. Large movable components such as switches were jammed with debris; smaller movable components such as relays were destroyed by flying debris and required replacement. Many structures suffered damage from winds or water. Two New Jersey Transit stations served by Amtrak, Princeton Junction station and Trenton suffered from roof damage and flooding, respectively, while water infiltration at the Washington Union station control center required pumping. Approximately nine miles of the New York City-Albany line were flooded to just below track level by the Hudson River.

I think we kept abreast of the accumulating damage pretty well, so we always had a picture of what the storm was doing and had done. Diesel locomotives and inspection cars patrolled the territory around the clock during and after the storm, to identify damage and assess risk of further damage. Most areas were inspected multiple times, for a total of nearly 2,353 miles of infrastructure inspection (Amtrak is responsible for maintaining 363 miles of the 457 mile NECmainline).

Work began early on clearance and recovery. Trains of rock ballast were loaded and positioned prior to storm landfall on Monday morning to address erosion and flooding and the entire right-of-way was inspected during and after the storm to identify damage and ensure safety. Every movable bridge was inspected and as the storm moderated we were able to begin the work of recovery. We ultimately had to remove 80 trees from the right-of-way and repair the electrical system in 15 places – which is, for reasons I will get into shortly, fewer than we might have expected. There were two washouts to be replaced and a serious debris slide, but once the water receded, we were able to quickly and easily restore the four interlockings we shut down. CSXT helped us get a ballast train from Albany down to Trenton, and New Jersey Transit loaned us their "Aqua Train" which is very helpful in clearing light deadfall off the right-of-way and washing the ballast, so that we could keep the drainage-ways clear to ensure a solid and stable track structure. With a lot of support from our partner railroads, contractors, and our own workforce, which put in a lot of long hours under very difficult conditions, we were able to reduce our challenges to the Hudson River tunnels and the Kearny substation pretty quickly, and we restored service between Washington and Newark, New Jersey on Tuesday, October 31.

The tunnels serving New York were, however, a different matter. They required pumping, and once the water level was down, they had to be dried out and thoroughly inspected. The electric traction systems were generally fine, because the water didn't get high enough to knock them out, but the signal systems and internal pumping systems were basically destroyed and required wholesale replacement. The Kearny substation was under water, and it had to be pumped out, cleaned out, inspected, and a lot of key electrical components had to be either repaired or replaced. We were able to reopen the southernmost of the Hudson River tunnels, known to the railroad as the North River tunnels on Wednesday, November 1, and with the support and assistance of Long Island Railroad, we were able to restore a limited Boston to

Washington service on the evening of Friday, November 2. The East River tunnels were put back into service on November 10 and 11, and the northern North River tube came back into service on November 12. It took about four days to get the Kearny Substation restored, but that came back online on November 16. During this time, we were able to provide some assistance to our partners at Long Island Railroad, New Jersey Transit, and Metro-North, and I hope we were as helpful to them as they were to us.

While the work that went into the recovery effort was absolutely tremendous, there's another aspect of it that I alluded to before, and that's "the work we didn't have to do." I want to make sure I mention that, because I know how hard many members of this Committee have worked to ensure that our capital program is adequately funded. Over the last decade, Congress has invested substantial sums in our capital program. Some of this money has come in annual appropriations, and some came in the $1.3 billion grant Amtrak received directly under the terms of the American Recovery and Reinvestment Act (ARRA). While we're typically familiar with the contributions this funding makes to the most visible parts of our capital program – replacement of infrastructure or equipment that is in disrepair or in danger of "aging out" – it has also been used for programs that improve the resilience of our system.

The first area is our Fire and Life Safety program for the tunnels into and out of New York. We realized in 2001 that Amtrak had some potential vulnerabilities associated with the New York tunnels, and I give my predecessors credit for the speed with which they moved to address these vulnerabilities once they were identified, and the work that was done to ensure that the improvements were funded. A standpipe system was installed; this was designed to allow the fire department to pipe water into the tunnels in the event of a fire. Vertical turbine pumps with a capacity of 700 gallons per minute were installed to assist with drainage, access stairways were rebuilt and a basket recovery system installed. Ventilation shafts were rebuilt and new ventilating plants installed at the tops of the shafts to ensure a sufficient supply of air into the tunnels.

The wisdom of these investments became apparent when we found ourselves with four flooded tunnels. The access improvements allowed us to get down into the tunnels to inspect them; the standpipe system gave us a point to hook the pumps up to and a means to evacuate the water from the tunnels, and the turbine pumps helped us pump the water out of the tunnels. Finally, the ventilation system helped us get the diesel fumes from the pumps out of the tunnel and dry out the tunnels once the water was pumped out. These improvements meant a difference of days, and perhaps weeks, in the restoration of service into and out of New York, and up and down the East Coast.

Similarly, one of the very first projects we undertook with ARRA money was the cleanup of our right-of-way. Trees are beautiful things, so this was not an easy task, but they're a challenge to a railroad, particularly if it's electrified like the Northeast Corridor is. Whenever you get a good strong wind, something blows down, and it doesn't necessarily need to be a whole tree. A dead limb can shut down the electrical or signal systems if it falls in the right place. So we undertook a right-of-way cleaning and clearing program as soon as we had the money we took on the task of undertaking the necessary pruning and tree removal. We've done about 230 miles of tree removal since 2008, and the result wasn't a complete absence of deadfall – this storm was much too strong for that – but a manageable amount.

Similarly, we did a lot of work cleaning out the culverts and ditches that carry runoff water away from our roadbed. Doing this ensures effective drainage, and prevents water accumulation and the challenges that come with it, such as erosion damage or the wholesale washout of track structure and electrical and signal components. We did have two washouts, but set against the magnitude of the storm, that's a pretty low number.

So if there's a single idea I would ask the Committee to take away from this hearing, it's this: investment works. We may take the benefits of it for granted sometimes, but storms like this really illustrate the vital point, which is that investment buys more than just capacity – it buys resilience. That's a resilience the larger community needs in times like this, to help it recovery from the effects of the disaster.

I say this because we have spent a great deal of money on this infrastructure, and I'm confident that we can keep it in service for decades to come. But storms like this highlight the fragility of century old structures, and the challenges that come when we're confronted with weather and conditions the designers never anticipated. They also highlight the lack of capacity. If we are going to continue to support the region and provide for its growth, capacity is going to be an issue, and we will need to address it. That means making the investments we need now for systems that will provide additional capacity of a day-to-day basis, and additional resilience in a crisis like this one.

One lesson we've learned is that high density signaling in the East River Tunnels between New York and Queens would be a simple and comparatively inexpensive improvement that would greatly improve our operational flexibility. We have high density signaling in the two North River Tunnels between New York and New Jersey to accommodate the traffic, but it hasn't been installed in the East River Tunnels because there are four of them. Because the damage in the two flooded East River tunnels was more extensive, we have not yet been able to return them to full service, and that meant that the undamaged pair of tunnels has had to carry a heavier traffic load. We can do it, but high density signaling would allow us to carry a much heavier traffic load on the same infrastructure, and would provide a much greater degree of flexibility and resilience. We would like to obtain planning funding to begin the process of improving the signal system.

While we've been able to restore Substation 41 at Kearny to service, it's clearly vulnerable to flooding and we want to rebuild it atop a platform that will be above the high water line, and we would like to make the platform's footprint large enough so that we could add additional electrical capacity at some point in the future to support our plans for additional capacity into and out of New York. We also need to improve the resilience of the infrastructure at Penn Station, so we can ensure that the station's infrastructure and power supply are capable of resisting a flood of the magnitude of Sandy.

We need this because I believe we need the Gateway Program. As you know, Amtrak has a vision for expanded track, tunnel and terminal capacity in New York City, and you, Chairman Lautenberg, and other members of this Committee have supported it energetically. We've always known that the city needs more rail capacity, and now it should be clear that our rail transportation system as a whole needs more resilience. That means a better ability to resist damage, recover from an event, and return the system to service, and those requirements translate into more capacity, pure and simple. We will continue to work with the existing infrastructure, of course, but there are finite limits to what we can accomplish, and the southern entrance to the city's rail terminals is basically operating at those limits on a good day. To address these three infrastructure needs – improving our signals, hardening the infrastructure, and beginning the design and construction of the Gateway project – and to cover the estimated operating losses we incurred during the storm, Amtrak will need a total of about $336 million.

We need a system that's robust enough to support our operational needs not just on good days, but every day. And for that reason, I would close by thanking Senator Lautenburg, the Committee and the Department of Transportation for all the support they have given us as we have developed and publicized this plan. We appreciate your support, and we look forward to working with you to making the Gateway Project a reality.

PUBLIC SERVICE ELECTRIC AND GAS COMPANY INFORMATION

1. EXCERPT FROM FILING TO NEW JERSEY BOARD OF PUBLIC UTILITIES DOCUMENTING DAMAGES AND RESILIENCY PROJECTS. (ENTIRE FILING UPLOADED TO SHAREPOINT)

STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program	**PETITION** BPU Docket No.________

Public Service Electric and Gas Company (PSE&G, the Company, Petitioner), a corporation of the State of New Jersey, having its principal offices at 80 Park Plaza, Newark, New Jersey, respectfully petitions the New Jersey Board of Public Utilities (Board or BPU) pursuant to N.J.S.A. 48:2-21 and 48:2-21.1, or any other statute the Board deems applicable, as follows:

Introduction and Overview of the Petition

1. In the last two years, the state has experienced several unprecedented weather events, including Hurricane Irene, the October 2011 snow storm and Superstorm Sandy. Each of these storms caused significant damage across the state, including to electric and gas infrastructure. In response to this heightened storm activity, PSE&G proposes investments to work towards improving our ability to withstand and recover from severe storms.

2. In this Petition, PSE&G describes the Energy Strong Program (the Program or ES Program) which will harden electric and gas infrastructure to make them less susceptible to damage from extreme wind, flying debris and water damage in anticipation of these changing weather patterns. The Program will improve the durability and stability of PSE&G's energy distribution infrastructure, making it better able to withstand the impacts of hurricanes and other severe weather events, and enabling a faster response to customers and outages than would otherwise be feasible. In addition, the Program investments will increase the resiliency of

PSE&G's electric delivery system, allowing it to recover more quickly than it would otherwise be able from damage to any of its components or to any of the external systems on which it depends.

3. It is not possible to completely eliminate power outages. Outages will undoubtedly occur when falling trees and limbs knock down power lines, but the full implementation of the proposed investments will reduce the frequency of such outages and enable PSE&G to restore service more quickly than would otherwise occur.

4. Superstorm Sandy was the largest and worst storm in PSE&G's history, affecting approximately 2 million of PSE&G's customers and causing widespread destruction in communities across the state. Sandy affected more than twice the number of customers impacted by Hurricane Irene, and three times the number affected by the October 2011 snow storm, with over 90% of PSE&G's customer base losing power, including refineries, schools, small businesses and other commercial enterprises.

5. During Superstorm Sandy, high winds and falling trees caused major damage to power lines and other equipment. More than three-quarters of PSE&G's distribution circuits were interrupted, while about one-third of transmission and subtransmission lines were interrupted. Over 2,500 poles were damaged beyond repair and had to be replaced, while over 48,000 locations required trees to be removed or trimmed.

6. The brackish water storm surge caused unprecedented damage along the Passaic, Hackensack and Hudson Rivers, as well as the Arthur Kill, causing outages to 20 electric switching and substations. Some of these stations had never previously been impacted by storm surges in the 60-85 years since they were constructed, but were damaged by four to eight feet of water during Superstorm Sandy. PSE&G had to take these stations out of service while the storm surge receded before the damage could be assessed, the equipment painstakingly dried, cleaned

and repaired, and then re-energized to restore service. Those outages caused the outage of 88 additional PSE&G and customer-owned substations.

7. PSE&G's gas distribution network was also exposed to damage from the storm surge, with resultant equipment and communication failures at metering and regulating facilities, which are the major supply points to the distribution system. Water damage resulting from the storm surge occurred in 25 towns in PSE&G's service territory, requiring gas inspections in approximately 41,500 premises, the replacement of over 6,300 meters and the clearing of water from approximately 30,000 feet of gas main to restore service.

8. Although Superstorm Sandy was an unprecedented event, PSE&G restored service to almost 2 million electric service customers in a two-week period. PSE&G is now proposing investments to maximize its ability to respond to and recover from future severe weather events through system hardening and resiliency measures. System hardening will make electric and gas infrastructure less susceptible to storm damage, such as that which results from high winds, flying debris, storm surge and flooding. Resiliency programs increase the electric system's ability to recover quickly from damage to its components.

9. PSE&G has continued to invest in its delivery system over its 100 year history. Those investments have allowed PSE&G to meet its obligations as well as win numerous awards for reliability.[1] PSE&G is proud of the system that it has built and the decisions made many years ago to invest in the current system. PSE&G believes that we are at a critical point where choices need to be made. We can continue to invest prudently in the electric and gas system and their

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[1] PSE&G has consistently been ranked as America's most reliable electric utility, as well as the most reliable electric utility in the mid-Atlantic region. PA Consulting, the industry's benchmarking group, has awarded PSE&G the most reliable electric utility in America for 5 out of the past 8 years, most recently winning the award in November 2012 as the most reliable electric utility in America in 2011. In addition, PSE&G has been named by PA Consulting as the most reliable electric utility in the mid-Atlantic region for the last 11 years (2001-2011). PSE&G also won the 2011 Outstanding Response to a Major Outage Event for its performance during Hurricane Irene, and the October 2011 snowstorm.

current designs, providing service to our customers with incremental improvements and repairs being made as necessary and appropriate. Alternatively, we can make more comprehensive enhancements to our delivery systems now. The instant Petition takes the latter approach and proposes to make infrastructure investments where such investments will have the greatest impact.

10. In this Petition, PSE&G is requesting the Board approve five years (60 months) of the Program, which involves an investment of approximately $1,703 million for electric delivery and $906 million for gas delivery, and associated gas and electric operation and maintenance expenses. PSE&G notes that the complete Program, as currently designed and described herein, provides for investments over a 10 year period. The current estimated cost of the entire Program, including the first five years (60 months) that PSE&G is requesting approval of in this Petition, would represent an investment of approximately $2,762 million for electric delivery and $1,180 million for gas delivery. PSE&G anticipates seeking Board approval to complete the Company's investment in the Program at a later date.

11. This Petition complements the Board's recently issued order requiring all Electric Distribution Companies to take specific actions to improve preparedness and response to major storms (Irene Response Order).[2]

12. In the instant Petition, PSE&G requests that the Board approve five years (60 months) of the Energy Strong Program (summarized below and depicted in Attachment 1), and also approve the methodology and recovery of costs for the Program through implementation of an Energy Strong Adjustment Mechanism. The initial charges and revenue requirements will be addressed in a supplemental filing in this docket.

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2 *I/M/O Board's Review of the Utilities' Response to Hurricane Irene*, BPU Docket No. EO11090543, Order Accepting Consultant's Report and Additional Staff Recommendations and Requiring Electric Utilities to Implement Recommendations (Jan. 23, 2013) ("Irene Response Order").

Timing of Investments

13. PSE&G is eager to receive Board approval and begin making the capital investments described herein in 2013 before the next hurricane season begins in June. While full implementation of the Program will take ten years, there are opportunities to implement some parts of the Program before or during the 2013 hurricane season. For example, and as stated more fully in the supporting testimony of Jorge L. Cardenas, PSE&G can commence implementation of an emergency generator stockpiling program within sixty (60) days of a Final Board order. As detailed in the testimony of Mr. Cardenas, there are other aspects of the Program that can be initiated promptly with benefits to be realized in 2013. Therefore, the Company requests that the Board retain this matter, and promptly set a pre-hearing conference with the goal of making investments in the Program by June 1, 2013.

Description of Energy Strong Program

Electric Delivery Infrastructure Hardening Investments

14. PSE&G proposes to implement six sub-programs for hardening of the electric delivery infrastructure.

Sub-Program 1: Station Flood and Storm Surge Mitigation

15. In the first proposed sub-program, referred to herein as Station Flood and Storm Surge Mitigation, the Company has reviewed and identified switching stations and substations which could benefit from flood and/or storm surge mitigation, including those which are located below the newly defined Federal Emergency Management Agency (FEMA) advisory based flood elevations. This program is in compliance with the advised FEMA post-Sandy flood elevations and the flood elevation requirements established by the NJ Department of Environmental Protection (NJDEP) Flood Hazard Rules, codified at N.J.A.C. 7:13. The

Company has identified 21 stations impacted by Superstorm Sandy, and 13 stations impacted by Hurricane Irene and prior water intrusion events. PSE&G is in the final stages of identifying all stations falling within the newly defined FEMA Advisory Based Flood Elevations.

16. Utilizing a targeted approach based on observations, studies and lessons learned in recent severe weather events, electric station infrastructure will be selected for one of three equally effective mitigation options: Installation of Flood Walls, Raise and Replace or Relocation. The proposed sub-program will involve consideration of each mitigation option following the principles outlined below for all of the stations that are located below the newly defined FEMA advisory based food elevations (including those impacted by Superstorm Sandy, Hurricane Irene and previous water intrusion events).

17. Installation of Flood Walls: Overall the installation of flood walls is likely to be the least costly mitigation option. PSE&G has completed a flood mitigation study and a mitigation impact study of each the stations impacted by Hurricane Irene and recent water intrusion events prior to Superstorm Sandy with an outside expert and has determined that the installation of flood walls is feasible as a potential mitigation measure. In some locations, however, due to soil conditions and extensive piling requirements, flood walls may be cost prohibitive. The alternative where flood walls cannot be installed is Raise and Replace. The duration and scope of the construction process is dependent on soil conditions, wall heights and the material make-up of the wall. PSE&G estimates that the total time from project initiation to completion of flood wall construction is approximately 12 to 18 months, that time frame being driven primarily by local and state permitting requirements.

18. Raise and Replace: The Raise and Replace option considers local conditions at

existing stations to determine whether infrastructure, including control houses, transformers, breakers, and feeder rows can be raised above potential flood levels. Raise and Replace in this context refers not just to raising certain equipment above potential flood levels, but the rebuilding of existing infrastructure at a higher elevation and replacing the existing facility. This analysis consists of extensive engineering studies, geotechnical, electrical, mechanical and physical analyses. To the extent infrastructure is raised, it must conform to the flood elevation requirements established by the NJDEP Flood Hazard Rules, codified at N.J.A.C. 7:13. Under these rules, which were adopted on an emergent basis on January 24, 2013, a party wishing to construct or reconstruct in a flood hazard area must construct at an elevation that is one foot above the elevation established by FEMA on its post-Sandy Advisory Based Flood Elevation maps.

19. The execution of Raise and Replace requires a detailed plan to maintain service to existing customers while construction is in progress. Temporary and mobile equipment would be used to facilitate continuance of service while the existing equipment is deconstructed and subsequently raised. Depending on the site and the height to be raised this option may not always be a viable alternative. The advantage of this option as compared to station relocation is that no new real estate is required and the existing outside plant facilities will be re-utilized. Although far more complicated than a flood wall due to outage coordination it is still more practical than total station relocation. PSE&G estimates that the entire project span from project initiation to completion is approximately 24 months.

20. <u>Relocation</u>: Relocation of existing stations requires large parcels of buildable land that are capable of housing a complete substation. Each new location must permit easy ingress and egress of transmission and distribution lines including expansive rights-of-way in

congested urban and suburban areas. New sites must also be located in areas that are not flood prone, meet soil condition criteria, and be zoned appropriately. Although relocation is possible, it is usually very costly and difficult to implement. PSE&G estimates that the entire project span from project initiation to completion would take approximately 30-36 months.

21. All of the proposed mitigation options involve conceptual engineering, detail engineering, licensing and permitting and a construction process. First, a site assessment must be performed including soil borings, surveys and collection of underground facilities data. Next, the Company will apply for the necessary permits. The permitting process typically involves a local site plan application, usually with variances requested due to either the size and type of wall construction or the installation of a new or modified substation. Following local site plan approval Department of Community Affairs (DCA) review approval would be required, as well as environmental permitting from the NJDEP. A detailed design would be completed in parallel with the DCA approval process. Based on final design material would be ordered, the construction bidding process would be completed and field construction would commence.

Prioritization of Stations

22. The Company proposes to first begin mitigation work at stations impacted by Superstorm Sandy, Hurricane Irene and previous water intrusion events. The Company expects that the majority of these stations can be completed within five years, depending on the timing of the permitting process, permissions from PJM to take a station or certain equipment out of service temporarily, and material and resource availability.

23. As shown in the chart below, the impacted stations were prioritized into three categories (high, medium and low) based on the magnitude of previous flooding or tidal surge

events at that station, and the number of customers likely to be affected by a future event.

Station Flood and Storm Surge Mitigation

Stations Impacted by Sandy

Priority	Station
High	Sewaren 230/138/26kV
High	Essex 230/138/26kV
High	Hudson 230kV
High	Linden 230/138/26kV
High	Bayonne 138/26/13
High	Marion 138/26kV
High	Newark Airport Bkr Station**
Medium	Hoboken
Medium	Marshall St
Medium	River Rd
Medium	South Waterfront
Medium	Bayway
Medium	Madison
Medium	Hackensack
Low	Jersey City 13kV
Low	St Paul's
Low	Little Ferry
Low	Howell
Low	Cliff Rd
Low	Third St
Low	Port St

Stations Impacted by Irene and Other Water Intrusion Events

Priority	Station
High	Marion 138/26kV
High	New Milford
High	Hillsdale
High	Somerville Substation
High	Jackson Road
Medium	Rahway Substation
Medium	Cranford
Medium	Bayway Sw./Sub.
Medium	Marshall St
Low	Ewing
Low	Belmont
Low	Garfield Place
Low	River Edge

** As a result of temporary measures taken prior to Superstorm Sandy, this breaker station was not impacted by storm surge, and is therefore not included in the total number of station outages resulting from the storm.

24. The Sewaren switching station, for example, was impacted by Superstorm Sandy and is categorized as high priority because of its potential for impact to significant numbers of customers, including large industrial customers. This location requires a Raise and Replace approach to meet new FEMA surge elevation guidelines and the new NJDEP Flood Hazard rule, as flood walls were not practical due to the configuration of the site. In contrast,

CONSOLIDATED EDISON COMPANY OF NEW YORK INFORMATION

1. EXCERPT FROM POST SANDY ENHANCEMENT PLAN. (ENTIRE PLAN UPLOADED TO SHAREPOINT)

Post Sandy Enhancement Plan

Consolidated Edison Co. of New York

Orange and Rockland Utilities

June 20, 2013

CONTENTS

INTRODUCTION

On October 29, 2012, Superstorm Sandy hit our region. With impacts beyond what forecasters even imagined, Sandy devastated many of our communities, and our own energy systems. The storm brought both flood impacts from a storm surge beyond any historical experience and sustained high winds. Sandy was an unprecedented storm, one that is part of a new weather pattern that is changing the way Con Edison plans for and responds to storms and other natural disasters. While many of our systems performed well, the size and scope of Superstorm Sandy posed a significant challenge to our systems and processes.

Going forward, our storm planning is being driven by these changing weather patterns and by our mission to provide energy to our customers with outstanding reliability and superior service. We have embarked on a long-term plan to make sure that our system is less susceptible to similar storms and more responsive to customer needs. We are doing this in three distinct ways:

- Hardening our systems – making changes that provide greater protection from flooding and make our overhead systems more resistant to high winds and tree damage

- Improving the information we provide to customers – developing more effective processes and investing in new technologies to ensure that we provide more accurate and timely information to officials and our customers

- Strengthening our partnerships – implementing strategies to improve pre-planning and post-storm coordination with public officials, businesses and the media

Our efforts are described in detail in this Post-Sandy Enhancement Plan. We have developed this plan based on careful study of information garnered from our own experiences with storm preparation and response, our benchmarking efforts to learn from other utilities around the world, and — importantly — the input of our customers, governmental agencies and other stakeholders.

The Plan you are about to read provides greater detail on our initiatives, demonstrating a commitment to our customers to improve our ability to withstand and recover from whatever Mother Nature throws our way. We know that the millions of people who live and work in our service areas depend on us. We have committed our resources to provide our customers and communities with an improved experience, even in the most extreme weather events.

EXECUTIVE SUMMARY

In October 2012, Superstorm Sandy tested the resilience of our region, its people, and our systems. Sandy affected our entire service territory, from Staten Island's Tottenville to Pennsylvania's Milford. Nearly 1.4 million homes and businesses in our area lost power, including those affected by the nor'easter that struck days later. Sandy caused more than four times as many customer outages as Hurricane Irene, previously the worst storm in Company history.

Two hurricanes – Sandy and Irene – in as many years, and more frequent nor'easters, tornados, and heat waves, suggest a trend that we cannot ignore. We cannot just rebuild. We must rebuild smarter, stronger, and more sustainable systems. We must also develop new technologies to meet our customers' need for better information.

To prepare for the likelihood of increasingly destructive storms, Con Edison has developed a plan that includes a broad array of measures to improve the resiliency of our energy systems in the face of future storms and other natural disasters. We are working with government and business leaders to enhance and protect our energy infrastructure. We are participating in a collaborative organized by the New York City Office of Long-Term Planning and Sustainability along with environmental organizations, climate scientists, urban planners, and other industry leaders to better understand the drivers for recent weather trends and the potential impacts of climate change on our region.

This plan details our current thinking on how best to safeguard our system and our region from violent weather events. The plan is not just a response to Superstorm Sandy, but to our cumulative experience with the increasing trend of extreme weather. This is part of our efforts to continually improve, a process that is ongoing in our business. For example, we modified our system design to install waterproof equipment in new installations based on the experiences of other coastal utilities during Hurricane Katrina. Our goal continues to be to minimize the hardships that weather events impose on the 10 million people who rely on us. To meet that goal, we are investing in and strengthening our energy systems, in many cases advancing projects that had been previously planned, and in other cases adopting new designs and strategies. We will continue to assess and improve, enhancing our storm response planning and restoration efforts every day, including expanding and diversifying both what and how we communicate with customers and stakeholders.

The plan focuses on three areas:

1. Fortifying the electric, gas, and steam systems against future storms;
2. Improving estimated times of restoration, and enhancing storm planning and restoration processes; and
3. Improving the flow of information to customers and other stakeholders.

To meet our goal of protecting our customers, the region, and our systems from future natural disasters, we have proposed and begun to invest $1 billion over the next four years in our energy systems. Some of these investments will prepare critical equipment and facilities for this year's hurricane season, while others will strengthen systems incrementally over the next few years. Many of the upgrades will keep our systems more reliable and add flexibility into our operations not only when bad weather strikes, but every day.

Our plan is flexible and will continue to be adjusted. Importantly, while we have planned substantial projects, we will continue to evaluate what we've accomplished and what additional steps we may need to take. With every action we take, we must balance our infrastructure and storm response needs against customer costs. We are committed to managing our costs, and will prioritize future projects that substantially reduce the risk of damage from severe weather events and/or lead to faster restoration and better information after storms. This is not simply a plan in reaction to Sandy: it is a plan to meet the challenges expected from future storms, rising sea levels, and changes in weather patterns that could emerge as a result of climate change.

Finally, our plan takes into consideration not only our own experiences, but the findings, recommendations, and input of our customers and a variety of government commissions and inquiries on the local, state, and federal levels. This feedback has focused on the need to improve our projections for customer restoration times and to develop a more collaborative process with local government on information flow and the use of resources. We have therefore placed special emphasis on improving our ability to provide accurate customer-specific estimated times of restoration (ETRs) and on our communication with local governments and other stakeholders.

In the weeks following Superstorm Sandy the Company compiled a list of 87 action items that appear in this plan at the end of each major section. To date we have completed 28 items, and have plans to finish an additional 18 by the end of September and another 9 by the end of 2013. In the 2014-2016 timeframe, we will complete 21 additional projects that have longer lead times. Eleven of the action items — such as working with our municipal partners to maximize resources during restoration — are continuous in nature; we will continue to work on these "ongoing" action items in parallel with our other projects.

FORTIFYING THE ELECTRIC, GAS AND STEAM SYSTEMS AGAINST FUTURE STORMS

Protecting our systems from extreme weather has long been central to our investment plan. Over the past five years, we've spent roughly $600 million to recover from the damage caused by severe storms, including Superstorm Sandy. From work as basic as trimming trees around power lines to investments in sophisticated smart-grid technologies, these measures give our energy systems greater flexibility and reliability. New, state-of-the-art monitoring sensors and remotely operated switches and valves help system operators respond to problems during extreme weather — whether that's flooding, downed wires, or heat waves.

We have completed substantial storm-hardening work in time for this year's hurricane season. For example, we have already expedited installation of new smart switches on overhead lines. These switches will reduce the number of homes and businesses that lose power when a tree brings down an electric wire. They do this by automatically disconnecting certain segments of the electric grid that are experiencing problems, ensuring that power flow to other areas is not interrupted while repairs are made.

Additional protections in place in time for this year's hurricane season include measures for the electric distribution system that will help protect 28,000 customers in Brooklyn in case of powerful storms. Substation flood walls and other measures will protect more than 200,000 customers in Lower Manhattan that experienced outages during Superstorm Sandy. At our steam generating plants, similar projects will ensure that four of five plants remain online during storms and maintain steam service to customers throughout Midtown Manhattan. Hardening measures at our fifth steam plant, which would be pre-emptively shut down to protect the steam system in Lower Manhattan, will allow that plant to come back online faster following a storm event. Both substations and generating plants will be designed to withstand at least Sandy flood levels, which means that these stations would not be at risk of severe impacts until a storm surge exceeded 14 feet. Furthermore, we have designed the new measures with enough flexibility to be modified should design standards change in the future.

Looking ahead, we will continue to invest in systems that are designed to withstand increasingly severe weather and floods. To fortify and protect our electric, steam, and gas systems, we plan to redesign portions of our energy-delivery systems, install higher and stronger flood barriers, introduce more submersible equipment, raise critical equipment, and selectively bury overhead power lines. We will also install additional switches and related smart-grid technologies to improve the flexibility and resiliency of our electric system. With underground smart switches and submersible equipment, coastal networks will be restored in 24 hours after they are pre-emptively taken off-line to protect equipment, which translates to services being restored 75 percent faster than the Sandy experience.

Below we highlight the key fortification projects that are detailed in this plan.

Redesigning underground networks

To protect underground networks vulnerable to corrosive salt-water flooding, and minimize power outages, we are reconfiguring our most vulnerable underground networks to form separate flood areas. When the region is threatened by floods, we will be able to pre-emptively isolate areas at risk, while keeping electricity flowing in the surrounding areas. Two of these vulnerable networks — Lower Manhattan's Fulton and Bowling Green — will be permanently divided into smaller networks. Fifty percent of the customers in these networks that experienced outages during Sandy will be protected from outages in similar storms. Isolation switches will be utilized in other networks to allow us to de-energize high-tension customer equipment that poses a risk to the electric grid if flooded. We have already successfully applied this segmentation strategy in our smart-grid demonstration projects in Queens, and with that experience, will now advance that approach. To the extent that there are customer generation resources able to provide additional power during emergencies, we are ready to explore new configurations that further enhance grid resiliency. The result is a more flexible and dynamic grid that gives operators more control in all conditions, and reduces the likelihood and size of widespread outages.

Flood-proofing vulnerable facilities

We are continuing our work to flood-proof energy equipment, incorporating our experience during Superstorm Sandy as well as the latest flood-zone guidance from FEMA and the National Oceanic and Atmospheric Administration (NOAA). In the aftermath of Hurricane Katrina, we began deploying submersible equipment, such as network protectors, in flood-prone networks and requiring commercial customers in those areas to install submersible or elevated equipment in their facilities.

Since Superstorm Sandy, we have developed additional flood-proofing measures that will better protect energy systems, including:

- Installing barriers and pumping equipment, or relocating critical equipment to higher elevations in customer buildings

- Applying sealants around pipes and other openings that provide a point of entry for floodwater

- Installing new submersible network equipment, including field testing and deployment of newly designed high-voltage equipment
- Constructing concrete moat walls and raising flood walls at our generating facilities, major flood-prone substations, and other critical facilities
- Installing remotely operated switches on our network feeders to isolate non-submersible components during a weather event

Investing in more smart-grid technologies

Smart-grid technologies give us tools that make the grid more flexible and responsive during extreme weather, which allows us to minimize power outages. Smart-grid measures such as sectionalizing switches allow system operators to identify and isolate problem areas and rapidly bring power back to the surrounding areas, keeping more customers in service. We will continue to advance the installation of smart-grid technologies, including sectionalizing switches in our underground and overhead electric systems.

Upgrading overhead systems

We will expand our efforts to upgrade our overhead distribution equipment, with the aim of making the system more resilient against damage from high winds and downed trees and limbs. Our expanded effort will include:

- Separating feeders into sections and installing remotely operated sectionalizing switches to isolate problems, so that damage does not cause outages for all customers on the feeder.
- Redesigning feeders so that they can be supplied power from both ends, or potentially from customer generation sources (e.g., combined heat and power/distributed generation) giving operators more options for restoring service.
- Installing stronger poles able to withstand wind gusts of up to 110 miles per hour in strategic locations.
- Redesigning wires to provide better protection from falling tree limbs, and to detach more easily when force on the wire is more extreme to reduce the likelihood of damage to poles and other pole-top equipment.
- Expanding use of overhead cables for greater resistance to damage from high winds and tree branches.
- Creating greater tree clearances around our distribution facilities near substations and critical infrastructure.

These investments will reduce the customer outage impact by 15 to 20 percent and provide the ability to restore affected customers more quickly though additional supply points and remotely operated smart switches.

Burying select overhead lines

During the next four years, we anticipate selectively undergrounding portions of the overhead system based on our analysis of outage data and field surveys of tree density. While undergrounding is an appealing option from the perspective of storm resiliency, undergrounding the entire overhead electric distribution system could cost up to $60 billion – which would dramatically increase our electricity rates. As we confront the challenges of extreme weather, however, we are considering burying overhead lines in selected areas with a history of significant damage and outages, including those that serve critical customers. We will focus on areas where tree trimming alone may not be sufficient, and where the added costs can provide significant added value in terms of reducing future restoration costs. To better understand the value of selective undergrounding, we are revisiting Con Edison's most recent undergrounding study, completed in 2007, and updating it with the latest information.

Protecting the gas systems from flooding

While our gas systems performed well throughout Superstorm Sandy, we are taking steps to protect all our energy systems from future natural disaster. The most critical threat to the gas system is the introduction of water into gas distribution equipment and tunnels, which can damage pipes and lead to service interruptions. Protecting our gas system means customers do not have to endure the long and laborious process of restoring gas, which must be done one customer at a time, ensuring that each and every pilot light is lit in the process. To fortify our gas system, we are accelerating and expanding plans to replace leak-prone cast iron and steel pipe and install valves that prevent water from entering high-pressure service vent lines. Installation of these valves will reduce the likelihood of flooding-related service interruptions for more than 22,000 gas customers.

In addition, we are taking the following steps to protect our gas system:

- Evaluating new methods to prevent damage to the distribution system caused by flooding of customer equipment.
- Considering strategic replacement of low-pressure cast iron distribution mains with high-pressure facilities that are more resistant to water intrusion and less likely to leak.
- Developing backup solutions for the communications systems that remotely monitor and control gas system pressures and flows.
- Employing flood-mitigation strategies around remotely operated gas valves and regulator stations.

Protecting our generating facilities

To protect our steam and electric generating plants from future storm surges, we are installing flood-control measures, including:

- Protective gates or barriers on intake tunnels to prevent water intrusion.
- Sealing perimeter walls and doors.
- Raising existing moat walls around critical equipment and installing new ones where needed.

- Introducing new mobile flood pumps.

- Backup generators for flood control equipment.

Flood-control measures at the generating plants will ensure that four of our five steam plants remain online throughout a storm surge. These measures will significantly reduce the number of customers for whom steam service is impacted following the storm and will reduce the number of days that service must be restricted while the full system is restored. These investments will minimize customer outages and allow for a faster recovery from flood surges. Our fifth steam plant will be pre-emptively shut down ahead of large storms to protect the steam distribution system in Lower Manhattan from contact with floodwater, but with the measures listed above it will return to service in half the time it previously took.

Reinforcing critical tunnels

Con Edison operates many underground tunnels that contain steam and gas mains as well as electrical feeders. Flooding results in interruption to services in the tunnels, including proactive isolation when water is expected to intrude, which leads to service outages for customers. In order to protect the tunnels against future storm surges and flooding, we will install hardened, reinforced concrete tunnel entrances that are designed to prevent or greatly reduce water intrusion. As an additional line of defense, we will install improved pumping equipment and back-up generators to remove any water that does intrude.

Hardening internal communications infrastructure

An extensive energy communications network allows us to remotely operate key pieces of equipment. The operational flexibility of our delivery systems requires the uninterrupted use of this communications network. To achieve this goal, we are evaluating ways to shore up our information systems to withstand flooding.

We will focus on expanding the use of water-resistant fiber-optic communications and control systems, rather than copper wires, which will enable us to remotely operate equipment during flooding. Our recent experience, in which fiber-optic equipment provided uninterrupted communications in a flooded substation, validates this approach.

Benchmarking and evaluating new capabilities and technology solutions

Regional leaders are discussing a range of flood-mitigating proposals, from building natural barriers, such as dunes and wetlands, to the use of floodgates, barriers, and artificial islands in New York Harbor.

Similarly, we are considering alternative approaches to system design that would reinforce the electric distribution system. For example, we are developing plans to create strategically placed sub-networks that can be isolated from the rest of the grid. This approach – part of our "third-generation" or "3G" solutions – would improve reliability while eliminating the need for additional capacity on our distribution system. We are also looking at how to incorporate customer-side distributed generation resources into our restoration plans, including the role that distributed generation can play in reducing localized customer impacts. Generators provide power to critical customers such as hospitals during outages, and they may also help reduce the need for grid upgrades in strained networks.

PASSAIC VALLEY SEWERAGE COMMISSION INFORMATION

1. SEPTEMBER 3, 2013 PRESS RELEASE/MESSAGE FROM THE EXECUTIVE DIRECTOR

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"Message from the Executive Director"

With autumn quickly approaching and the Hurricane Season in full swing, PVSC continues to make steady progress on our Post-Sandy recovery efforts at the plant, while at the same time preparing for any incidents of extreme weather.

As you may have noticed, PVSC recently completed a comprehensive project to protect against flooding and tidal surges from extreme storms and hurricanes. The deployment of a "Muscle Wall' or flood control barricade system is designed to protect key infrastructure at the plant.

As part of our Post-Sandy recovery efforts, one item of monumental importance are the preparations PVSC is making for the 2013 Hurricane Season. As many meteorologists note, September through November are among the most dangerous months here on the East Coast for volatile Hurricane activity. To that end, PVSC has implemented this new flood control barricade system to ensure we are prepared in the event that a storm like Sandy strikes again.

Installation of the flood barricade began on July 22 and was completed on August 9. A total of 7,760 linear feet (just under 1.5 miles) of wall has been installed around key PVSC facilities such as the plant's electrical substation, treatment process facilities and other vulnerable operations.

Although our work with the Federal Emergency Management Agency (FEMA) on the construction of permanent flood control measures is still on-going, PVSC cannot afford the risk this year of not being ready. We are well-prepared for any extreme weather situation and I am proud that PVSC has taken a leadership role in these flood mitigation efforts.

PVSC also continues to work with FEMA on the completion and submission of Project Worksheets (PWs). Because of our diligence, PVSC is tentatively approved to receive more than $100 Million from FEMA for repairs and upgrades. To date, 44 PW's have been anticipated for PVSC, with 41 PW's already in the FEMA system. 37 of these have been obligated – including one PW for $2.49 million in repairs to PVSC's underground utility tunnel infrastructure – which means that the money eligible to PVSC will be sent to the State of NJ for allocation at a future date.

There are a number of PWs ready for signature or under review which include repairs to the Witco Facility, Sludge Heat Treatment Facility, the Lab, the OEM Building, and the Administration Building. PWs are also contemplated for Marine Debris Removal and the Outfall System.

I'm very pleased with these developments at the plant. Thanks to all those involved for this excellent work!

Thank you,

Mike DeFrancisci, Executive Director

ATTACHMENT A2

Focus Area Analyses Report

ATTACHMENT A

2. Nassau County Back Bays, NY, Focus Area Report

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Appendices

1. APPENDIX A – Stakeholder Inquiry Letter, List of Contacts
2. APPENDIX B – Meeting Documentation from Stakeholder Meetings
3. APPENDIX C – Stakeholder Feedback/Information

1. Study Authority

The focus area analysis presented in this report is being conducted as a part of the North Atlantic Coast Comprehensive Study (NACCS) authorized under the Disaster Relief Appropriations Act of 2013 (Public Law [PL] 113-2), Title X, Chapter 4 approved 29 January 2013.

Specific language within PL 113-2 states, *"…as a part of the study, the Secretary shall identify those activities warranting additional analysis by the Corps."* This report identifies coastal storm risk management activities warranting additional analysis that could be pursued for the Nassau County Back Bays study area. Public Law 84-71 is a plausible method for further investigation.

2. Study Purpose

The purpose of this focus area report is to capture and present information regarding the possible cost-shared, future phases of study to provide structural and/or non-structural coastal storm risk management, flood risk management, ecosystem restoration, and other related purposes for the Nassau County Back Bays study area.

The focus area report will:

- Examine the Nassau County Back Bays area to identify problems, needs, and opportunities for improvements relating to coastal storm risk management and related purposes.
- Identify a non-Federal sponsor(s) willing to cost-share the potential future investigation.

3. Location of Study Area / Congressional District

The study area encompasses the Nassau County Back Bays area that was subject to flooding, storm surge, and damages as a result of Hurricane Sandy. The area is bound to the north by Lakeview Avenue, Seaman Avenue, and East Sunrise Highway and to the south by the Atlantic Coast. The western boundary of the study area is defined by the Queens County line, and the eastern boundary is defined by the Suffolk County line. The inland extent of storm surge caused by Hurricane Sandy as defined by the Federal Emergency Management Agency (FEMA) within the southern shoreline of Nassau County is entirely included in the study area. Approximately 98 square miles of Nassau County are included within the study area boundary. A map of the study area is included as **Figure 1**.

The study area includes three major communities within Nassau County: 1) the Town of Hempstead, 2) the City of Long Beach, and 3) the Town of Oyster Bay. The Town of Hempstead contains 22 villages and 37 hamlets; 14 of these villages (Lynbrook, Malverne, Valley Stream, East Rockaway, Rockville Centre, Cedarhurst, Lawrence, Woodsburgh, Hewlett Neck, Hewlett Bay Park, Hewlett Harbor, Atlantic Beach, Island Park, and Freeport) fall within the Nassau County Back Bays study area. The Town of Oyster Bay includes 18 villages and 18 hamlets. The Village of Massapequa Park, within the Town of Oyster Bay, lies within the study area boundaries.

The study area contains parts of the 2nd (Representative Peter King), 3rd (Representative Steve Israel), and 4th (Representative Carolyn McCarthy) New York Congressional Districts. In addition, Congressional interest in the study area lies with New York Senators Charles Schumer and Kristen Gillibrand.

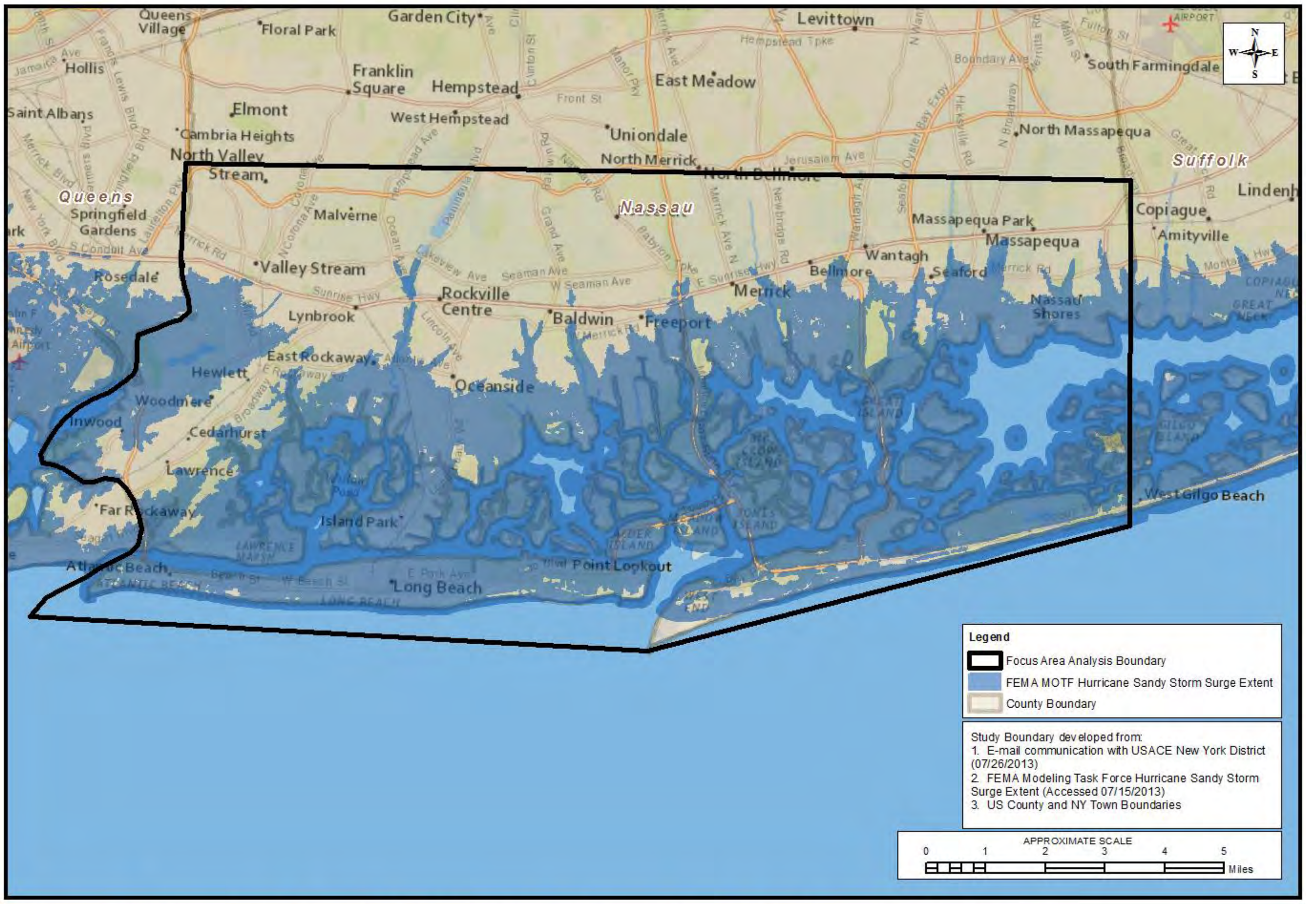

Figure 1. Nassau County Back Bays Focus Area Analysis Boundary

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4. Prior Studies and Existing Projects

This focus area report will identify problems and opportunities within the Nassau County Back Bays study area as they relate to coastal storm risk management and related purposes. Historic coastal flooding and the associated risks are documented in various studies. Several projects have already been implemented to manage coastal storm risk. **Table 1** summarizes various studies and existing projects related to coastal storm risk management and related purposes for each of the three major communities within the Nassau County Back Bays area. Some of these studies are applicable to the entire study area. These projects and studies are detailed in the following sections.

4.1 Study-Wide

The State of New York developed a Multi-Hazard Mitigation Plan, (New York State Office of Emergency Management, 2011) which represents the state's approach to mitigating risks and adverse impacts from natural disasters. This plan assesses risks for the state, identifies the state's mitigation strategy, and details the plan monitoring and evaluation process.

Similarly, the Nassau County, New York Multi-Jurisdictional Natural Hazard Mitigation Plan was developed to identify policies, actions, and provide information and analyses that will manage the risk and potential for future losses caused by natural disasters. The plan features the identification of potential hazards, risk assessment, capabilities and resources, mitigation goals, identification and prioritization of mitigation actions considered, and an implementation strategy.

In the aftermath of Hurricane Sandy, the New York Joint Field Office (JFO) developed a report that outlines the approach of the Federal response to the disaster titled, "New York Recovers, Hurricane Sandy Federal Recovery Support Strategy – Version One" (FEMA, 2013). This report is part of the National Disaster Recovery Framework (FEMA, 2011). The report provides detailed information regarding the damages from Hurricane Sandy within Nassau County and its cities and towns, based on stakeholder meetings. The damages identified within the report include flooding, power outages, and damages to utilities, dunes, water treatment facilities, and infrastructure. The report outlines strategies to support more resilient communities.

Nassau County further quantified the damages incurred to its county-owned facilities. These county-owned assets include parks, community centers, beaches, roadways, pump stations, treatment plants, and bulkheads. To date, Nassau County has documented approximately $469,000,000 worth of damages to their facilities within the Nassau County Back Bays study area (Nassau County, 2013). These damage assessments represent preliminary numbers, since some damages have not been quantified at the time of this report.

Table 1. Summary of Prior Studies and Existing Projects

Study / Report	Focus Area	Structural / Non-Structural	Responsible Party	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
STUDY-WIDE											
2011 New York State Standard Multi-Hazard Mitigation Plan	Study-wide	N	NYS OEM	LT	N/A		X	X		X	X
New York Recovers Hurricane Sandy Federal Recovery Support Strategy - Version One, June 2013	Study-wide	N	FEMA	LT	N/A	X	X	X	X	X	X
Nassau County, New York Multi-Jurisdictional Natural Hazard Mitigation Plan (2007)	Study-wide	N/S	Nassau County	Ongoing	N/A	X	X	X		X	X
CITY OF LONG BEACH, NY											
Jones Inlet to East Rockaway Inlet	Long Beach	S	USACE		Plan		X				
Reynolds Channel and New York State Boat Channel	Long Beach	S	USACE	LT	Recon	X					
East Rockaway Inlet, NY	Long Beach	S	USACE	Ongoing		X					
Hurricane Sandy Storm Damage Report (2012)	Long Beach	N	City of Long Beach	N/A	N/A		X				X

Study / Report	Focus Area	Structural / Non-Structural	Responsible Party	Time Frame [Ongoing / Proposed Short Term / Proposed Long Term]	Status	Navigation	Coastal Storm Risk Management	Flood Risk Management	Ecosystem Restoration	Water Resource Management	Community Resilience
Conditions Evaluation of Bulkheads & Outfall Structures in the City of Long Beach, New York (2013)	Long Beach	S	City of Long Beach	N/A	N/A		X				
Coastal Protection Study City of Long Beach, NY Bayside Flood Protection Plan (2009)	Long Beach	S	City of Long Beach	LT	N/A		X	X		X	X
City of Long Beach Comprehensive Plan Technical Memorandum Existing Conditions / Issues and Opportunities (2005)	City of Long Beach	N/S	City of Long Beach	LT	N/A		X	X		X	X
City of Long Beach Superstorm Sandy Damage Assessment Reports	City of Long Beach	N	City of Long Beach	ST	N/A						
TOWN OF OYSTER BAY, NY											
Fire Island Inlet and Shores Westerly to Jones Inlet, NY	Oyster Bay	S	USACE	Ongoing	Out to Bid/ Design	X	X				
TOWN OF HEMPSTEAD, NY											
Jones Inlet	Hempstead	S	USACE	Ongoing	N/A	X					
Jones Inlet to East Rockaway Inlet	Long Beach	S	USACE, others	ST	Plan		X				

4.2 City of Long Beach

An assessment of the bulkheads and outfalls along the northern shore of the City of Long Beach was conducted in 2013 following Hurricane Sandy. The details of the analysis reported in “Conditions Evaluation of Bulkheads & Outfall Structures in the City of Long Beach, New York” suggest the repair or replacement of bulkheads in poor condition or not offering a sufficient level of protection. In addition, the report recommended that tide valves be added to outfalls where they are not currently installed and further investigate existing tide valves to better assess their function and condition (City of Long Beach, 2013).

The “Coastal Protection Study for the City of Long Beach, NY, Bayside Flood Protection Plan” (City of Long Beach, 2009) provides planning guidance to the City of Long Beach to address the risk of flooding on the northern bay side of the city. The study’s recommendations include inspection/repair of outfalls and bulkheads along the city’s northern shoreline, construction of new bulkheads in vulnerable areas, and the addition of outfall tide valves.

“The City of Long Beach Comprehensive Plan Technical Memorandum” was developed to provide an overview of the existing conditions of the City of Long Beach and to assist in future planning efforts. The plan outlines the following topics in detail:

- Community structure
- Community Character
- Public facilities
- Traffic, parking and transportation
- Areas subject to change
- Public policy
- Socioeconomic policy

This memorandum discusses existing conditions and issues and opportunities for each topic (City of Long Beach, 2005).

Hurricane Sandy caused the erosion and deflation of the coastal beaches throughout the City of Long Beach, NY. A study was performed by Coastal Planning & Engineering, Inc. for the City of Long Beach (City of Long Beach, 2012) to quantify beach loss and storm damages. Approximately 294,000 cubic yards of sand were lost from the coastal beaches of the City of Long Beach. The report recommends restoring the beach and increasing the overall level of protection from the beaches.

A damage assessment was performed post-Hurricane Sandy for the City of Long Beach. This assessment evaluated the damages incurred to 54 city-owned assets including wastewater? water treatment plants, wells, playgrounds, and other facilities. Based on this investigation, the City of Long Beach incurred $46,741,565 in damages to its 54 properties, which includes demolition, disposal, and reconstruction to damaged civic facilities. (City of Long Beach, n.d.)

USACE has proposed and/or executed several projects within and surrounding the City of Long Beach, NY relating to navigation and coastal storm risk management. Reynolds Channel and New York State Boat Channel and East Rockaway Inlet are Federally authorized navigation channels which USACE maintains through dredging.

The City of Long Beach, NY is a non-Federal sponsor and beneficiary of the Jones Inlet to East Rockaway Inlet (Long Beach) Federal Coastal Storm Risk Reduction proposed project, along with the Town of Hempstead, Nassau County, and the New York State Department of Environmental Conservation (NYSDEC). The project area reaches over nine miles of shoreline from Jones Inlet to East Rockaway Inlet. The project area has been subject to wave action and flooding during major storm events. The project proposes the construction of a 110-foot wide berm, a 25-foot wide dune system, rehabilitation of three existing groins, construction of four new groins, extension of the groin on the western side of Jones Inlet, and nourishment of restored beaches over a 50 year period. A feasibility report was completed in February 1995. While this project has been approved, it has not been constructed. It is referenced in the Second Interim Report (USACE, March 2013) with an estimated construction cost of $200,000,000.

4.3 Hempstead, NY

USACE maintains the Federally authorized navigation channel of Jones Inlet and performs annual condition surveys. An assessment of the jetty at the entrance of the inlet following Hurricane Sandy is also being performed.

The Town of Hempstead, NY is a non-Federal sponsor and benficiary of the Jones Inlet to East Rockaway Inlet (Long Beach) Federal Coastal Storm Risk Reduction project, along with the City of Long Beach, Nassau County, and NYSDEC. The project area reaches over nine miles of shoreline from Jones Inlet to East Rockaway Inlet. This region has been subject to wave action and flooding during major storm events. The project proposes the construction of a 110-foot wide berm, a 25-foot wide dune system, rehabilitation of three existing groins, construction of four new groins, extension of the groin on the western side of Jones Inlet, and nourishment of restored beaches over a 50 year period. A report was completed in February 1995. While this project has been approved, it has not been constructed. It is mentioned in the Second Interim Report (USACE, March 2013) with an estimated construction cost of $200,000,000.

4.4 Oyster Bay, NY

The Fire Island Inlet and Shores Westerly to Jones Inlet USACE project incorporates navigation and coastal storm risk management. The project performs periodic dredging of the Fire Island Inlet, placing the dredged sand on the Gilgo Beach area of Jones Beach Island. Nourishment to the Gilgo Beach area and Westerly beaches provides coastal storm risk management. This nourishment sand has the potential of reaching the beaches of Oyster Bay, NY.

5. Plan Formulation

Six planning steps in the Water Resource Council's Principles and Guidelines are followed to focus the planning effort and recommend a plan for potential future investigation. The six steps are:

- Identifing problems and opportunities
- Inventorying and forecast conditions
- Formulating alternative plans
- Evaluating effects of alternative plans
- Comparing alternative plans
- Selecting a recommended plan

The iterations of the planning steps typically differ in the emphasis that is placed on each of the steps.

This focus area report emphasizes identification of problems and opportunities. The following sections present the results of the initial iterations of the planning steps conducted as part of the focus area analysis. This information will be refined in future iterations of the planning process that will be accomplished during future study phases.

5.1 Problems and Opportunities

Nassau County is subject to several natural hazards including coastal erosion, coastal wave action, storm surge, flooding, severe winds and severe weather events. These hazards, as well as others, are detailed in the Nassau County, New York Multi-Jurisdictional Natural Hazard Mitigation Plan (Nassau County, 2007).

The Nassau County Back Bays study area is particularly vulnerable to these natural hazards. Much of the shoreline of the study area has been physically altered by anthropogenic sources, creating a more stationary system than would normally exist in a barrier island and back bay system. This has resulted in changes to the natural sediment transport processes of the area and has had an impact on sensitive ecosystems and species which thrive on the barrier island habitats. Many of the tidally influenced areas of Nassau County are low elevation, developed with residential and commercial infrastructure, and subject to flooding during storms. Within the Nassau County Back Bays study area, the southern boundary of barrier islands are subject to coastal wave action, flooding, storm surge, and erosion. Back bays within the study area are subject to tidal flooding and storm surge. Overwash of coastal shorelines can increase the existing flood risk for the back bay areas as the additional flooding source will contribute to the volume of water within the bay. Historic sea level change has exacerbated the flood probability over the past century, and potential accelerated sea level change in the future will only increase the magnitude and frequency of the problem.

Between 1996 and 2013, 21 flooding events, 32 coastal floods, and 80 flash floods were recorded within Nassau County, New York. Since 1954, Nassau County has experienced 16 flood events warranting Presidential Disaster declarations. Of those 16 events, five have impacted Nassau County between 2000 and 2013. During Hurricane Sandy alone, damages to the Nassau County facilities within the Nassau County Back Bays study area are currently estimated at approximately $469,000,000 (preliminary estimate) (Nassau County, 2013).

The impact of these natural hazards ranges from coastal storm damage to environmental impacts. When wastewater treatment facilities are inundated, water quality can be impacted by the partially treated or untreated sewage that is often released. . The release of partially treated sewage occurred within the Nassau County Back Bays study area during Hurricane Sandy, when several of the wastewater treatment facilities were impacted by storm surge. Similarly, inundation of sites identified through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), otherwise referred to as Superfund sites, or other hazardous waste sites may also severely impact water quality.

Nassau County's Office of Emergency Management (OEM) reported flooding from Hurricane Sandy in all of the south shore communities located south of Merrick Road in Hempstead. They reported that two of the wastewater treatment facilities in the county were shut down due to inundation. Other critical facilities, such as police precincts, were shut down and evacuated as a result of coastal storm surge. Damage was also incurred at several county parks because of Hurricane Sandy. Prior to Hurricane Sandy, in 2009, a transportation and evacuation study was performed for Nassau County. As a result of

Hurricane Sandy, Nassau County is currently working with FEMA to finalize plans for the wastewater treatment facilities throughout the county that are subject to flooding. This feedback from the Nassau County OEM is included in the appendices of this report.

Within the City of Long Beach, Hurricane Sandy caused approximately $46,700,000 in damages (City of Long Beach, n.d.), loss of power for more than 10 days, and damage to more than 10,000 homes and other critical facilities (FEMA, 2013). The northern shoreline of the City of Long Beach, which is bordered by Reynolds Channel, experienced substantial flooding. The northern portion of the city is at a lower elevation than the southern shoreline, which abuts the Atlantic coast. The City of Long Beach is located entirely within a FEMA floodplain, with the exception of a small strip along Broadway (City of Long Beach, 2005). Flooding on the bayside of the city caused disruption in the operation of the water supply and wastewater treatment facilities. This resulted in some minor sewer back-ups. During Hurricane Sandy, water breached the southern shoreline of the city, and the overwash added additional flooding volume to the already flooded bay area. Hurricane Sandy also destroyed the city's southern shoreline dune system.

A project has been proposed in partnership with the City of Long Beach, NYSDEC, Nassau County, the neighboring Town of Hempstead, and USACE, to renourish the beaches on the Long Beach barrier island, rehabilitate existing groins, and construct additional groins. Flood risk management structures along the northern shoreline of the City of Long Beach are not continuous and are in varying condition. The city would like to see existing structures repaired and improved, and would like to see the development of risk management measures where none currently exist. "The City of Long Beach Comprehensive Plan Technical Memorandum" (2005) found that replacing all of the existing 9-foot high bulkheads would improve coastal flood resilience, however, there is no funding to undertake such efforts. In addition, they hope to develop a force-main pumping system to force stormwater into the bay during times of flooding and repair the pumps at their municipal facilities that were damaged during Hurricane Sandy.

The Town of Hempstead identified problems that the community experienced during Hurricane Sandy and opportunities to mitigate these problems. The Town of Hempstead experienced flooding from Jamaica Bay as result of Hurricane Sandy as well as other hazards. They have been collecting damage assessments from Hurricane Sandy and have collected information regarding claims related to the National Flood Insurance Program. Many bulkheads along the town's shorelines were reported to be in need of repair after Hurricane Sandy.

The Village of Cedarhurst, within the Town of Hempstead, identified problem areas that require further analysis. The village's stormwater drainage system could benefit from inspection and preventative maintenance to allow the system to operate at full capacity. In addition, the village identified a lack of general coastal storm risk management measures on the northern edge of the village which boarders Motts Creek. One section of the coastal front of the village, which was armored with a seawall, experienced severe damage during Hurricane Sandy and other prior storms and is in need of repair. The instability of this seawall poses a risk to nearby homes and roads during future coastal storm events.

As part of this focus area report, plan formulation will include identification of potential measures to help these vulnerable areas become more resilient to coastal storm damage.

In order to collect data on problems and opportunities for the Nassau County Back Bays study area, stakeholder meetings and webinars, were conducted with U.S. Army Corps of Engineers (USACE), State, and local agencies. **Appendix A** includes a list of points of contact (POCs) invited to participate in meetings and webinars, and meeting materials. **Appendix B** includes meeting minutes with a list of participants.**Appendix C** includes comments received from agencies and stakeholders that were unable to attend meetings and/or webinars or from attendees provided additional feedback following meetings and webinars. Stakeholder input was incorporated into the development and analysis of potential measures for this focus area analysis. A summary of stakeholder input is included in **Table 2.**

Table 2. Summary of Stakeholder Input - Problems

Problem Area	Problems Identified	References
Long Beach, NY	Vulnerability to coastal flooding, beach and dune erosion, and collection system flooding	City of Long Beach, meeting 8/26/13
Hempstead, NY	Vulnerability to coastal flooding, beach and dune erosion	Town of Hempstead, meeting 8/26/13
Village of Cedarhurst, NY	Vulnerability to coastal flooding	Village of Cedarhurst, meeting 9/5/13
Nassau County, NY various facilities	Vulnerability to coastal flooding	Nassau County, various correspondence 9/13

5.2 Objectives

The national or Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to National Economic Development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

USACE also has a National Ecosystem Restoration (NER) objective in response to legislation and administration policy. This objective is to contribute to the nation's ecosystems through ecosystem restoration, with contributions measured by changes in the amounts and values of habitat.

Projects which produce both NED benefits and NER benefits will result in a "best" recommended plan so that no alternative plan or scale has a higher excess of NED benefits plus NER benefits over total project costs. This plan shall attempt to maximize the sum of net NED and NER benefits, and to offer the best balance between two Federal objectives. Recommendations for multipurpose projects will be based on a combination of NED benefit-cost analysis, and NER benefit analysis, including cost effectiveness and incremental cost analysis.

In addition to Federal water resources planning objectives, the main goals of the NACCS under which this focus area analysis is being conducted, are to:

1) Reduce risk to which vulnerable coastal populations are subject.
2) Ensure a sustainable and robust coastal landscape system, considering future sea level change and climate change scenarios, to reduce risk to vulnerable populations, property, ecosystems, and infrastructure.

Specific objectives for this focus area analysis are to:

1) Manage risk from storm surge.
2) Manage flood risk.
3) Provide adaptive and sustainable solutions for future development that account for future changes such as sea level change, land subsidence and climate change.
4) Maintain or improve ecosystem goods and services provided (social, economic and ecological balance).
5) Incorporate opportunities for nature-based infrastructure, alone and in combination with traditional measures.
6) Maintain economic viability of the working coastline.
7) Improve emergency response and evacuations by improving the transportation systems before and during flood events.
8) Incorporate problems, needs, and opportunities identified by stakeholders to manage flood risk.
9) Manage erosion occurring along the shoreline.
10) Manage risk to National Register of Historic Places and other cultural resources
11) Better incorporation of regional sediment management into non-Federal Projects.

5.3 Planning Constraints

Planning constraints are both institutional (policy/programmatic, legislative, and funding-related) and physical (such as sensitive ecosystem areas, land use, etc.).

5.3.1 Institutional Constraints

1) Comply with all Federal laws and executive orders, such as the Act (NEPA), the Clean Water Act, the Endangered Species Act and Executive Order 11988.
2) Avoid increasing the flood risk to surrounding communities and facilities.
3) Avoid solutions that cannot be maintained, whether due to expense or complicated technologies, by the non-Federal sponsors.
4) Comply with local land use plans and regulations.
5) Difficulty in funding for long-term operation and maintenance costs.
6) Permitting with Federal, state, and local agencies.
7) Many of the beaches within the study area are recognized as a recreational resource, particularly for the surfing community. It is important that this resource is not compromised.

8) Acquisition of real estate and easements.

5.3.2 Physical Constraints

1) Some areas within this study are highly developed.
2) Avoid additional degradation of water quality, which would put additional stress on aquatic ecosystems.
3) Avoid impacting or exacerbating existing hazardous, toxic and radioactive wastes (HTRW) that have been identified within the project area.
4) Minimize the impact to authorized navigation projects.
5) Minimize the impact to other projects, protected areas, sensitive wetlands, wildlife management areas, etc.
6) Minimize effects on cultural resources and historic structures, sites, and features.
7) Loss of streetscape character and potential economic loss by elevation of structures or placement of floodwalls / levees.
8) Lack of sand borrow areas for projects.
9) Some offshore areas may not have the structural integrity to support structures.

5.4 Future Without Project Condition

The future without project (FWOP) condition is the most likely condition expected to exist in the future in the absence of proposed projects. The FWOP condition is the baseline against which all project plans are evaluated. FWOP conditions, including sea level change considerations, will be developed along with the no-action alternative during the future phases of study.

5.5 Measures to Address Identified Planning Objectives

This section identifies a broad range of potential solutions (measures) to address the study area objectives. Many of these measures are outlined in “Coastal Risk Reduction and Resilience: Using the Full Array of Measures” (USACE, September 2013). Any of these potential measures will be weighed against a “No-action Plan” in the future phases of study.

5.5.1 Structural Measures

Structural measures are used to control floodwaters. Broad-based structural measures identified include:

1) Seawall/Revetment: Seawalls are built parallel to the shoreline with the purpose of reducing overtopping and consequent flooding of areas behind the seawall due to storm surge and waves. Revetments are onshore sloping structures which manage shoreline erosion. Areas immediately seaward of seawalls or revetments may be impacted because of isolation from an inland sediment source.
2) Groins: Groins are narrow structures, built perpendicular to the shoreline, that stabilize a beach experiencing longshore erosion. Beach material will accumulate on the updrift side of a groin, but the downdrift side will experience erosion caused by isolation from the longshore sediment transport source. Both the accretional and erosional effects extend some distance alongshore away from the groin.

3) Detached Breakwaters: The primary function of a detached breakwater is to reduce beach erosion by reducing wave heights in the lee of the structure. The reduction in wave heights reduces longshore and cross-shore sediment transport. Detached breakwaters are built nearshore, in shallow water, and generally parallel to the shoreline. They are low-crested structures which decrease wave energy and help promote an even distribution of material along the coastline. Since detached breakwaters can impact the transport of beach material, there can be erosional impacts in downdrift areas. In addition, detached breakwaters, when submerged, can cause a non-visible hazard to boats and swimmers.

4) Berms / Levees: Berms, levees, or dunes can be constructed along the shoreline, tying into high ground or surrounding an area entirely, to reduce risk of storm surge, wave run-up, and erosion to the landward shoreline. These measures have a large footprint, since their stability is partially dependent on a maximum side slope from the top to the toe, and are often composed of earthen materials. Levees or berms also need to be constructed to prevent or control underseepage of floodwaters through the existing soils. They may need to include pumping stations to remove interior stormwater drainage. Roads sometimes need to be ramped to cross these features.

5) Multipurpose Berms/Levees: Berm and levee features require a large footprint to remain stable. However, it is possible to incorporate features in the design of the levees, such as parking areas/garages, commercial or residential development, recreational greenways, etc., to take advantage of the increased elevation.

6) Floodwalls and Bulkheads: Floodwalls or bulkheads can be constructed along the shoreline, tying into high ground or surrounding an area entirely to reduce risk of storm surge, wave run-up, and erosion to the landward shoreline. These measures have smaller footprints than berms and levees but require concrete or steel pilings for stability to withstand force from floodwaters, including waves. Floodwalls must also be designed to prevent or control underseepage in the existing soils. Floodwalls may need to include pumping stations to remove interior stormwater drainage and often include floodgates to allow for access roads to any waterside property.

7) Flood/Tide Gates: A flood or tide gate can be constructed across a waterway to provide risk reduction from coastal inundation upstream of the gate. Flood and tide gates are constructed with openings to allow for recreational or industrial uses of a tributary to continue and to allow for some connectivity of the ecosystem. There are several types of floodgates; two types include an Obermeyer Gate and a Steel Gate. The Obermeyer gate lifts a steel gate flap to close the gate, whereas a Steel gate slides horizontally into closing position. Inflatable dams can also be used as a gate, as they can be filled with air or water to inflate and act as a closed gate.

   If the watershed upstream of the flood or tide gate does not have enough natural floodplain storage to hold increases in water level due to precipitation runoff, then either additional storage will need to be created and/or pumping stations will need to be added to remove interior drainage upstream of a flood or tide gate.

8) Portable Floodwalls: Portable floodwalls are a potentially viable measure when complete portability is necessary and no permanent fixings or structures are desired. Portable floodwalls are typically constructed of lightweight aluminum and rely on the weight of the water to press down and stabilize the wall to create a watertight seal. Temporary floodwalls can vary in height to accommodate the change in existing elevation and optimize cost. However, installation of a system of portable floodwalls may need to begin several days prior to a pending event depending on available resources. Therefore, portable floodwalls may not be suitable for some

events and areas when installation time exceeds event warning time. Additionally, portable floodwalls are not applicable where subject to storm wave action.

9) Portable Berms/Cofferdams: Portable cofferdams are another rapidly deployable, temporary method that can be used for flood risk management. The cofferdam, made of commercial grade vinyl coated polyester, is a water-inflated dam, which consists of a self-contained single tube with an inner restraint baffle/diaphragm system for stability. The dam has the ability to stand alone as a positive water barrier without any additional external stabilization devices. The system can be installed easily in the field when needed and removed when the threat is over. Once laid out, it can be inflated using any available water source. Each unit is up to 100 feet long and 8 feet high. Portable cofferdam units can be joined together by overlapping end to end at any angle to provide risk reduction to large areas.

   Temporary pumps are required to fill the cofferdam units; however, the pumps can be used as temporary pump stations to pump trapped water on the "dry" side of the cofferdam and discharge the water into the "wet" side.

10) Storm Surge Barrier: Storm surge barriers are often coupled with levees to prevent storm surge from propagating up waterways. Storm surge barriers generally consist of a series of movable gates that are normally open to let flow pass, but will close when storm surge exceeds a certain water level.

11) Road, Rail, or Light Rail Raises: Roads can be raised on berms or levees. The advantage of raising a road is two-fold. First, to raise main evacuation routes so they will not be flooded during a coastal and heavy precipitation event. Secondly, existing easements can provide some of the property needed for the footprint for building a berm or levee. However, main routes in the Nassau County Back Bays study area are heavily developed. In order to raise existing main routes, a large amount of property along the roadways likely will need to be acquired and this could have a major impact for the main business corridors. Additionally, the side roads leading to these main roads would need to be ramped for access.

    Another option is raising existing rail or light rail lines on berms or levees. A road, rail, or light rail line raise may create interior drainage problems if stormwater storage is insufficient. Additional storage space and/or pumping stations may be required to remove interior stormwater drainage.

12) Beach and Dune Restoration: Shoreline restoration by sand nourishment or replenishment of beaches subject to erosion. Restoration often includes include dune restoration/enhancement to provide additional risk reduction for flooding and wave action.

13) Stormwater System Improvements: Existing stormwater systems can be improved by increasing capacity, through additional piping and stream channelization, increasing pipe sizes and inlets and adding more storage areas, adding gates to outfall pipes to prevent storm surge from entering the storm sewer system, and pumping water from the storm system.

14) Bridge Trash Racks: Trash racks can be installed upstream of critical bridges to collect debris during a flood event to help preserve the structural integrity of the bridge support structure.

5.5.2 Non-Structural

Broad-based non-structural measures identified include:

1) Acquisition / Buyouts: Homes that are subject to repetitive loss from flooding and are outside of an area proposed for a structural flood risk management project are viable candidates for buyouts or relocations. A buyout occurs when the homeowner is paid fair market value for the property and moves to a new location. Relocations can occur when the homeowner has a parcel large enough that a home can be moved to higher ground on the existing parcel or a home can be relocated to a different parcel entirely. Acquisitions and buyouts restore the natural floodplain in the location of previous development.

2) Early Warning Systems: Flood warning systems are important to notify citizens of a flooding event. Coastal storms typically have a several-day timeframe where the community is aware of the possibility of impact, but last minute changes in speed and direction can alter the level of impact dramatically, and evacuations need to be planned well in advance for these types of storms in flat coastal areas. It is important for the community to have the means to reach out to their citizens before and during a large storm event. Large precipitation events from storms other than coastal storms may develop with little notice. Road signs that indicate flooded areas using real-time communications from citizens are one way to alert the community of these issues.

3) Elevating Structures: This measure involves raising the building in place so that the lowest floor is above the flood level for which floodproofing is provided. The building is jacked up and set on a new or extended foundation.

4) Floodproofing: There are two types of floodproofing techniques: dry floodproofing and wet floodproofing. Dry floodproofing keeps the floodwaters from entering the structure while wet floodproofing allows the floodwaters to enter the building but minimizes the damages. Dry floodproofing involves sealing the walls of structures such as buildings with waterproofing compounds, impermeable sheeting, or other materials and using closures for covering openings from floodwaters. Dry floodproofing is most applicable in areas of shallow, low-velocity flooding.

   Wet floodproofing allows the structure to flood inside while ensuring minimal damage to the building and any contents. By allowing the force of the water to pass through a building, the interior flooding allows hydrostatic force on the inside of the building walls to equally counteract the hydrostatic force on the outside, thus eliminating the chance of structural failure. Wet flooding practices include installation of flood vents in the ground floor or crawl space to allow floodwater to flow through the building without causing structural damage or conversion of ground floor living space to uninhabitable space such as a carport or open garage.

5) Increase Storage: In order to manage flooding from precipitation events, natural storage of the watershed can be restored or additional storage can be added. Restoration of natural storage includes restoring wetlands and returning floodplains to undeveloped states in riverine areas. Increasing natural storage in stormwater systems includes reducing impervious areas to allow infiltration of runoff from precipitation events. Additional storage can be added through detention ponds and on a more localized basis through rain barrels or cisterns. A major component of increasing natural infiltration in stormwater management includes the use of green stormwater management.

6) Public Engagement and Education: A community can aid in flood risk management by educating its citizens about the existing flooding hazards and what can be done to reduce risk to their property. Additionally, if a flood risk management project is constructed, educating the community on residual project risk must occur.

7) Relocating Utilities and Critical Infrastructure: A community can manage risk to its own public infrastructure by relocating utilities underground and moving critical infrastructure out of floodplain areas. Examples of critical infrastructure include hospitals and shelters.

8) Preservation: Land preservation programs should be developed to place environmentally sensitive land in permanent easements to better manage watersheds and their interrelated systems.

9) Resilience Performance Standards: Develop resilience performance standards for infrastructure to be used when making investment decisions. These standards may include information such as the recurrence interval of a storm that infrastructure should be designed to withstand, how long different end users can be without power, or how and when to include climate change or sea level change into design standards.

10) Emergency Response Systems: Emergency response systems include preparation for floods in anticipation of the flood event and flood-fighting plans to assist after the fact. The plans should include contingency and emergency floodproofing and must be properly integrated with emergency evacuation plans.

11) Modify / Remove Structures for Better Channel Function: Channel alterations such as modifying or removing features or widening/deepening channels can help manage flooding by improving channel function.

12) Design or Redesign and Location of Services and Utilities: Services and utilities can be relocated to areas of low risk or to higher areas not subject to flooding . Additionally, existing services/features can be elevated above the flood elevation or can include floodproofing features in the design.

13) Surface Water / Stormwater Management: Management of surface water and stormwater systems can improve water quality, decrease erosion, and increase storage to minimize flood risks in the event of a storm. The development of a surface water or stormwater management plan can help facilitate best management practices of the systems.

14) Building Codes and Zoning: Climate change and coastal hazard considerations should be incorporated into building and zoning codes. Building codes can promote construction techniques that manage damages to future construction or to areas of redevelopment. Some examples include requiring new structures to be raised above flooding elevations and structures to be built on pier foundations in areas of wave action. Zoning can be used to avoid activities on the floodplain other than those compatible with periodic flooding.

15) Strategic Acquisition: Purchase of undeveloped land for flood risk management.

16) Emergency Plans/Hazard Mitigation Plans: Emergency planning allows a community to be prepared for storm events, such as flood inundation from coastal storms. Hazard mitigation plans are developed to document hazards a community is exposed to and determine mitigation measures a community would like to implement to manage risk from these hazards. It is important for both of these plans to be kept up to date with local issues in order to prepare and recover after a flooding event.

17) Retreat: Consider managed retreat, allowing wetlands and beaches to take over land that is dry. Include land use and zoning appropriate for coastal storm risk management.

18) Wetland Migration: Adjust zoning laws for wetland migration.

19) Regional Sediment Management (RSM): Continuation of RSM practices in place and identifying new opportunities.

20) Coastal Zone Management: Coastal Zone Management regulates activities within the "Coastal Zone" to ensure that development is accomplished with the least amount of damage to the coastline.

5.5.3 Natural and Nature-Based Infrastructure

Nature-Based Infrastructure (NBI) refers to the planned use of natural and engineered features to produce engineering functions in combination with ecosystem services and social benefits. Natural and nature-based features include a spectrum of features, ranging from those that exist due exclusively to the work of natural process to those that are the result of human engineering and construction. The built components of the system include nature-based and engineered structures that support a range of objectives, including coastal storm risk management (e.g., seawalls, levees), as well as infrastructure providing economic and social functions (e.g., navigation channels, ports, harbors, residential housing). Natural coastal features take a variety of forms, including reefs (e.g., coral and oyster), barrier islands, dunes, beaches, wetlands, and maritime forests. The relationships and interactions among the natural and built features comprising the coastal system are important variables determining coastal vulnerability, reliability, risk and resilience.

1) Green Stormwater Management: Management practices can be used to reduce impervious areas and increase storage on a localized basis for stormwater. Some examples include bio-swales, rain gardens, green roofs, rain barrels, or cisterns. Green stormwater management practices that involve plantings also allow for evapotranspiration of stormwater and provide for a pleasing aesthetic component. Reducing impervious areas allows for infiltration of stormwater, which reduces runoff quantity and improves runoff quality. Green stormwater management can also allow for opportunities to add public recreational features and provide for ecosystem restoration, while providing for wave attenuation and stormwater storage.

2) Constructed or Rehabilitated Reefs: Reefs can act as a natural barrier to dampen storm wave activity.

3) Salt Marshes: Salt marshes can provide sediment stabilization to an area, and can dissipate and/or attenuate oncoming wave action. Depending on the cross-shore width of a salt marsh, it has the potential to reduce storm surge effects. The traditional rule of thumb (USACE, 1963) was that for every 2.7 miles of marsh, storm surge is reduced by one foot; however, the degree of risk management that wetlands provide from storm surge is extremely complicated.

4) Freshwater Wetlands: Freshwater wetlands can provide flood risk management by detention and/or storage for floodwaters. Infiltration through a freshwater wetland to an aquifer below can assist in groundwater recharge and provide water quality benefits. Freshwater wetlands also provide sediment stabilization benefits.

5) Vegetated Dunes and Beaches: Vegetation helps to stabilize dunes and beaches from erosion due to wind and wave action.

6) Vegetated Submerged Aquatic Vegetation (SAV), Salt Marshes and Wetlands: Vegetated features help to break offshore waves, attenuate wave energy, slow the inland transfer of storm water and increase infiltration.

7) Oyster and Coral Reefs: Reefs can act as a natural barrier to dampen wave action, while providing essential habitat to marine organisms.

8) Barrier Island Restoration: Barrier islands act as the first line of defense in reducing risk to the mainland from storm surge and wave action. Restoration includes increasing barrier island elevation or plan form (length/width) and can include vegetation components such as dune/beach grass to stabilize sediments and increase wave dissipation.

9) Maritime Forests / Shrub Communities: The dense vegetation of maritime forests and shrub communities helps to stabilize soils while dissipating wave action and slowing the inland transfer of storm water.

The broad measures identified herein, structural, non-structural, and nature-based, have the potential for further development to target specific areas for coastal storm risk management. The goal of measures development is to achieve the objectives by combining one or more measures while avoiding constraints. Measures identified will be further evaluated, screened and used in combination (as appropriate) in future phases of study to determine area-specific project viability to meet the planning objectives.

5.5.4 Area Specific Measures

The previously described broad-based measures (structural, non-structural, and nature-based) are applicable to most areas within the study area. Specific area-focused measures provided through stakeholder input and/or otherwise derived from previous studies, particularly any existing hazard mitigation plans, are listed below. This comprehensive list includes some measures that are beyond the purview of USACE. Potential measures that could be evaluated as part of future study phases are included herein.

5.5.4.1 County-Wide

The following county-wide measures were identified in the Nassau County Hazard Mitigation Plan (Nassau County, 2007):

1) Continue to maintain county ponds to improve drainage and manage flooding. This effort will help manage interior flooding from stormwater runoff.

2) Dredge, replace, and repair rotted bulkheads in various county ponds and parks to manage erosion.

3) Improve communication of hazard mitigation capabilities and efforts and communication of risks. This will help with community understanding of hazards and improve community preparedness for any hazards.

4) Apply hazard mitigation measures to critical county facilities in areas of high risk.

The following county-wide measures were identified based on a preliminary assessment of the damages incurred to the area during Hurricane Sandy:

1) Elevate bridges and other county roadways above anticipated storm surge elevations.

2) Apply floodproofing measures to county-owned facilities to manage flood risk.

3) Repair and raise any bulkheads along the bay shoreline which appear to be low or in poor condition.

5.5.4.2 City of Long Beach

The following area specific measures were based on discussions with the City of Long Beach on August 26, 2013. A memorandum for record of this meeting can be found in **Appendix B:**

1) Design and construct a stormwater force-main system to relieve interior flooding during high storm surge events and improve interior stormwater drainage.
2) Replace pumps at Roosevelt pump station with submersible pumps.
3) Evaluate opportunities to harden critical infrastructure for public services throughout the City of Long Beach. This includes the Long Beach police department, which was damaged during Hurricane Sandy.

The following area specific measures were identified in the "Coastal Protection Study of the City of Long Beach, Bayside Flood Protection Plan" (City of Long Beach, 2009):

1) Raise and repair bulkheads along the bayside shoreline to at least 9 feet relative to the National Geodetic Vertical Datum (NGVD).
2) Install new bulkheads in areas where bayside shoreline protection is currently lacking or existing bulkheads have been destroyed.
3) Install tide valves on all storm drain outfalls to eliminate backflow into the city's stormwater collection system.
4) Develop a maintenance plan to inspect all storm drains, outfalls, and bulkheads on the bayside shoreline.
5) Install a temporary site-specific solution at the confluence of the canal entrances and the bay to alleviate storm tide flooding.
6) Work with USACE to evaluate the need for a bayside storm protection project.

The following area specific measures were identified in the "Conditions Evaluation of Bulkheads & Outfall Structures in the City of Long Beach, New York" (City of Long Beach, 2013):

1) Replace the Riverside Boulevard concrete headwall structure.

The following area specific measures were identified in the Hurricane Sandy Storm Damage Report (City of Long Beach, 2012):

1) Restore and improve the beach and dune system on the south shore of the city. This beach and the dunes provide a first line of defense for the city from oncoming wave action and increased storm surge. A beach dredge and fill project can help improve the city's resilience coastal storm impacts. Future renourishment of the beaches may be necessary.

   Additional area specific measures which may be considered for the City of Long Beach, NY:

2) Regional sediment management should be incorporated into any nourishment project in this area to minimize costs and impacts to neighboring communities.
3) Add vegetation to existing and proposed dunes to minimize erosion.
4) Evaluate the effectiveness of developing flood / tide gates, as listed in the broad-based structural measures, across East Rockaway Inlet and underneath the Long Beach Boulevard

Bridge to minimize storm surge from penetrating into the back bay areas during extreme coastal storm surge events.

5) Update building codes and zoning regulations to make new development and renovated buildings more resilient and limit development in highly flood prone areas.
6) Identify buyouts and relocations of homes (as listed in the broad-based measures) in high-risk flood prone areas.
7) Design and install constructed reefs to manage coastal storm risk from wave action for the City of Long Beach. An offshore reef could also provide optimal conditions for recreational surfing.
8) Rehabilitate and create wetland conditions within South Oyster Bay to manage storm surge impacts on the northern coastline of the City of Long Beach.
9) Floodplain management.

5.5.4.3 Town of Hempstead

The following area specific measures were derived from the "County-wide Hazard Mitigation Plan" (Nassau County, 2007):

1) Install backflow valves of outfalls to prevent water from Reynolds Channel from entering the streets.
2) Retrofit the Atlantic Beach Water Declaration District for submersible operation and emergency power.
3) Develop stormwater management plans for communities where they do not already exist.
4) Improve streams and culverts to eliminate flooding.

The following area specific measures were derived from a letter provided by the Village of Cedarhurst, New York, located within the Town of Hempstead:

1) Inspect and review integrity of the village's stormwater management system and make any necessary repairs and alterations for optimal utilization.
2) Survey the village's northern coastal shoreline to identify potential coastal storm risk management solutions. One potential solution is a new seawall combined with two floodgates on the Rockaway Turnpike to manage the risk of coastal flooding along the northern shoreline of the village.

Additional area specific measures which may be considered for the Town of Hempstead, NY:

1) Increase coastal edge elevations along South Oyster Bay to reduce coastal flooding.
2) Design and construct a stormwater force-main system to relieve interior flooding in the event of high storm surge events and improve interior stormwater drainage.
3) Rehabilitate and create wetland conditions within South Oyster Bay to reduce storm surge impacts on the bay coastline of the Town of Hempstead.

Reevaluate the Jones Inlet and East Rockaway Inlet Federal Navigation Projects to determine the Federal Standard (least costly environmentally acceptable method of dredged material placement) based on the development of new Ecosystem Goods and Service Performance Metrics for Natural and Nature-based Infrastructure for the NACCS (USACE, August 2013).

5.5.4.4 Town of Oyster Bay

The following area specific measure was derived from the County-wide Hazard Mitigation Plan (Nassau County, 2007):

1) Buyout, relocate, elevate, and/or floodproof homes that are subject to repetitive losses from coastal storm events.

Additional area specific measures which may be considered for the Town of Oyster Bay, NY:

1) Manage water levels in Unqua Lake, Massapequa Lake, and other inland water bodies.
2) Increase coastal edge elevations along South Oyster Bay.
3) Evaluate the installation of a permanent or temporary tide / floodgate at the mouth of Carmen's River, Jones Creek, Grand Canal, Massapequa River, and other inlets into South Oyster Bay.

6. Preliminary Financial Analysis

Given the size of the study area (98 square miles) there could be more than one study and multiple sponsors.

The potential non-Federal sponsors identified in **Table 3** would be required to provide 50 percent of the cost of the potential future investigation. Up to 100% of the non-Federal sponsor's share could be work in-kind. The potential non-Federal sponsor is also aware of the cost sharing requirements for potential project implementation. A letter of support from the non-Federal sponsor stating willingness to pursue potential future investigation and to share in its cost and an understanding of the cost sharing that is required for project implementation will be required.

7. Summary of Potential Future Investigation

Based on the identified measures, potential alternative plan development, and future screening of alternatives, there appears to be a large array of solutions that have the potential to be economically justified, environmentally acceptable, addressable through engineering solutions, and consistent with USACE polices and the Infrastructure Systems Rebuilding Principles (NOAA and USACE, 2013).

Table 3 summarizes the non-Federal sponsors with potential interest in future phases of study to address coastal storm risk management for the Nassau County Back Bays study area. In general, NYSDEC would be the non-Federal sponsor for any potential future study, and would execute a study agreement with USACE as the non-Federal sponsor on behalf of the local government entities listed in **Table 3** below.

Table 3. Potential Future Investigation and Non-Federal Sponsors

Non-Federal Sponsor	Area of Interest	Navigation	Coastal Storm Risk Management	Flood Risk Management	Nature-based	Water Resource Management	Community Resilience
New York State Department of Environmental Conservation (NYSDEC)	Nassau County Back Bays area		X	X	X	X	X
City of Long Beach	Long Beach		X	X	X	X	X
Town of Hempstead	Hempstead	X	X	X	X	X	X
Town of Oyster Bay	Oyster Bay		X	X	X	X	X
Nassau County	Nassau County		X	X	X	X	X

8. Views of Other Resource Agencies

Due to the funding and time constraints of this focus area analysis, very limited coordination was conducted with other agencies. Coordination with other resource agencies is being conducted as part of the overall North Atlantic Coast Comprehensive Study. Additional coordination would occur during the future phases of study.

9. References

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APPENDIX A

STAKEHOLDER INQUIRY LETTER

LIST OF CONTACTS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW YORK DISTRICT
JACOB K. JAVITS FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, NY 10278-0090

REPLY TO ATTENTION OF
CENAN-PL-F

22 August 2013

Dear Stakeholder,

The United States Army Corps of Engineers (USACE) is conducting the North Atlantic Coast Comprehensive Study (NACCS) under the authority of Public Law 113-2, the Disaster Relief Appropriations Act of 2013, Chapter 4, which authorized USACE investigations as follows:

- "*That using up to $20,000,000 of the funds provided herein, the Secretary shall conduct a* ***comprehensive study*** *to address the flood risks of* ***vulnerable coastal populations*** *in areas that were affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the Corps.*
- "*….as a part of the study, the Secretary shall* ***identify those activities warranting additional analysis by the Corps***".

The goals of the NACCS are to:

- Promote resilient coastal communities with sustainable and robust coastal landscape systems, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable populations, property, ecosystems, and infrastructure; and
- Provide a risk reduction framework (reducing risk to which vulnerable coastal populations are subject) consistent with USACE-NOAA Rebuilding Principles.

To identify those activities warranting additional analysis, USACE is conducting a Reconnaissance-Level Analysis (RLA) for the Nassau County Back-bays. The area that will be studied as part of this RLA is shown in Figure 1 (attached).

The purpose of the RLA is to determine if there is a Federal (USACE), interest in participating in a cost-shared feasibility study to formulate and evaluate specific coastal flood risk management projects in the Nassau County Back-bays study area. Possible coastal flood risk management measures could include: structural, non-structural, natural, nature-based, and policy and programmatic measures or a combination of them, if a feasibility study is initiated.

To conduct the RLA, **USACE requests feedback from your jurisdiction** on related problems and potential opportunities to address these issues such as those experienced during Hurricane Sandy and other storm**s.**

a. Did your area experience tidal or tidally influenced storm surge?
b. Be specific on particular areas and water bodies within your jurisdiction that experienced storm surge.
c. What factors, if any, exacerbated damages from storm surge?

2) **Description of damages for your area:**
   a. Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.
   b. Provide a map depicting the spatial extent of damages.

3) **Prior related studies or projects (local, state, federal) in the damaged area.**

4) **List measures that your jurisdiction has considered to address the problem** (for documentation purposes, should there be a follow-on study).

Responses should be emailed to:

Ginger Croom, croomgl@cdmsmith.com (USACE Contractor)
Or faxed to Ginger Croom at 617-452-6594

Due to the aggressive schedule to complete the RLA and to meet the Congressional mandate to complete the NACCS, please provide responses to these questions by **September 6, 2013.**

If you have any questions related to this request, please contact Ginger Croom, CDM Smith (USACE Contractor) at 617-452-6594 or Roman Rakoczy at 518-698-4330.

For more information on the NACCS, please visit:

http://www.nad.usace.army.mil/Missions/CivilWorks/HurricaneSandyCoastalRecovery/NorthAtanticComprehensiveStudy.aspx

Sincerely,

Donald E. Cresitello

Donald E. Cresitello
USACE, New York District

Encl
1. Figure 1: Study Area Map

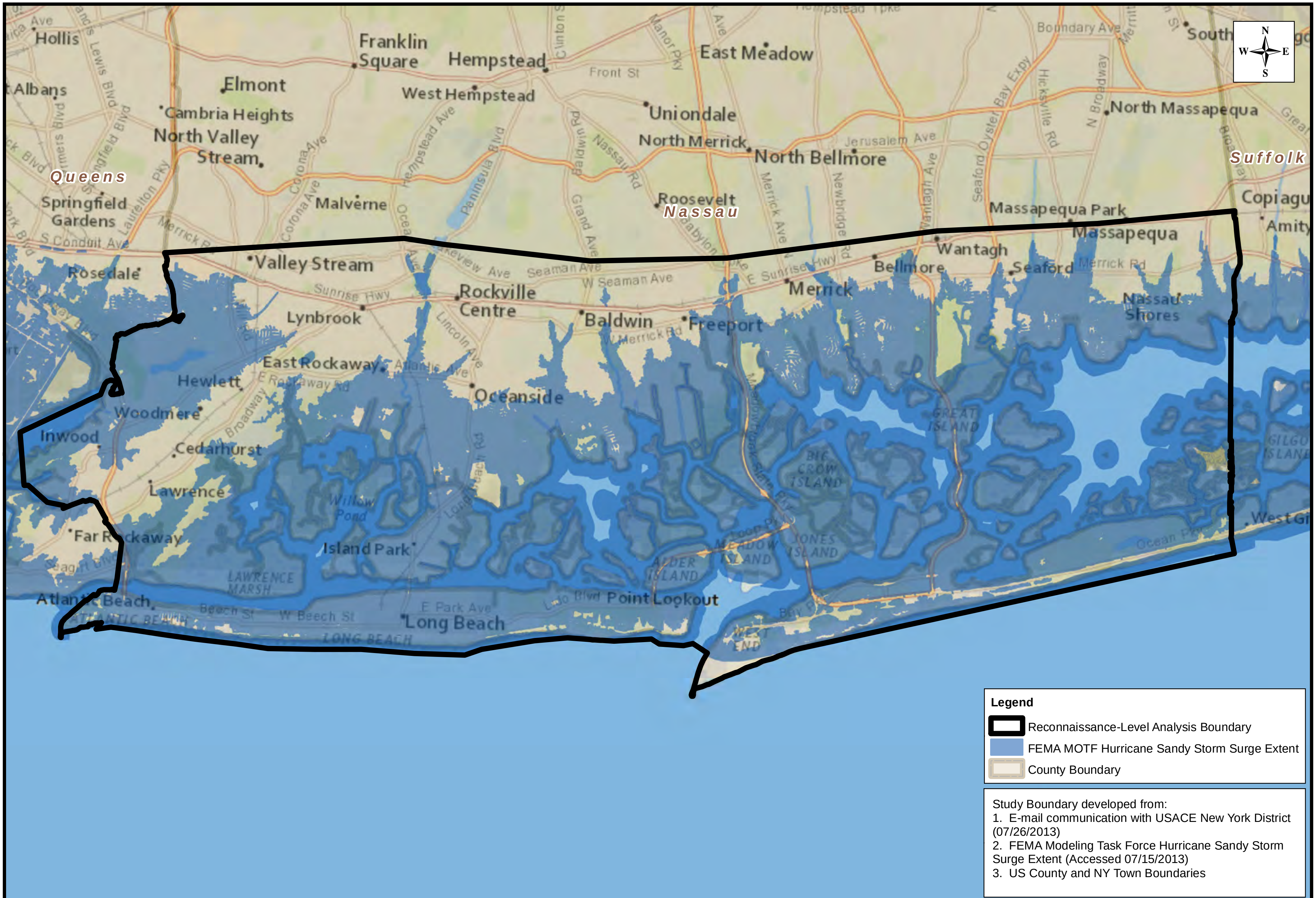


FIGURE 1

U.S. ARMY CORPS OF ENGINEERS

NASSAU COUNTY BACK-BAYS

NORTH ATLANTIC COAST COMPREHENSIVE STUDY

APPROXIMATE SCALE

0 1 2 3 4 5 Miles

RECONNAISSANCE-LEVEL ANALYSIS BOUNDARY MAP

Path: C:\GIS\NACCS\MXD\Nassau_BackBays.mxd

USACE, New York District
Nassau County Back-bays Focus Area Analysis - Point of Contacts

CITY / TOWN	VILLAGE	FIRST NAME	LAST NAME	TITLE	ORG	ADDRESS	COMMUNITY	STATE	ZIP	PHONE	EMAIL	**WEBSITE**
Long Beach		Jack	Schnirman	City Manager	City of Long Beach	1 West Chester Street	Long Beach	NY	11561	(516) 431-1001	citymanager@longbeachny.org	http://www.longbeachny.org
Hempstead	Atlantic Beach	Stephen	Mahler	Mayor	Village of Atlantic Beach	65 The Plaza PO Box 189	Atlantic Beach	NY	11509	(516) 371-4600	plaza65@aol.com	http://www.vofab.org
Hempstead	Baldwin Harbor	Erik	Mahler	Co-President	Village of Baldwin	1030 Merrick Rd.	Baldwin	NY	11510	(516) 223-8080	baldwinchamber.com/contact.asp	http://www.baldwinchamber.com
Hempstead	Bay Park	N/A	N/A	N/A	Village of East Rockaway	First Avenue	East Rockaway	NY	11518	(516) 571-7245	NCOEM@nassaucountyny.go	http://www.nassaucountyny.gov/agencies/parks/wheretogo/active/bay.html
Hempstead	Bellmore	N/A	N/A	N/A	Village of Bellmore	N/A	Bellmore	NY	11710	N/A	N/A	N/A
Hempstead	Cedarhurst	Andrew	Parise	Mayor	Village of Cedarhurst	200 Cedarhurst Ave	Cedarhurst	NY	11516	(516) 295-5770	village@cedarhurst.gov	http://cedarhurst.gov/
Hempstead	Freeport	Robert	Kennedy	Mayor	Village of Freeport	46 N. Ocean Ave.	Freeport	NY	11520	(516) 377-2200	mayor@freeportny.gov	http://www.freeportny.com
Hempstead	Hewlett Bay Park	Steve	Kausman	Mayor	Village of Hewlett Bay Park	30 Piermont Ave	Hewlett	NY	11557	(516) 295-1400	villages3@optimum.net	N/A
Hempstead	Hewlett Harbor	Mark	Weiss	Mayor	Village of Hewlett Harbor	449 Pepperidge Road	Hewlett Harbor	NY	11557	(516) 374-3806	http://hewlettharbor.org/contact.php	http://hewlettharbor.org
Hempstead	Hewlett Neck	Ross	Epstein	Mayor	Village of Hewlett Neck	30 Piermont Ave	Hewlett	NY	11557	(516) 295-1400	villages3@optimum.net	N/A
Hempstead	Island Park	James	Ruzicka	Mayor	Village of Island Park	127 Long Beach Rd	Island Park	NY	11558	(516) 431-0600	http://hewlettharbor.org/contact.php	http://www.villageofislandpark.com
Hempstead	Lawrence	Martin	Oliner	Mayor	Village of Lawrence	196 Central Avenue	Lawrence	NY	11559	(516) 239-4600	mayoroliner@villageoflawrence.org	http://www.villageoflawrence.org/
Hempstead	Merrick	N/A	N/A	N/A	Village of Merrick	N/A	Merrick	NY	11566	N/A	N/A	N/A
Hempstead	Oceanside	Mark	Bonilla	Town Clerk	Village of Oceanside		Oceanside	NY	11572	(516) 489-5000	mbonilla@tohmail.org	http://toh.li/town-clerks-office
Hempstead	Point Lookout	Richard	Zampella	COC Officer	Village of Point Lookout	PO Box 4	Point Lookout	NY	11569	(917) 280-6483	news@pointlookoutcommerce.com	http://www.pointlookoutcommerce.com
Hempstead	South Floral Park	Geoffrey	Prime	Mayor	Village of South Floral Park	383 Roquette Avenue	South Floral Park	NY	11001	(516) 352-8047	mayorgeoffreyprime@southfloralpark.org	http://www.southfloralpark.org
Hempstead	Valley Stream	Edwin	Fare	Mayor	Village of Valley Stream	123 South Central Ave	Valley Stream	NY	11580	(516) 825-4200	VSEMO@valleystream.govoffice.com	http://www.vsvny.org
Hempstead	Wantagh	Kate	Murray	Supervisor		1 Washington Street	Hempstead	NY	11550	516489-5000	http://toh.li/helpline	http://toh.li/

USACE, New York District
Nassau County Back-bays Focus Area Analysis - Point of Contacts

CITY / TOWN	VILLAGE	FIRST NAME	LAST NAME	TITLE	ORG	ADDRESS	COMMUNITY	STATE	ZIP	PHONE	EMAIL	**WEBSITE**
Hempstead	Woodmere	N/A		N/A	Village of Woodmere	N/A	Woodmere	NY	11557	N/A	N/A	N/A
Hempstead	Woodsburgh	Lee	Israel	Mayor	Village of Woodsburgh	30 Piermont Ave	Hewlett	NY	11557	(516) 295-1400	villages3@optimum.net	N/A
Hempstead		Wayne	Hall	Mayor	Village of Hempstead	99 Nichols Court	Hempstead	NY	11550	(516) 489-3400	http://hewlettharbor.org/contact.php	http://villageofhempstead.org/
Oyster Bay		John	Venditto	Town Supervisor	Oyster Bay	54 Audrey Avenue	Oyster Bay	NY	11771	(516) 624-6350	N/A	www.oysterbaytown.com
Oyster Bay	Massapequa	Patricia	Orzano	President of Chamber of Commerse	Village of Massapequa	674 Broadway	Massapequa	NY	11758	(516) 541-1443	masscoc@aol.com	http://www.massapequachamber.com
Oyster Bay	Massapequa Park	Peggy	Caltabiano	Administrator	Massapequa Park	151 Front Street	Massapequa Park	NY	11762	(516) 798-0244	villadmin@masspk.com	www.masspk.com
		Edward	Mangano	County Executive	Nassau County	1 West Street	Mineola	NY	11501	(516) 571-6000	emangano@nassaucountyny.gov	http://www.nassaucountyny.gov/
		Shila	Shah-Gavnoudias	Commissioner of Public Works	Nassau County	1194 Prospect Avenue	Westbury	NY	11590	(516) 571-9600	ssood@nassaucountyny.gov	http://www.nassaucountyny.gov/
		Jeffrey	Greenfield	Chairman	Nassau County Planning Commission	400 County Seat Drive	Mineola	NY	11501	(516) 571-5847	lfwolf@nassaucountyny.gov	http://www.nassaucountyny.gov/
	2nd District of New York	Pete	King	District Congressman	Nassau County District	1003 Park Boulevard	Massapequa Park	NY	11762	(516) 541-4225	pete.king@mail.house.gov	http://peteking.house.gov/contact/offices

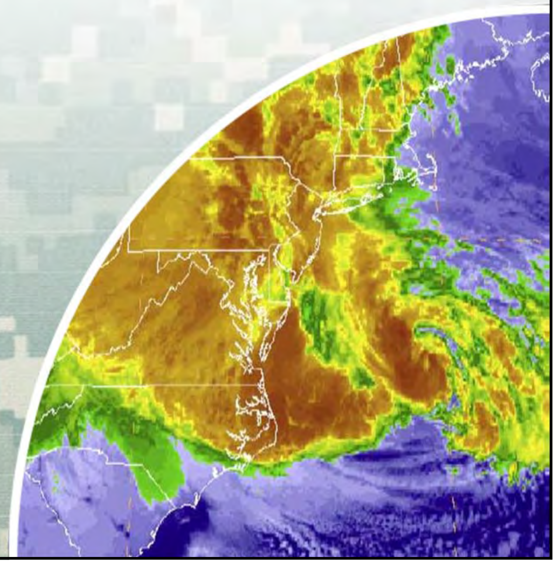
APPENDIX B

PRESENTATION

MEMORANDUM FOR RECORD

SIGN-IN SHEETS

North Atlantic Coast Comprehensive Study
Nassau County Back-bays
Reconnaissance-Level Analysis



U.S. Army Corps of Engineers
Coastal Storm Risk Management
Planning Center of Expertise
26 August 2013

Background

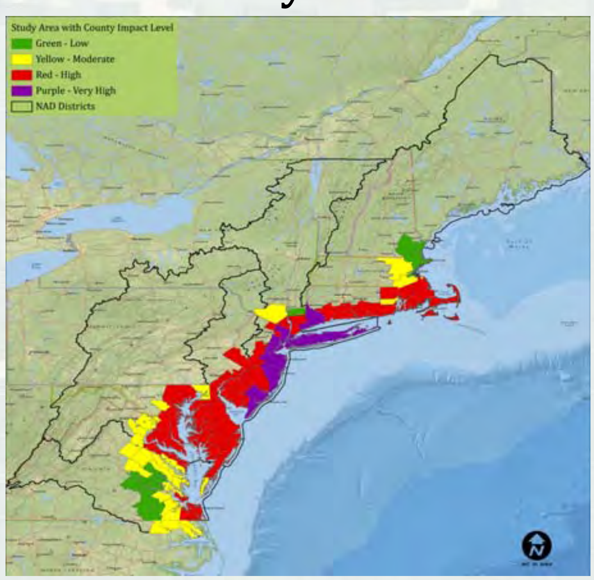
- Greatest areas of Sandy's impact: NJ, NY, CT
- Public Law 113-2
- "That using up to $20,000,000 ($19,000,000 after sequestration) of the funds provided herein, the Secretary shall conduct a **comprehensive study** to address the flood risks of **vulnerable coastal populations** in areas that were affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the Corps…"
- Comprehensive Study to be submitted to Congress by Jan 2015

NACCS Study Goals

1. *<u>Provide Risk Reduction Framework</u>– Reduce risk to which vulnerable coastal populations are subject.*
2. *<u>Promote Resilient Coastal Communities</u> – Ensure a sustainable and robust coastal landscape system, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable population, property, ecosystems, and infrastructure.*

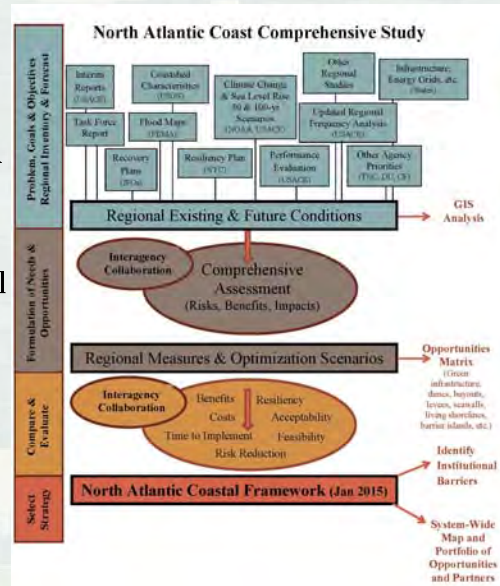
**Consistent with USACE-NOAA Rebuilding Principles*

Study Area



NACCS Scope

- **Coastal Framework**
  - ❑ Regional scale
  - ❑ Interagency collaboration
  - ❑ Opportunities by region/state
  - ❑ Identify range of potential solutions and parametric costs by region/state
  - ❑ Identify activities warranting additional analysis



Key Technical Components

- Engineering
- Environmental, Cultural, and Social
- Sea Level Rise and Climate Change (SLR & CC)
- Economics
- Plan Formulation
  - ▶ Policy & programmatic
- Coastal GIS Analysis

NACCS Schedule

- ✓ April 2013 – Existing/Future Conditions
- ✓ May – Problems/Opportunities
- ✓ June – Hydrodynamics and Measures Working Meetings
- ✓ July –Aug – Refine Analyses & Measures
- July - Dec 2013 – Interagency Collaboration Webinar Series
- Oct-Dec 2013– Reviews of Analyses
- ~Jan-March 2014– Opportunities for Additional Feedback
- April-July 2014 – Alignment & Refinement
- Aug-Sept 2014 – Final Draft Report Production
- Oct-Dec 2014 – NAD, HQ, ASA(CW), OMB Reviews
- Jan 2015- Submit to Congress

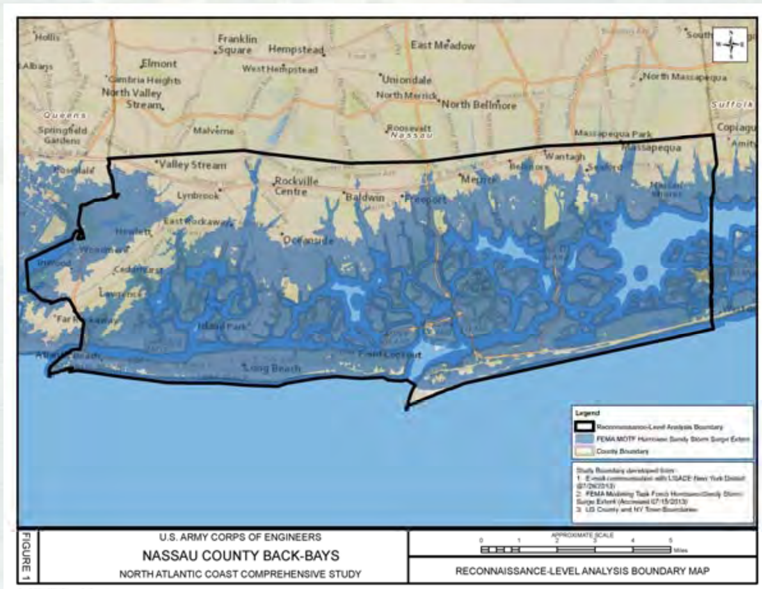
Reconnaissance-Level Analyses

Reconnaissance-Level Analyses

- Investigation is being conducted as a part of the North Atlantic Coast Comprehensive (NACC) Study under the authority of Public Law 113-2, the Disaster Relief Appropriation Act of 2013
- Specific language within PL 113-2 states, "…*as a part of the study, the Secretary shall identify those activities warranting additional analysis by the Corps*
- Reconnaissance-level analyses will identify activities warranting additional analysis that could be pursued

Reconnaissance-Level Analyses

- The purpose is to determine if there is a Federal, (USACE) interest in participating in a cost-shared feasibility phase study in the interest of providing potential types of projects in the Nassau County Back-bays study area
- Possible coastal flood risk management measures could include: structural, non-structural, natural, nature-based, and policy and programmatic measures or a combination of them, if a feasibility study is initiated.



Reconnaissance-Level Analyses

- What is the water resources problem to be solved?
- Is there a viable engineering solution to the problem?
- Are there potential National Economic (NED) benefits associated with a potential project?
- Is there a need/interest for Federal (USACE) participating and is there a qualified non-federal sponsor?

Reconnaissance-Level Analyses

Typically identify the following:

- Study Area Boundaries
- Problems and Opportunities
- Planning Objectives
- Planning Constraints
- Measures to Address Planning Objectives
- Next Steps

Feedback Requested

1. Problem identification for your area:

- ► Did your area experience tidal or tidally-influenced storm surge?
- ► Specify particular areas and water bodies within your jurisdiction that experienced storm surge.
- ► What factors, if any, exacerbated damages from storm surge?

Feedback Requested

2. Description of damages for your area:

- ► Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.
- ► Provide a map depicting the spatial extent of damages.

Feedback Requested

3. Prior related studies or projects (local, state, federal) in the damaged area.

4. Measures that your jurisdiction has considered to address the problem

Stakeholder Outreach

- Letters emailed by USACE New York District (August 22)
- Feedback requested by September 6
- POC list (copy provided)

Next Steps

- Fall 2013 – Draft RLA
- FY 2014 – sign letters of intent with local sponsor, work towards Project Management Plan (PMP) for Feasibility Phase
- FY 2015 – Move to Feasibility phase IF:
  - Federal interest is determined during Recon-phase
  - Non-federal Sponsor is identified
  - Federal funding is available

Questions/POCs

- Roman Rakoczy – USACE New York District
  - Roman.G.Rakoczy@usace.army.mil
  - 518-698-4330 (mobile)
- Ginger Croom – CDM Smith (USACE Contractor)
  - croomgl@cdmsmith.com
  - 617-452-6594 (ph and fax)
  - 617-999-9631 (mobile)

North Atlantic Coast Comprehensive Study

Nassau County Back-bays
Focus Area Analysis Meeting Memorandum for Record
Subject: Long Beach, NY

On Monday, August 26th, 2013 the US Army Corps of Engineers (USACE) met with representatives from the City of Long Beach, NY State Department of Environmental Conservation, and CDM Smith to discuss the North Atlantic Coast Comprehensive Study (NACCs) Nassau County Back-bays Focus Area Analysis. Six people attended the one-hour meeting.

Roman Rakoczy from the USACE spoke generally about the focus area analysis study.

Ginger Croom from CDM Smith presented handouts of a PowerPoint presentation which provided information on the focus area analysis study, and pertinent information requested from communities necessary to complete the focus area analysis.

Sign-in sheets, comment cards, copies of the PowerPoint presentation which was reviewed in the meeting, and point of contact information were provided to members of the audience.

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study

Nassau County Back-bays Focus Area Analysis Meeting

August 26, 2013

11:00 AM – 12:30 PM

Location: Long Beach City Hall
1 West Chester Street, Long Beach, NY 11561

Attendees: Olabisi Kenku – Environmental Engineer at NYSDEC Stony Brook
Roman Rakoczy – Senior Planner at USACE
Lauren Klonsky – Engineer at CDM Smith
Ginger Croom – Project Manager at CDM Smith
Jim LaCarrubba – Commissioner of Public Works for City of Long Beach
Scott Kemins – Building Commissioner for City of Long Beach

Meeting Minutes:

- Introduction
  - **Roman Rakoczy**, USACE, addressed the meeting participants and provided an overview of the study.
  - **Roman Rakoczy,** USACE, mentioned that he would provide the City of Long Beach with the draft focus area analysis report for Nassau County Back-bays after he receives it from CDM Smith.

- Presentation
  - **Ginger Croom**, CDM Smith, went through a presentation on the NACCS and the focus area analyses with the meeting participants

- Comments/Discussions
  - Roman suggested that the City of Long Beach try to use the information they acquired to compute a damage cost per square mile.
  - This focus area analysis study should consider damages incurred as result of Hurricane Sandy, as well as damages that did not

occur, but could have.

- Ginger and Roman emphasized that the ideas and projects proposed as part of this focus area analysis should be as general and all-encompassing as possible.

- The City of Long Beach is highest on the southern end of the City, which borders with the Atlantic Ocean and slopes downward towards the northern end of the City.

- There are several critical facilities on the northern end of the City of Long Beach that are vulnerable to flooding. The shoreline near these critical facilities is not protected.

- During Hurricane Sandy, the water treatment plant had 24’ of water at the intake point. The generator to the water treatment plant was damaged during Hurricane Sandy and therefore lost all power to the plant.

- The northern end of the City of Long Beach was hit hardest by Hurricane Sandy. Water from the ocean breached the southern shore and rushed towards the northern end of the City. In addition, water from the bay flooded the northern border of the city. This volume of water was not relieved during low tide, so when high tide occurred, flooding worsened.

- The City of Long Beach would like to see the unstructured sections of the shoreline on the northern border of the City become structured. The unstructured sections of the shoreline run from Magnolia Boulevard to Monroe Boulevard. The City of Long Beach has applied for FEMA 404 money to harden the northern shoreline of the City that is not currently structured.

- Structures that exist along sections of the northern border of the City of Long Beach are sporadic, with varying heights, and varying conditions. These structures protect individual parcels and are left to the digression of the homeowners to upkeep.

- To address stormwater issues, the City of Long Beach would like to have a forcemain pumping system on the north side of the City, similar to an existing system in Virginia Beach to force stormwater into the Bay.

- Scott attested to the flooding in the City of Long Beach during Hurricane Sandy saying “… there was water everywhere, there was not a dry street". He noted that there was 6 feet of water outside of the City Hall building.

    - During Sandy, the City shut the gates of the wastewater treatment plant. Around the same time as the wastewater treatment plant shut down, the water treatment plant went down, so residents weren't adding much flow to the wastewater system, reducing their sewer overflows. There was some minor backing up of the sewer system into homes and basements.

    - The pumps failed at the Roosevelt Pump Station. The City is looking to replace the pumps with submersible pumps.

- Prior Studies/Reports

    - The City of Long Beach will provide a PDF of a preliminary damage assessment done on the bayside of the City.

    - FEMA 404 applications were submitted by the City of Long Beach for floodgates, raising structures, and stormwater retention. The City of Long Beach will send CDM Smith the 404 applications that they submitted.

    - "Conditions Evaluation of Bulkheads and Outfall Structures in the City of Long Beach, New York," Cameron Engineering Associates. CDM Smith to contact for a copy. Jim to let them know to release report to CDM Smith.

    - A digital copy of the study 'Hurricane Sandy Storm Damage Report, City of Long Beach, NY' dated December 2012 by Coastal Planning & Engineering Inc. was provided to CDM Smith. This details the damages caused by Hurricane Sandy on the southern ocean side of the City of Long Beach.

    - "Coastal Protection Study City of Long Beach, NY Bayside Flood Protection Plan" by Coastal Planning & Engineering, November 2009. [2481 N. W. Boca Raton, FL 33431, ph: 561-391-8102 Tpierro@coastalplanning.net]. CDM Smith to contact for a copy. Jim to let CP&E know to release copy of report.

---End of Minutes---

North Atlantic Coast Comprehensive Study

Nassau County Back-bays
Focus Area Analysis Meeting Memorandum for Record
Subject: Hempstead, NY

On Monday, August 26th, 2013 the US Army Corps of Engineers (USACE) met with representatives from the Town of Hempstead, Nassau County, NY State Department of Environmental Conservation, and CDM Smith to discuss the North Atlantic Coast Comprehensive Study (NACCs) Nassau County Back-bays Focus Area Analysis. Nine people attended the one-hour meeting.

Roman Rakoczy from the USACE provided introductions and the meeting purpose – NACCS and Nassau County Back-bays Focus Area Analysis.

Ginger Croom from CDM Smith presented handouts of a PowerPoint presentation which provided information on the overall NACCS, and the focus area analysis, as well as information that is being requested from various stakeholders pertinent to complete the focus area analysis.

Sign-in sheets, comment cards, copies of the PowerPoint presentation which was reviewed in the meeting, and point of contact information were provided to meeting participants.

US Army Corps of Engineers

North Atlantic Coast Comprehensive Study

Nassau County Back-bays Focus Area Analysis Meeting

August 26, 2013

1:30 PM – 2:30 PM

Location: Town of Hempstead Conservation and Waterways Office
1 Parkside Drive, Point Lookout, NY 11569

Attendees: Ron Masters- Commissioner, Department of Conservation and Waterways
Dan Fucci – Hydrogeologist at Nassau County Public Works Department
Michael Foley – Lab Director at Town of Hempstead
Bob Wenegenofsky – Environmental Analyst at Town of Hempstead
Olabisi Kenku – Environmental Engineer at NYSDEC - Stony Brook
Roman Rakoczy – Senior Planner at USACE
Rebecca Furst – Floodplain Manager at Town of Hempstead
Lauren Klonsky – Engineer at CDM Smith
Ginger Croom – Project Manager at CDM Smith

Meeting Minutes:

- Introductions and Overview
    - **Roman Rakoczy** from the USACE addressed the meeting participants and provided an overview of the study area and purpose of the focus area analysis.
    - **Roman Rakoczy** mentioned that he would provide the Town of Hempstead with the draft focus area analysis report for Nassau County Back-bays after he receives it from CDM Smith.

- Presentation
    - **Ginger Croom**, CDM Smith, went through a presentation on the NACCS with the meeting participants.

- Comments/Discussion
  - Ron Masters mentioned that a wave gage study, which could be used as a community warning system, was stopped and should be restarted
  - The Town of Hempstead is in the process of doing a community rating system for the NFIP
  - Hempstead is impacted by flooding in Jamaica Bay. The Town will include information on any studies / projects / reports / ideas for improvements to CDM Smith, although this information will likely be included in the NY Bays its Tributaries and Jamaica Bay Focus Area Analysis report.
  - The Town will provide damage assessment reports (in GIS) to CDM Smith.
  - CDM Smith will provide GIS shapefiles of the Nassau County Back-bays study area. Per request of the Town of Hempstead, the Town may want the focus area analysis boundary extended to include additional tributaries.
  - CDM Smith will share the study area map (GIS shapefile and PDF of map) for the New York Bay, Its Tributaries and Jamaica Bay Focus Area Analysis) so the Town of Hempstead can see what areas of Jamaica Bay are included in the focus area analysis analysis.
  - The Town of Hempstead will provide CDM Smith with damage assessment information post hurricane Sandy as well as repetitive losses from the National Flood Insurance Program (NFIP) dating back to 1992. The Town of Hempstead will also provide a disk to CDM Smith with a disk of Geographic Information System (GIS) data of flooding within the Town of Hempstead.
  - CDM Smith will provide Ron Masters, with digital copies of the PowerPoint presentation reviewed during the meeting, digital copies of the comment cards created, as well as a digital list of the four major questions outlined in the PowerPoint presentation for which feedback is required for the focus area analysis.
  - Ron Masters and staff will coordinate with the incorporated villages, and other relevant Departments regarding the information request/letter
  - All reviewed contact list for this focus area analysis, and CDM Smith noted both incorporated villages and unincorporated villages, for which CDM Smith needs to obtain info from separately for this focus area analysis.
  - The Town of Hempstead is included in the multi-jurisdictional Nassau County Hazard Mitigation Plan.
  - CDM Smith will request the 404 applications submitted through Nassau County, since CDM Smith is assisting the County with submission of these applications as part of a separate contract.
  - The Town of Hempstead has a lot of damaged bulkheads along the shoreline that need to be repaired. They will need permits from the NY State DEC in order to complete this work.

---End of Minutes---

USACE, New York District

Nassau County Back-bays Reconnaissance-Level Analysis Meeting - Hempstead, NY - 8/26/2013

Name	Community/Agency	Title	E-Mail	Telephone
Ron Masters	Town Hempstead	Commissioner	rmasters@tohmail.org	516897-4118
DAN FUCCI	N.C. Public Works	Hydrogeologist II	dfucci@nassaucountyny.gov	516 571-7520
MICHAEL FOLEY	TOWN OF HEMPSTEAD	LAB DIRECTOR	MICHFOL@TOHMAIL.org	5168974133
BOB WENEGENOFSKY	HEMPSTEAD C+N	ENVIRONMENTAL ANALYST	BWENEGENOFSKY@GMAIL	516-897-4111
OLABISI KENKU	NYSDEC Stony Brook	Environmental Engineer	oakenku@gw.dec.state.ny.us	631-444-0409
Roman Rakoczy	USACE	Sr. Planner	roman.g.rakoczy@usace.army.mil	518-698-4330
REBECCA FURST	Town of Hempstead	Certified Flood Plain manager	rlouvaris@aol.com	516 8123094
LAUREN KLONSKY	CDM SMITH	ENGINEER	klonskyls@cdmsmith.com	(617)452-6361
GINGER CROOM	CDM SMITH	P.O.C	croomgl@cdmsmith.com	(617) 999-9631

USACE, New York District

Nassau County Back-bays Reconnaissance-Level Analysis Meeting - Long Beach, NY - 8/26/2013

Name	Community/Agency	Title	E-Mail	Telephone
OLABISI KENKU	NYSDEC - Stonybrook	Environmental Engineer	oakenku@gw.dec.state.ny.us	(631)-~~444~~-0409
Jim LaCarrubba	City of Long Beach	Commissioner of Public Works	jlacarrubba@longbeachny.gov	516-431-1011
Scott Kemins	City of Long Beach	Building Commissioner	sKemins@longbeachny.gov	516 431-1005
Roman Rakoczy	USACE	Sr. Planner	roman.g.rakoczy@usace.army.mil	518-698-4330
Lauren Klonsky	CDM SMITH	ENGINEER	klonskyls@cdmsmith.com	(617) 452-6301
GINGER CROOM	CDM SMITH	CLIENT SERVICE MANAGER/ P.O.C	croomgl@cdmsmith.com	(617) 999-9631

APPENDIX C

STAKEHOLDER FEEDBACK

City of Long Beach, NY Feedback

The City of Long Beach Provided the Following Reports:

1. Coastal Protection Study City of Long Beach, NY Bayside Flood Protection Plan [2009]
2. Hurricane Sandy Storm Damage Report City of Long Beach, NY [2012]
3. City of Long Beach – Superstorm Sandy Damage Assessment Reports [2013]
4. Conditions Evaluation of Bulkheads & Outfall Structures in the City of Long Beach, New York [2013]

Town of Hempstead, NY Feedback

CEDARHURST, NY

-----Original Message-----

From: Rakoczy, Roman G NAN02

Sent: Thursday, September 05, 2013 8:04 PM

To: Croom, Ginger; Cresitello, Donald E NAN02

Subject: Nassau Couty Back Bay Recon (UNCLASSIFIED)

Classification: UNCLASSIFIED

Caveats: NONE

I met with Joe Battaglia and Frank Praise from the Village of Cedarhurst today regarding the Recon. They have two areas of concern where tidal influence during major storm events causes inland flooding. They are wondering if flood gates constructed at two bridge sites could be a solution to their problem. They will be forwarding maps and more detail information. They are also pursuing hazard grant mitigation money to address the problem. They also do not know if they have problems with several storm drain discharge lines.

Tomorrow I will be meeting with Peter Vita from Nassau County OEM to explain what the Recon is intended to accomplish.

Thanks

Roman

Classification: UNCLASSIFIED

Caveats: NONE

BACK BAY RECON

LOCATIONS	PROJECTS	OWNER	COST
beaches			
	view vs use - man made vs natural		
	dunes - view vs utility - continuity		
	breach contingency		
	long term jurisdiction		
	standard engineering design		
	elevated structures		
	ada compliance		
	private vs public ownership		
reynolds channel			
	connect with intra-coastal waterway		
	establish ownership		
	sewer discharge - water quality - shellfish		
	revive CORPS recon. plan		
	as a marine conveyance		
marshes			
	rebuilding		
	dredge management		
	reestablish		
	insects - mosquito		
	bay houses		
	sample coring - historic		
bays			
	navigation		
	habitat		
	dna analysis - sources of pollution		
	hydrodynamics		
	aquatic vegetation		
marine terminals/ports			
	transport debris and waste - avoid roads		
	heavy materials storm response		
	scaled to area		
inlets			
	federal inerest in stability - revetments, navigation		
	federal commitment dredging		
	sand rights		
	sand bypass - reestablish littoral sand down		
gauging			
	tributaries - flow and water quality	county	
	tide stages -	usgs, town	
	wave climate - off shore	corps	
	water quality - bay and ocean		
	long term data collection		

Stakeholder Feedback
Town of Hempstead, NY

recreation			
	navigation		
	water access		
	hand powered craft		
habitat			
	wildlife		
	invasive species - identification and elimination		
	beach		
	shellfish		
	set asides on public lands		
	survey		
big projects			
	sand rights		
	home rule		
	climate change - verification and adaptation		
	public transportation		
	historic perspective and documentation		
	bay as brown fields - bay bottom		
	dredge material management		
	storm gates - study		
	economic analysis of fight or flight - various views		
storm debris			
	local wet debris removal sites		
	upland integration with water sites		
	local funding		
infrastructure			
	natural gas		
	sewer - storm harden - effluent relocation	nassau county	
	centeral electrical	lipa	
	storm water system renovation - valves	town	
	bulkheads - revetments		
	sanitation - individual septic system		
quality or life			
	over crowding		
	noise		
outreach + education			
	funds		
storm damage protection			

Stakeholder Feedback
Town of Hempstead, NY

alt energy			
	microgrid		
	virtual metering		
	community wide networks		
	storm usages - encourage granularity		
	geothermal		
	tidal currents		
	hydrogen generation		
	wind		
	solar		
storm hardening			
	homes		
	trees		
	electric - underground, transformers		
	sewer systems		
government			
	redundancy		
	permit regulations - uniformity based on science		
	zoning		
	planning		
	remove politics from storm response		
	fema process		
	available funding sources		
	training centers		
adjacent land issues			
	bulkheads		
	roads		
	emergency response and access		
	permits to close storm water access	state	
storm response			
	fed		
	state		
	fire service		
	municipal		
	standard paperwork for recovery		
	fema teams		
building			
transportation			
	navigation		
emergency services			
	coordination		
commercial use			
	seafood		
	marinas		
	rescue and salvage services		
	education		

	food services		
	community development		
	recreational support		

Nassau County, NY Feedback

Nassau County provided preliminary damage assessments to facilities within the Nassau County Back-bays focus area.

Nassau County Office of Emergency Management

From: "Vita, Peter" <pvita@nassaucountyny.gov>
Date: September 6, 2013 10:54:56 AM EDT
To: "'croomgl@cdmsmith.com'" <croomgl@cdmsmith.com>
Subject: FW: USACE Study information

From: Bruckbauer, John
Sent: Friday, September 06, 2013 10:21 AM
To: Vita, Peter; Craft, Craig
Subject: USACE Study information

1. **Problem identification for your area:**

a. Did your area experience tidal or tidally influenced storm surge?

Yes

b. Be specific on particular areas and water bodies within your jurisdiction that experienced storm surge.

South of Merrick Road from border to border

c. What factors, if any, exacerbated damages from storm surge?

Landfall of storm was during high tide cycle and full moon cycle.

2. **Description of damages for your area:**

a. Provide a narrative including the types of infrastructure damaged or temporarily out of use, structure (building) damages, personal injuries/fatalities.

Two of the County's waste water treatment plants were compromised. Bay park sewage plant was about 12 feet under water and completely shut down. Long Beach Bridge and Bayville Bridge both lost power due to saltwater inundation. 1st(Baldwin), 4th, (Hewlett), and the 7th (Seaford) police precincts were evacuated and shut down due to the storm surge, to include the police Marine

Bureau in East Rockaway. A couple of county parks in Wantagh Park, Cedar Creek Park (Seaford), Bay Park (East Rockaway), Shell Creek (Island Park), Nickerson Beach also had some damage due to storm surge.

b. Provide a map depicting the special extent of damages.

All south shore communities south of Merrick Rd within county lines.

2. **Prior related studies or projects)local, state, federal) in the damaged area.**

Transportation/Evacuation Hurricane study was conducted in 2009 for Nassau County

3. **List measures that your jurisdiction has considered to address the problem.**

Discussion in ongoing between FEMA and engineers to finalize a plan for the sewage plants.

ATTACHMENT B

USACE State Problems, Needs, and Opportunities Correspondence with Individual State Responses

ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

APR 2 9 2014

Lieutenant General Thomas P. Bostick
Commander
United States Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

Dear Lieutenant General Bostick:

We are writing to elicit your support for further study, by the U.S. Army Corps of Engineers, of the focus area identified in the North Atlantic Coast Comprehensive Study (NACCS) known as "New York – New Jersey Harbor and Tributaries." Our request also responds to the April 16, 2014 letter from Frank Santomauro, Chief of the Planning Division for the New York District of the Army Corps of Engineers. Mr. Santomauro asked for New York's input related to problems, needs, and opportunities related to future planning initiatives." Without a doubt, the New York – New Jersey Harbor focus area is New York State's highest priority for Army Corps future planning efforts.

In May 2013, Commissioner Martens sent the enclosed letter to Joseph Vietri, Director of the U.S. Army Corps of Engineers' National Planning Center Coastal and Storm Risk Management, to advocate for an Army Corps feasibility study of the Harbor. This letter reiterates New York's request. The need for a Harbor study was similarly emphasized by New York State's 2100 Commission report, which recognized the importance of infrastructure improvements and resiliency for New York City, with particular emphasis on the economically important New York Harbor region. Due to the importance of the Harbor, Congresswoman Nydia Velazquez from New York City offered an amendment to H.R. 3080, the 2013 Water Resources Development Act bill, which recognized this critical New York State – New York City goal.

Subsequently, on January 27, 2014, representatives of the New York State Department of Environmental Conservation and the New York City Office of Long Term Planning and Sustainability met with members of the U.S. Army Corps of Engineers North Atlantic Division and New York District to discuss the New York – New Jersey Harbor and Tributaries component. This meeting and subsequent discussions have affirmed the necessity for the Harbor study and potential pathways to make this occur.

New York State believes that to be successful the NACCS must set the stage for one or more feasibility studies focused directly on the New York – New Jersey Harbor and Tributaries component. We recognize that this effort will be a costly one, possibly costing up to $25 million. It is our hope that any study can be accomplished at full federal expense.

An effective feasibility study should include the following elements:

- Consideration of a wide range of engineering alternatives to address the full range of human, private property, and public infrastructure risks.
- A description of the level of risk that would justify expedited project implementation.
- A recognition that the New York and New Jersey Harbor is a shared waterway.
- A recognition that bi-state cooperation is desirable.
- An outline of the necessary and sufficient contents of any feasibility study stemming from the New York – New Jersey Harbor and Tributaries component.

Therefore, we respectfully request that our respective staffs meet at the earliest convenient date so that we can have the benefit of the Army Corps' views on how to structure the New York – New Jersey Harbor and Tributaries component to ensure full success of the NACCS. It is our hope that New Jersey and New York City will support us in this hallmark effort.

Sincerely,

Joseph J. Martens
Commissioner

James Rubin
Director
Governor's Office of Storm Recovery

Enclosure

c: Governor Chris Christie
Mayor William de Blasio
Senator Charles E. Schumer
Senator Kirsten E Gillibrand
Congressman Gregory W. Meeks
Congresswoman Grace Meng
Congresswoman Nydia M. Velazquez
Congressman Hakeem Jeffries
Congresswoman Yvette D. Clarke
Congressman Jerrold Nadler
Congressman Michael Grimm
Congresswoman Carolyn Maloney
Congressman Charles B. Rangel
Congressman Joseph Crowley
Congressman Jose E. Serrano
Colonel Paul Owen
Mr. Frank Santomauro

ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

MAY - 9 2013

Mr. Joseph Vietri
National Planning Center Coastal and Storm Risk Management Director
United States Army Corps of Engineers, North Atlantic Division
Fort Hamilton Military Community
301 General Lee Avenue
Brooklyn, New York 11252-6700

Dear Mr. Vietri:

It was a pleasure meeting with you and your team recently to discuss the United States Army Corps of Engineers' North Atlantic Coast Comprehensive Study (Study). Thank you for providing the draft Project Management Plan and Scope of Work (Scope of Work) for comment. The Department of Environmental Conservation (DEC) generally supports the Scope of Work subject to the comments below. However, I respectfully request that the United States Army Corps of Engineers (Army Corps) dedicate half of the appropriation for the comprehensive study to New York/New Jersey Harbor to evaluate storm resiliency and adaptation.

As you know, authorized Army Corps projects or study areas already extend over much of the ocean coast of New York from Staten Island to Montauk Point, including Jamaica Bay. It is my understanding that similar Army Corps projects or study areas have been authorized for extensive areas of coastal New Jersey, as well as much of the Atlantic Ocean coast affected by Hurricane Sandy. Funding from the Hurricane Sandy relief appropriations to the Army Corps, separate and apart from the $20 million study, should be available to fund the evaluation of these numerous existing authorized projects or study areas so that specific resiliency measures can be developed, designed and implemented at those locations.

Notably missing from the authorized Army Corps projects or study areas is the highly vulnerable New York/New Jersey Harbor – its population centers, its ports, its businesses, and its natural spaces. This situation places the New York/New Jersey Harbor region at a significant disadvantage relative to most other North Atlantic coastal areas and population centers. Given this situation, the Army Corps would be more than justified to use $10 million of the appropriation to address this massive vulnerability.

Governor Cuomo has identified the critical need for a comprehensive resiliency strategy, including naturally protective infrastructure and structural measures, for New York Harbor. New York envisions that the Army Corps would undertake a heightened engineering and geo-technical evaluation of hazards and storm resiliency measures within the harbor and along its coastline. Proposed locations, feasibility assessments and detailed concepts for natural and structural breakwaters (including wetland complexes, living shorelines, shellfish reefs, dunes, ecologically friendly in-harbor breakwaters, barrier islands and protective seawalls) could be developed under this proposal to set the stage for protective action. Such a study would complement major on-going natural infrastructure efforts on upland areas of New York City, as well as contemplated structural elevations that increase flood resiliency.

A focused study makes particular sense given the immense risk to the New York/New Jersey Harbor demonstrated by Sandy and the fact that that the Army Corps already has extensive background information on which to base the requested Study. This includes information from the Army Corps "Harbor Deepening Project" and its "Comprehensive (ecological) Restoration Plan for New York Harbor." We can build on this existing information to complete this critical portion of the study within the two-year time period provided in the legislation. New York stands ready to assist in any way it can.

I also note that $50 million was appropriated to the National Oceanic and Atmospheric Administration "for mapping, charting, geodesy, services and marine debris surveys for coastal states impacted by Hurricane Sandy." An additional $25 million was appropriated to NOAA "to improve weather forecasting and hurricane intensity forecasting capabilities. . . ." Many of the very useful items presented in the draft scope of work for the comprehensive study might well be funded with these NOAA monies as part of the federal agency collaboration.

I have a few additional recommendations for your consideration:

1. The document provides a map of the study area which highlights in different colors the areas of the Study. The language in the document indicates that tidally influenced areas affected by Sandy will be the focus of the Study, but the map does not highlight the Hudson River up to the Troy dam which is tidally influenced and had areas affected by Sandy. I recommend you amend the map to include this portion of the Hudson River.

2. The Goals and Objectives Section of the Scope of Work includes a "Problem" section which states, "Occurrences of flooding, erosion, and other damage processes as a result of coastal storms put significant populations, property, and economic infrastructure in peril." I recommend that you add the following phrase to the end of this statement: "due, in part, to development in coastal flood plains."

3. The Goals and Objectives Section of the Scope of Work includes an "Opportunity" section which states, "[t]he risk of flooding and other impacts from coastal storms may be reduced through implementation of management measures." I recommend adding the following phrase at the end of this statement "which addresses both the protection of current risk areas, along with the development of future polices which limit further development in high risk areas."

4. The section addressing "USACE Meeting" sets up a series of monthly progress meetings. I recommend that the Army Corps allow for a representative from each state to be included in these progress meetings/calls in order to provide input and information. This will facilitate timely completion of the Study.

Separate from these brief recommendations on the Scope of Work, New York State is developing specific resiliency strategies for the regions impacted by Sandy and other severe storms. We will share these strategies with you shortly.

During our meeting on April 23, 2013, the Army Corps requested a contact person be identified for the state. Ms. Eileen Murphy will be the state's contact and can be reached at (518) 402-2797 or at emmurphy@gw.dec.state.ny.us if you have any questions or need more information.

Sincerely,

Joseph J. Martens

Joseph J. Martens

cc: Colonel Paul Owen
Roselle H. Henn
David Robbins
Karla Roberts