

**Atlantic Coast of Long Island
Jones Inlet to East Rockaway Inlet
Long Beach Island, New York
Coastal Storm Risk Management Project**

**HURRICANE SANDY LIMITED REEVALUATION REPORT
VOLUME 1. MAIN REPORT AND ENVIRONMENTAL ASSESSMENT**



**U.S. Army Corps of Engineers
New York District**



**New York State
Department of Environmental Conservation**

August 2015

Executive Summary

In response to extensive storm damages resulting from Hurricane Sandy and an increased vulnerability to future events, Congress passed the Disaster Relief Appropriations Act of 2013 (Public Law [P.L.] 113-2). As a result of P.L. 1113-2, the U.S. Army Corps of Engineers (USACE), New York District (District), in partnership with the non-Federal sponsor, New York State Department of Environmental Conservation (NYSDEC) completed this Hurricane Sandy Limited Reevaluation Report (HSLRR) and plans to construct the Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York (Long Beach) Coastal Storm Risk Management Project. The Long Beach project was identified in both the First and Second Interim Report to Congress as an authorized but unconstructed project (ABU) in ongoing construction with initial construction cost sharing at 100% Federal expense.

An approved Hurricane Sandy Limited Reevaluation Report (HSLRR) is required to proceed with construction and to be completed with funds appropriated through P.L. 113-2. This HSLRR will serve as the decision document to use funds provided by P.L. 113-2 and for execution of a Project Partnership Agreement (PPA) with the non-Federal sponsor, the NYSDEC, in order to complete initial project construction and continue renourishments for the 50-year period of analysis for the Long Beach Project.

The recommended plan consists of constructing a berm from Point Lookout west to the western boundary of the City of Long Beach where the plan tapers into the existing shoreline in East Atlantic Beach (approximately 35,000 lf); it is noted that a 4,950 ft long area (Nickerson Beach) about a mile west of Point Lookout has ephemeral pool areas. Fronting the dune, a berm width of 110 ft at elevation +9 ft NAVD88 with a shore slope of 1V: 20H will extend along the easternmost 5,000 lf of the project area (Point Lookout), and a 1V:30H shore slope for the remaining 30,250 lf (Nickerson Beach, Lido Beach and Long Beach) of the project area. It is noted that the 4,950 lf, the Nickerson Beach reach situated between these two areas, has existing shore slopes of between 1V:20H at the eastern segment of this reach to 1V:30H at the western segment. This area is designated as a bird nesting and foraging area. The dune will have a crest elevation of +14 ft NAVD88 for a crest width of 25 ft with a 1V:5H side slopes on the landward and seaward sides of the dune (1V:3H side slope on the landward side in front of the boardwalk in the City of Long Beach). The dune extends approximately 35,000 lf from Point Lookout to the western boundary of the City of Long Beach. Fifteen existing groins in the City of Long Beach and 2 existing groins in the Town of Hempstead (Point Lookout) will be rehabilitated. The terminal groin in the Town of Hempstead (Point Lookout) will also be rehabilitated and extended (100 ft). In addition, the project includes four new groins fronting the Town Park in the Town of Hempstead (construction of 2 additional groins deferred based on monitoring and determination of future needs). A total sand fill quantity of 4,720,000 cubic yards for the initial beach fill placement, including the following: +1.0 ft tolerance, overfill factor of 2.5% and advanced nourishment width of 50 ft. The dune construction includes the planting of 34 acres of dune grass and the installation of 75,000 lf of sand fence for dune sand entrapment as well as the construction of dune crossing structures.

A total of 38 pedestrian and vehicular accessways/walkovers will be provided in the City of Long Beach in approximately the same locations as in the pre-project condition, a total of 21 accessways/walkovers will be provided in the Town of Hempstead and 6 accessways/walkovers will be provided in Nassau County. One relocation (modifications to the existing comfort station underneath the boardwalk at National Avenue) will be provided in the City of Long Beach. Renourishment of approximately 1,770,000 cy of beach fill from the offshore borrow area will occur every five years for the 50-year period of analysis. Note that

Jones Inlet may also be used as a sand source depending on the Inlet's maintenance dredging schedule.

The initial project first cost, which includes real estate administration costs and pertinent contingency, engineering and design and construction management costs, is \$209,267,000. Pursuant to P.L. 113-2, the initial project first cost of the project will be implemented at 100% Federal expense. The cost for each renourishment cycle for Long Beach is \$34,542,000 which will be cost-shared at 65% Federal and 35% non-Federal.

The recommended plan has total average annual costs of \$16,655,000, and total average annual benefits of \$30,208,000. The project is economically justified, with a Benefit Cost Ratio (BCR) of 1.8.

Escalating to the midpoint of construction, the fully funded initial project first cost is \$230,533,000 and the fully funded renourishment cost (total continuing construction) is \$795,835,000. The fully funded renourishment cost is based upon a renourishment quantity of 1,770,000 CY per renourishment cycle every five years for the 50-year period of analysis. These two fully funded costs are required to support the PPA.

The Environmental Assessment updates the March 1998 Environmental Impact Statement and February 1999 Record of Decision and addresses any changes to environmental conditions and minor project modifications proposed within this HSLRR. It is recognized that the project will result in minor short-term negative impacts to water quality, terrestrial and aquatic habitats. The use of pre-construction surveys for species of special concern, avoidance of key breeding/nesting and spawning periods, Best Management Practices (BMP), post-construction surveys to monitor affects of groins on coastal processes and species of concern, will minimize any potential impacts. The two historic wrecks identified within the Project area will be avoided during the rehabilitation of the groins; therefore there will be no adverse effects to these historic properties. Due to the anticipated construction duration, it has been determined that the proposed Project would exceed the Federal de minimis thresholds of 100 tons per year for NO_x air emissions.

Based on a thorough evaluation of potential impacts performed for the prior FEIS and this EA, it has been determined that there will be no significant adverse impacts due to implementation of the proposed updated Project. To ensure compliance with the Clean Air Act General Conformity Rule, a Conformity Determination and a Final Statement of Conformity is appended to this document identifying the mitigation options that the District will implement.

PERTINENT DATA

DESCRIPTION: The authorized project, including changes developed for this Hurricane Sandy Limited Reevaluation Report (HSLRR), provides a beach berm, dune and groin system to reduce the potential for storm damage along approximately 35,000 linear feet (lf) of shoreline along the barrier island of Long Beach, New York.

LOCATION: Town of Hempstead, the City of Long Beach, and Nassau County, NY

BEACH FILL

Volume of Initial Fill	4,720,000 cubic yards (cy)
Volume of Renourishment Fill	1,770,000 cy
Interval of Renourishment Fill	every 5 years for 50 years, subject to USACE monitoring

Length of Fill *	35,000 lf
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* In the Nickerson Beach area in Nassau County, dune (no berm) will be placed along approximately 5,000 lf of shoreline. The existing berm will remain undisturbed to allow for bird nesting and foraging area for piping plovers and least terns. Deferred berm construction.

Width of Beach Berm (Point Lookout)	110 feet (ft) at +9 ft NAVD88
Width of Beach Berm (Nickerson Beach, Town of Hempstead)	existing at +9 ft NAVD88

Width of Beach Berm (Lido Beach and Long Beach)*	40 ft at +9 ft NAVD88 20 ft at 1V:10H and 130 ft at +7ft NAVD88
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* Stepped beach berm extending 40 ft from the seaward toe of the recommended dune at an elevation of +9 ft NAVD88, a 1V:10H slope downward to +7 ft NAVD88, a 130 ft flat berm at +7 ft NAVD88, then 1V:30H slope to intersection with existing bathymetry

Dune Crest	25 ft at +14 ft NAVD88
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SLOPES

Dune (Seaward)	1V:5H
Dune (Landward, except fronting boardwalk in Long Beach)	1V:5H
Dune (Landward, fronting the boardwalk in Long Beach)	1V:3H

Beach Berm to existing bathymetry (Point Lookout)	1V:20H
Beach Berm to existing bathymetry (Lido Beach and Long Beach) *	1V:30H

* Stepped beach berm extending 40 ft from the seaward toe of the recommended dune at an elevation of +9 ft NAVD88, a 1V:10H slope downward to +7 ft NAVD88, a 130 ft flat berm at +7 ft NAVD88, then 1V:30H slope to intersection with existing bathymetry

GROINS

Rehabilitation of 15 existing groins in the City of Long Beach *

Rehabilitation of 2 existing groins in the Town of Hempstead (Point Lookout) *

Rehabilitation and extension (100 ft) of the terminal groin in the Town of Hempstead (Point Lookout) *

* Retention of 26 existing groins as project elements, inclusion in maintenance estimates

Four new groins fronting the Town Park in the Town of Hempstead (construction of 2 additional groins deferred based on monitoring and determination of future needs)

DUNE APPURTANCES

City of Long Beach

Gravel surface vehicle accessways

* one located east of the boardwalk and one located west of the boardwalk

Timber dune walkovers – ADA	21
Timber dune walkovers from boardwalk to berm – ADA	13
Timber vehicle and pedestrian accessways from boardwalk to berm	2
* located at Riverside Boulevard and Franklin Boulevard	

Town of Hempstead	
Gravel surface vehicle and pedestrian accessways	5
Timber dune walkovers – ADA	7
Timber dune walkovers – non ADA	9

Nassau County	
Gravel surface vehicle and pedestrian accessways	2
Timber dune walkovers – ADA	1
Timber dune walkovers – non ADA	3

ENVIRONMENTAL CONSIDERATIONS

HSLRR Plan for Long Beach will comply with Section 106 of the National Historic Preservation Act, as amended, the Clean Air Act General Conformity (GC) requirement (40CFR§90.153) through the options presented in Section VI. C Air Quality Compliance was coordinated with the New York State Department of Environmental Conservation (NYSDEC) and US Environmental Protection Agency (EPA), Region II.

PROJECT COSTS (October 2014 price levels)

Initial Project First Cost	\$ 209,267,000
Total Real Estate Cost	\$150,000
Renourishment Cost at 5-year intervals	\$34,542,000

ECONOMICS Analysis (October 2014 price levels)

Annual Project Cost (Discounted at 3.375% over a 50-year period)	\$16,655,000
Average Annual Benefits (Discounted at 3.375% over a 50-year period)	\$30,208,000
Average Annual Net Benefits	\$13,553,000
Benefit Cost Ratio	1.8

COST APPORTIONMENT (October 2014 price levels)

Fully Funded Initial Project First Cost for PPA	
Federal (100%)	\$ 230,533,000
Non-Federal (0%)	\$ 0
Total	\$ 230,533,000

Fully Funded Renourishment Cost for PPA	
Federal (65%)	\$ 517,293,000
Non-Federal (35%)	\$ 278,542,000
Total	\$ 795,835,000

TABLE OF CONTENTS

Executive Summary	i
PERTINENT DATA	iii
I. Introduction	1
A. Purpose of the Hurricane Sandy Limited Re-Evaluation Report	1
B. Report Organization	2
C. History of the Project	2
D. Description of Authorized Project	5
E. Authorization	6
F. Changes in Project Purpose	7
II. Existing Conditions	8
A. Physical Conditions	8
B. Economic Conditions	14
C. Environmental Resources	15
D. Cultural Resources	19
III. Problem Identification	22
A. Description of the Problem	22
IV. Without Project Future Conditions	23
V. Plan Formulation	25
A. Planning Needs, Objectives, and Constraints	25
B. Design Changes	28
VI. With Project Conditions	35
A. Physical Conditions	35
B. Environmental Conditions	35
C. Air Quality Compliance	40
D. Cultural Resource Impacts	41
E. Economics	41
F. Cost Estimate	47
G. Benefit Cost Ratio	49
VII. Selected Plan	53
A. General	53
B. Monitoring	55
C. Public Access	56
D. Real Estate Requirements	57
E. Value Engineering (VE) Study	59
VIII. Public Law 113-2 Considerations	60
A. Project Partnership Agreement Costs and Cost-Sharing	60
B. Section 902 of WRDA 1986, as amended	61
C. Risks, Economics and Environmental Compliance	62
D. Resiliency, Sustainability and Consistency with the Comprehensive Study	62
IX. Project Implementation	65
A. Construction Schedule	65
B. Local Cooperation	65
X. Conclusions	70
XI. Recommendation	71
XII. References	72

FIGURES (located at the back of the HSLRR)

- Figure 1: Project Location
- Figure 2 - 12: Plans Sheets for 1995 Authorized
- Figure 13: Weldment Area
- Figure 14- 27: Plan Sheets for 2015 HSLRR Recommended Plan
- Figure 28: Typical Dune Walkover
- Figure 29: Typical Vehicle Access Ramp
- Figure 30: Bird Nesting and Foraging Area
- Figure 31: Construction Schedule

TABLES

Table 1: Annual Percentage of Wind Direction by Speed	8
Table 2: Ocean and Bay Still Water Level Stage-Frequency Elevations in ft NAVD88	9
Table 3: Community Populations	42
Table 4: Benefits of 1995 Authorized Plan	43
Table 5: Comparison of Average Beach Attendance	45
Table 6: Summary of Factors Used to Update Benefits	46
Table 7: Summary of Updated Benefits	46
Table 8: First Cost	50
Table 9: Annual Costs	52
Table 10: Comparison of 1995 Authorized Plan to 2015 HSLRR Plan	53
Table 11: Summary of Anticipated Project Real Estate Costs	59
Table 12: Cost Apportionment	61

VOLUME 2. APPENDICES

- Appendix A: Pertinent Correspondence
- Appendix B: Engineering and Design
- Appendix C: Cost Engineering
- Appendix D: Benefits Update
- Appendix E: Real Estate Plan
- Appendix F: Public Access Plan

I. Introduction

1. The barrier island of Long Beach, New York is located on the Atlantic Coast of Long Island, New York, between Jones Inlet and East Rockaway Inlet (Figure 1). The area lies within Nassau County, New York. The Long Beach Island, New York Final Feasibility Report with Final Environmental Impact Statement for Storm Damage Reduction was completed in February 1995, with a Record of Decision (ROD) issued in December 1998. The recommended project was authorized for construction in the Water Resources Development Act (WRDA) of 1996.

2. The Long Beach Project is a coastal storm risk management project (previously referred to as a shore protection or storm damage reduction project), which has been designed to provide risk reduction against wave attack, erosion and inundation for homes and businesses along 6.4 miles of oceanfront, including the Town of Hempstead (Point Lookout and Lido Beach), Nassau County (Nickerson Beach), and the City of Long Beach. The project was authorized for construction in the Water Resources Development Act of 1996, the authorized plan contains dune, berm, groins and groin rehabilitation to provide coastal storm risk management for a 100-year storm event, or a storm that has a one percent chance of being equaled or exceeded in any one year. This area has been subject to major flooding during storms, causing damage to structures along the barrier island. Over the years, continued erosion, particularly at the eastern end of the island, has resulted in a reduction in the height and width of the beachfront, which has increased the potential for storm damage. The western end beachfront, primarily the City of Long Beach are very low, making it highly susceptible to storm damage caused by inundation.

3. On October 29, 2012, Hurricane Sandy made landfall approximately five miles north of Atlantic City, NJ, after colliding with a blast of arctic air from the north, creating conditions for an extraordinary historic storm along the East Coast with the worst coastal impacts centered on the northern New Jersey, New York City, and the Long Island coastline. The highest water level ever recorded at the Battery, on the southern tip of nearby Manhattan measured 11.28 ft NAVD88 exceeding predicted tidal elevations caused by a storm surge of 9.41 feet (NOAA 2013). Coastal erosion and damages to Long Beach Island as a result of Hurricane Sandy were severe and substantial. With record-setting storm surge and wave heights, the island was inundated and hundreds of structures were either damaged or destroyed.

4. As a consequence of the historically severe coastal erosion during Hurricane Sandy, the dune and berm system which was already compromised became more depleted and particularly susceptible to storm events. This increased the potential for devastating storm damage to occur in the communities of Long Beach Island. In response to the extensive storm damage and increased vulnerability to future events, congress passed the Disaster Relief Appropriations Act of 2013 (P.L. 113-2). The Long Beach project was identified in both the first and second interim reports to congress as an authorized but unconstructed project (ABU) in ongoing construction with initial construction cost sharing at 100% federal expense.

A. Purpose of the Hurricane Sandy Limited Re-Evaluation Report

5. This Hurricane Sandy Limited Reevaluation Report (HSLRR) serves as a decision document to support the construction of the Long Beach Island, New York Coastal Storm Risk Management Project. It addresses relevant changes to the existing conditions that have occurred since the Feasibility Report was completed in February 1995, including changes due to Hurricane Sandy. This HSLRR was prepared to expedite implementation of the authorized but unconstructed project in response to Public Law (P.L.) 113-2 of January 29, 2013, "Disaster

Relief Appropriations Act, 2013". This HSLRR documents design refinements that improve project cost effectiveness and its acceptability to local interests and provides updated costs that serve as the basis for a Project Partnership Agreement (PPA) between the Federal Government and the non-Federal Sponsor, New York State Department of Environmental Conservation (NYSDEC). This HSLRR, which includes an Environmental Assessment (EA), also provides an updated economic analysis and demonstrates that the plan is economically justified, environmentally sound and technically acceptable, in accordance with policy. Finally, this HSLRR is prepared to address the requirements of P.L. 113-2, including cost sharing, sustainability, resiliency and consistency with the North Atlantic Coast Comprehensive Study (NACCS).

6. This report incorporates minor design refinements from the 1995 Authorized Plan. This report does not reanalyze the alternatives, but simply updates the recommended plan, and incorporates recent changes.

B. Report Organization

This report is organized as follows:

- a) First, it presents the history of the project and the existing conditions;
- b) Second, it summarizes changes that have occurred since approval of the Feasibility Report and the effects of these changes on the HSLRR Recommended Plan;
- c) Third, it confirms that the HSLRR Recommended Plan, which has minimal changes from the 1995 Authorized Plan, remains economically justified and environmentally acceptable and addresses sustainability and resiliency.
- d) Last, it establishes the costs, cost sharing and items of local cooperation necessary for the execution of the PPA.

C. History of the Project

7. In 1965, the United States Army Corps of Engineers (USACE) prepared a draft survey report, addressing coastal storm risk management for Long Beach, New York. This survey report, entitled Beach Erosion Control and Interim Hurricane Study for the Atlantic Coast of Long Island, New York, Jones Inlet to East Rockaway Inlet, was prepared to determine the best method of restoring adequate protective beach fronts and recreational beaches, to provide continued stability of the beach, and to develop an adequate plan of risk management against storm tidal inundation of the barrier island.

8. The 1965 report recommended a multiple purpose plan of improvement for coastal storm risk management of the study area. This plan was designed to provide risk management against tidal inundation caused by the occurrence of a hurricane surge level of 12.3 ft above sea level. This plan included hurricane barriers, closure levees, an oceanfront dune with beach berm, groin reconstruction, construction of a terminal groin at Jones Inlet and periodic beach nourishment. This plan was economically justified.

9. Local interests voiced objections to the 1965 recommended plan. The primary objection was that the proposed dune along the oceanfront was not compatible with the type of development on the barrier island of Long Beach. Even after various modifications, the plan was still not acceptable to local interests. USACE sent a letter, dated July 21, 1971, to the NYSDEC (the local cooperating agency), indicating that the study was to be terminated and a negative report issued. The local interests concurred with the termination of the study.

10. Following Hurricane Gloria in 1985 and in response to the authorizing resolution of 1986, Federal funds were allocated in 1988 to conduct a reconnaissance study of the area. The reconnaissance report entitled Atlantic Coast, of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York: Reconnaissance Report, dated March 1989, was approved by the Office of the Chief of Engineers (OCE) in July 1989. State and local government officials concurred in the decision to proceed, and a Cost Sharing Agreement was signed in September 1990.

11. Numerous reports and other documents have been prepared regarding the navigation oriented studies conducted in the Jones Inlet area. The most recent of these reports entitled Section 933 Evaluation Report, Jones Inlet, New York, dated March 1993, connected the dredging of material from Jones Inlet with the coastal storm risk management potential for the barrier island, specifically the eastern end of the island at Point Lookout. This evaluation report determined that it is justified to place material dredged from Jones Inlet onto the adjacent beaches based on the benefits derived from storm risk management. This report was approved by the Headquarters of the Army Corps of Engineers (HQUSACE) in August 1993. Based upon the findings of the evaluation report and the authorizing language in Section 933 of the Water Resources Development Act of 1986, the incremental cost of placing the dredged material from Jones Inlet onto the adjacent beaches in the Town of Hempstead was cost-shared 50% Federal and 50% non-Federal, in lieu of offshore (or less costly) disposal. In 1994, 1996, 2008, Jones Inlet was dredged and the material was placed onto the adjacent beaches in accordance with the basic design presented in the Section 933 Evaluation Report. In 2014, Jones Inlet was dredged and the material was placed onto the adjacent beaches in accordance with the basic design presented in the Section 933 Evaluation Report and this HSLRR. The work in 2014, was accomplished as a post-Hurricane Sandy Flood Control and Coastal Emergencies (FCCE) action at 100% Federal cost.

12. In 1995, the feasibility report titled; Long Beach Island, New York Final Feasibility Report with Final Environmental Impact Statement for Storm Damage Reduction was completed. The description of the 1995 Authorized Plan is provided in Section D, Description of Authorized Project.

13. Following approval of the 1995 Feasibility Report, the 1996 WRDA authorized the project for construction, stating:

The project for storm damage reduction, Atlantic Coast of Long Island from Jones Inlet to East Rockaway Inlet, Long Beach Island, New York: Report of the Chief of Engineers, dated April 5, 1996, a total cost of \$72,091,000, with an estimated Federal cost of \$46,859,000 and an estimated non-Federal cost of \$25,232,000.

14. Due to a change in Federal policy regarding the budgeting of coastal storm risk management projects that include a beach nourishment component, the Pre-Construction Engineering and Design (PED) Phases were not initiated immediately subsequent to the authorization of the project recommended by the 1995 Feasibility Report.

15. Following authorization of the project recommended by the 1995 Feasibility Report, East Atlantic Beach chose not to participate in the project. Along with the Village of Atlantic Beach, which opted out of the project during the Feasibility phase, the East Atlantic Beach community (an unincorporated village in the Town of Hempstead) opted out of the project because they were unwilling to provide the level of public access required by the State of New York. The removal of East Atlantic Beach represented a small change (based upon the small percentage

of total project benefits and costs, approximately 10% of the 1995 Authorized Plan) to the overall project as recommended by the 1995 Feasibility Report. It was determined the elimination of the approximately 6,000 linear feet (lf) dune and beach fill from East Atlantic Beach would not significantly affect the design for coastal storm risk management for the rest of the project's coastal storm risk management area.

16. The Final Environmental Impact Statement (FEIS) was completed in March 1998. Following completion of the FEIS, the Record of Decision (ROD) was received in December 1998 and filed in the *Federal Register* in January 1999.

17. As part of the PED phase for the authorized project for Long Beach, in February 1999, a technical analysis entitled Terminal Groin Rehabilitation and Extension at Jones Inlet, Long Beach Island was completed as an internal document which developed a design modification to include the rehabilitation and extension of the terminal groin at Point Lookout to reduce the loss of sand from the beach and shoaling in the inlet, associated with construction of the project.

18. As part of the PED effort for Long Beach, in March 2000, a report entitled, Technical Reanalysis of the Shoreline Stabilization Measures for the Eastern Portion of the Long Beach Island, New York Project was completed. This internal report evaluated and developed a revised plan for groin construction along the Town of Hempstead shoreline reaches, based upon more extensive modeling. The proposed groin field was found to be necessary to reduce sand losses to the berm and dune system, and recommended design refinements to improve functioning of the groin field.

19. State and local officials were concerned that the proposed groin field would, because of its ability to retain sand, reduce transport of sand downdrift of the groin field, thus inducing greater erosion (more erosion than in the without project condition) immediately west of the last groin. The New York District, the U.S. Army Engineer Research and Development Center Coastal and Hydraulics Laboratory (ERDC-CHL) and New York State conducted a more detailed analysis of the groin field, as part of the Technical Reanalysis, that addressed the issues of local concern using the latest computer models and field measurements or surveys obtained since the Feasibility Report. This technical reanalysis recommended the redesign of the groin field. The redesign included the construction of 7 more closely spaced, and tapered groins in the same footprint of the original groins. The reanalysis, however, also acknowledged that the changed shoreline conditions would limit the number of groins that are necessary for initial implementation.

20. Significant accretion has taken place in the western portion of the eastern study area, especially at the ebb shoal attachment point (herein also called the ebb shoal "weldment"). However, to the east of the weldment, beach erosion has continued to occur with the attendant potential for flooding and other types of storm damage including endangering shorefront bath house and parking facilities. Additional discussion concerning these coastal processes can be found in the Physical Conditions section below.

21. A separate resolution to study the bay side was adopted in April 2006 stating:

Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Chief of Engineers on the Atlantic Coast of Long Island from Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, dated April 5, 1996, and other pertinent reports to determine whether any modification to the recommendations

contained therein are advisable at the present time in the interest of storm damage reduction, navigation, ecosystem restoration, and related purposes on areas of Long Beach Island, New York, affected by tidal inundation from Reynolds Channel, Hempstead Bay, and other connected waterways.

Although a study of the bay side was authorized, no funding was appropriated by Congress to allow the study to be conducted.

22. Recent storm events, such as Hurricane Irene in 2011 and Hurricane Sandy in 2012 have left the barrier island system within the study area even more vulnerable to coastal storm damages. There is an increased probability for overwash and breaching during future less severe storm events, which could cause major damage in the study area. Based upon these risks, there is an increased urgency to implement the authorized project. As a result of the devastation from Hurricane Sandy, Public Law 113-2, the "Disaster Relief Appropriations Act, 2013" provided supplemental appropriations to federal agencies for expenses related to the consequences of Hurricane Sandy. The Second Interim Report to Congress named Long Beach (see Second Interim Report Table 1) in the list of projects that have been previously authorized but unconstructed for reducing coastal storm risks in the affected area. This HSLRR and the future work being recommended for construction is being funded under PL-113-2

D. Description of Authorized Project

23. The 1995 Authorized Plan is a storm damage reduction (now called coastal storm risk management) plan which is characterized by a 110 ft wide beach berm at an elevation of +9 ft NAVD88, and a dune system with a top elevation of +14 ft NAVD88. The plan includes approximately 41,000 lf of beach fill which extends from the easternmost end of the barrier island at Point Lookout to Yates Avenue in East Atlantic Beach, where the recommended plan tapers into the existing shoreline in Atlantic Village. The 1995 plan also includes groin construction and rehabilitation of existing groins to minimize the need for future beach renourishment. The 1995 Authorized Plan is shown on Figure 2 to Figure 12. The Plan consists of the following components.

- a) Dune: Crest elevation of +14 ft NAVD88 for a crest width of 25 ft with 1V:5H side slopes on the landward and seaward sides: A 15 to 25 ft maintenance area is included landward of the dune, between the boardwalk and the dune.
- b) Berm: Extending 110 ft from the seaward toe of the dune at an elevation of +9 ft NAVD88 with a shore slope of 1V:25H for the easternmost 5,500 lf of the project then transitioning to a 1V:35H slope for the remaining shoreline.
- c) A total sand fill quantity of 8,642,000 cy including the following:
 - +1.0 ft tolerance
 - overfill factor of 2.5%
 - advanced nourishment width of 50 ft
- d) The dune construction includes planting 29 acres of dune grass and installation of 90,000 lf of sand fence for dune sand entrapment.

- e) In the City of Long Beach, 16 dune walkovers and 13 timber ramps for boardwalk access, and 12 vehicle access ramps over the dune, relocation of one lifeguard station and timber retaining walls around six at grade comfort stations.
- f) In the Town of Hempstead, 11 timber dune walkovers and 7 vehicle accessways.
- g) Six new groins west of the existing groins at the eastern end of the island, spaced approximately 1,200 ft apart across 6,000 lf of beach frontage.
- h) Rehabilitation of 16 of the existing groins, including rehabilitation of 640 ft of the existing revetment on the western side of Jones Inlet.
- i) Renourishment of approximately 2,111,000 cy of sand fill from the offshore borrow area every five years for the 50-year period of analysis. Beach fill for the proposed project is available from an offshore borrow area containing approximately 36 million cy of suitable beach fill material. The borrow area is located approximately one mile offshore (south) of the barrier island of Long Beach.
- j) To properly assess the functioning of the 1995 Authorized Plan, monitoring of the placed beach fill, borrow area, shoreline and wave and littoral environment is included in the plan. Environmental monitoring is being addressed through coordination with other interested agencies.

E. Authorization

24. The feasibility phase of studies for coastal storm damage management for the Long Beach barrier island was the second of a two-part study effort. The study was conducted in response to the authority of a resolution by the Committee on Public Works and Transportation of the U.S. House of Representatives adopted October 1, 1986, which reads:

"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, that the Board of Engineers for Rivers and Harbors is hereby requested to review the previous report on the Atlantic Coast of Long Island, New York, Jones Inlet to East Rockaway Inlet, authorized by resolution of the Committee on Public Works and Transportation, adopted March 20, 1963, and June 19, 1963, respectively, and also in response to Public Law 71, 84th Congress, First Session, approved June 15, 1955, with a view to determining the feasibility of providing storm damage protection works for Long Beach Island."

25. The construction of the Long Beach Island Coastal Storm Risk Management Project was authorized in Section 101 of the Water Resources Development Act of 1996, which reads in pertinent part:

"(21) ATLANTIC COAST OF LONG ISLAND, NEW YORK. – The project for storm damage reduction, Atlantic Coast of Long Island from Jones Inlet to East Rockaway Inlet, Long Beach Island, New York: Report of the Chief of Engineers, dated April 5, 1996, at a total cost of \$72,091,000, with an estimated Federal cost of \$46,859,000 and an estimated non-Federal cost of \$25,232,000."

26. In response to extensive storm damages and increased vulnerability to future events, Congress passed the Disaster Relief Appropriations Act of 2013 (P.L. 113-2). The Long Beach

project was identified in both the first and second interim reports to congress as an authorized but unconstructed project in ongoing construction with initial construction cost sharing at 100% federal expense.

F. Changes in Project Purpose

27. There is no change in project purpose. The 2015 HSLRR project purpose remains the same as presented in the 1995 Feasibility Report, which is to provide for coastal storm risk management along the barrier island of Long Beach. There is also no significant change in project scope; coastal storm risk management has been eliminated for East Atlantic Beach, which is about 10 percent of the authorized project benefits, however, the risk reduction remains the same for the rest of Long Beach Island. Even after Hurricane Sandy, there is no support for coastal storm risk reduction measures for East Atlantic Beach, the area west of the City of Long Beach to East Rockaway Inlet. There is no increase in the Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas (LERRD) requirements. As in the 1995 Authorized Plan, the local sponsors (The City of Long Beach, Town of Hempstead and Nassau County) will acquire the LERRDs for the non-Federal Sponsor (NYSDEC). The HSLRR Plan covers the Atlantic Coast of Long Island from Jones Inlet to East Rockaway Inlet and considers the restoration and coastal storm risk management of the shore of Long Beach Island from storm damages caused by erosion, wave attack and inundation.

II. Existing Conditions

A. Physical Conditions

28. The current physical coastal conditions are generally the same as presented in the 1995 Feasibility Report and will be summarized here. There have been refinements to the existing conditions which are reflected in the summary of physical conditions for the study area listed below:

29. Tides. Tides along the Atlantic shore portion of the study area are semi-diurnal. The mean tidal range along the outer coast of Long Beach is 4.5 ft and the spring tidal range reaches 5.4 ft. In Hempstead Bay, these ranges are 3.9 ft and 4.7 ft, respectively. The Mean High Water (MHW) level and Mean Low Water (MLW) level relative to NAVD88 are +1.5 ft and -3.0 ft, respectively for the Atlantic Coast of the Island.

30. Currents. Tidal currents are generally weak. Currents at Jones Inlet and East Rockaway Inlet have respective average maximum velocities of 3.1 and 2.3 knots at flood tide, and 2.6 and 2.2 knots at ebb tides.

31. Winds. Wind speed/direction data for the study area were available from the US Naval Oceanographic Office (1970). Annual percent-occurrence statistics for wind direction/speed data were separated into eight direction bands as shown in Table 1 below. As shown in Table 1, predominant wind directions are from the south, southwest, and west, which occur approximately 18, 16 and 17 percent of the time, respectively. Winds from the south and southeast contribute the most to littoral transport in the study area and account for nearly 26 percent of all wind occurrences. Wind speeds are typically less than 27 knots, accounting for approximately 95 percent of all observations. The dominant wind speed range is from 7 to 16 knots, which occurs nearly 49 percent of the time. Wind speeds exceeding 27 knots (strong breeze) are less frequent with a total occurrence percentage of approximately 5 percent.

Table 1: Annual Percentage of Wind Direction by Speed

Wind Speed		Direction									
Knots	Description	Ind.	North	NE	East	SE	South	SW	West	NW	Total
0 – 6	Calm	3.2	2.3	1.8	2.4	2.9	4.8	3.9	2.9	2.0	26.2
7 – 16	Gentle breeze		4.1	4.1	4.2	4.2	9.7	8.8	7.9	5.8	48.8
17-27	Fresh breeze		2.0	2.2	1.3	1.0	2.7	2.8	4.5	3.7	20.2
28-40	Strong breeze		0.5	0.7	0.2	0.1	0.3	0.4	1.3	0.9	4.4
>40	Gale		*	0.1	*	*	0.0	*	0.1	0.1	0.3
Total		3.2	8.9	8.9	8.1	8.2	17.5	15.9	16.7	12.5	99.9

Source: U.S. Naval Oceanographic Office

*= 0.01 to 0.05% occurrence

32. Waves. The direction of wave approach to the Long Beach Island shoreline is primarily from the south and southeast. A wave height-frequency curve was developed to obtain storm wave conditions (USACE, 1995). Breaking wave heights were calculated for the 10, 25, 50, 100 and 500-year return periods using the data provided by the ERDC-CHL. The results of storm wave conditions, including significant and breaking wave heights and the corresponding wave

periods, are summarized in Appendix A of the 1995 Feasibility Report. The results of these calculations indicate that the deep-water wave height for a storm having a 100-year return period would be 21 ft.

33. Stage-Frequency. A comparison of 2005 Fire Island to Montauk Point (FIMP) stage-frequency relationships with the 1985 FIMP stage-frequency relationships used in the Feasibility Study is presented in Figure 2-10. The 2005 curve (node 55, Long Beach Ocean) lies offshore of the center of Long Beach Island. The 2005 curve and the 1985 curve used in the Feasibility Study are nearly identical up to the 100-year return period. Between the 100-year and 500-year return periods the original 1985 FIMP curve gradually exceeds the 2005 curve until it is approximately 1.2 ft higher at the 500-year level. The original 1985 FIMP stage-frequency relationship was therefore retained for design of the Recommended Plan. Appendix B Table 2-4 gives comparative stage-frequency values, and Appendix B Figure 2-10 plots these graphically.

34. A check was made for more recent stage-frequency modeling in the area. The Federal Emergency Management Agency, FEMA, performed a stage-frequency analysis for New York City, and parts of New Jersey in 2012, and provided draft results to USACE in September 2013. Note that this work does not include Hurricane Sandy. Outputs from this modeling include locations in Nassau County, but USACE has been informed that the focus of this study was the five boroughs of Manhattan, and FEMA is not using the Nassau County output. The USACE was further informed that FEMA, as of the date of this report, is using USACE generated 2005 FIMP stage-frequency relationships for Nassau County. Therefore, no change was made to the design stage-frequency curve for the Long Beach project based on draft 2013 FEMA results."

Table 2: Ocean and Bay Still Water Level Stage-Frequency Elevations in ft NAVD88

Return Period (years)	Still Water Level (no wave setup) ft NAVD (1)	Still Water Level (with wave setup) ft NAVD	Bay Stages (2) ft NAVD
2	4.5	5.9	
5	5.0	6.5	4.4
10	5.5	7.3	4.8
20	6.3	8.1	
50	7.8	9.7	6.3
100	9.0	11.0	7.2
200	10.3	12.5	
500	11.9	14.2	10.0

(1) Conversion NAVD = NGVD - 1.11 using NOAA Vertcon

(2) Bay stages from Appendix B Table A-6, year 0, no sea level change

35. Sea Level Change (SLC). In December 2013, USACE published guidance to incorporate sea-level change for project planning and design (ref. ER1100-2-8162). This guidance recommends both the National Research Council report (NRC, 1987) and the Intergovernmental Panel for Climate Change report (IPCC, 2007) findings for prediction of future sea level change.

For this project with a 50-year design life, the future SLR in year 2060 is used. The extrapolation of historical rate of +0.7 ft/50 years or 1.4 ft/100 years with 95% confidence is used for project planning, design, and analysis. Sensitivity, risk and uncertainty analyses will be conducted to determine how sensitive recommended designs are to these various rates of future local mean SLC, how this sensitivity affects calculated risk, and what design of operations and maintenance measures can be implemented to minimize adverse consequences while maximizing benefits. The intermediate rate of +1.3 ft and high rate of +2.6 ft in year 2060 will be used for sensitivity, risk & uncertainty analysis (estimates include 0.5 ft land subsidence in 50 years).

36. Storms. The study area is subject to damages from hurricanes and from extratropical cyclones known as "nor'easters". Hurricanes strike the study area from June through November, and more frequently within this period from August through October. Nor'easters primarily strike the study area from October through March.

37. A summary of storms that struck, or occurred, near the project area from 1665 to 1962 is given in Appendix E of the 1965 Survey Report. More detail on historic storms can be found in that document. Appendix A of the 1995 Feasibility Report gives details on the major storms, which affected the project area in the more recent past.

38. Hurricanes. This type of storm affects the project area most severely with its high winds, waves, rainfall and tidal flooding. A hurricane is defined as a cyclonic storm with winds greater than or equal to 74 mph which originates in the tropical or subtropical latitudes of the Atlantic Ocean and move erratically in a curved path, changing from an initial northwest to a final northeast direction. Hurricanes may affect localities along the entire Atlantic and Gulf Coasts of the United States.

39. The hurricanes that most severely affect the study area usually approach from the south-southwest direction after recurving around eastern Florida and skirting the Middle Atlantic States. Recently Hurricane Irene of 2011 brought hurricane force wind gusts and the damage on Long Island included extensive power outages from fallen trees. Flooding occurred in Long Beach from the back-bay, with some ocean wave overtopping also occurring. The most severe hurricane on record for the study area is Hurricane Sandy which occurred on October 29, 2012. This exceeded the previous storm of record, Hurricane Donna, which occurred on September 12, 1960. Hurricane Sandy caused record setting storm surge and wave heights in the area, Long Beach Island was inundated by storm surge and hundreds of structures were either damaged or destroyed.

40. Nor'easters. Named after the predominant wind direction, these are large-scale, low pressure extratropical storms that are less intense than hurricanes. Nor'easters have sustained wind speeds that rarely exceed 50 knots, although gusts can reach hurricane strength in a very intense nor'easter. Flood damage caused by a nor'easter is often a function of duration rather than intensity. This type of storm typically lasts two to three days, making it possible for it to act through several periods of high astronomic tide. The longer the storm, the more opportunity it has to destroy both natural and engineered shoreline coastal storm risk management features.

41. Nor'easters sometimes develop into more complex storms. Relative location of high and low pressure centers may cause wind speed in excess of what would be expected from a single storm cell. Winds reaching almost hurricane speed may occur over many thousands of square miles. The most severe nor'easter of record that struck the project area occurred March 6- 8, 1962. It caused serious tidal flooding and widespread damage all along the Middle Atlantic Coast.

42. The Halloween Nor'easter of 1991 and the December 1992 Nor'easter caused significant inundation and erosion. Damages associated with these extratropical storms included property damage, damage to the boardwalk, groin damage and debris washing into the streets due to the severe coastal flooding.

43. Geology. Long Island lies within the Coastal Plain physiographic province and marks the southern boundary of Pleistocene glacial advance in the eastern part of the North American continent. Two terminal moraines form the physiographic backbone along the northern part of Long Island. These moraines are superimposed along the western half of Long Island but split in west-central Long Island and diverge around Great Peconic Bay. Terrain south of the terminal moraines originated as glacial outwash plains, and is composed of sand and gravel detritus transported south by melt-water streams during Pleistocene time. Shallow brackish-water lagoons and low relief sandy barrier islands with associated dunes are the dominant landforms along most of the southern shore of Long Island. Long Beach Island is one of these barrier islands. Metamorphic bedrock underlies sandy deposits, at depths varying from -199 ft NAVD88 in northern Long Island to -1999 ft NAVD88 below Fire Island.

44. The back-barrier lagoons and elongated-barrier islands are geologically very recent features, which owe their origins to coastal processes operating during the gradual worldwide rise in sea level. The barrier islands are constructional landforms built up over the past several thousand years by sand from the sea floor and by sand transported westward along the Long Island shoreface by wave-generated longshore currents. This chain of sandy barrier islands extends from the western end of Long Island eastward to Southampton and is presently broken up by six tidal inlets.

45. Littoral Materials. Beach sediment grab samples were collected in 1988 along ten profile lines at +7, -1, -9, -19 and -31 ft NAVD88. Sand samples were described as tan to dark tan in color, with sizes ranging from very fine sand to coarse sand, with some shell fragments. Grain size distribution curves were then calculated based on composite beach samples for each profile line. Three overall composites were made by combining the profile composites to produce typical beach sand models for the Lido Beach, the City of Long Beach and Atlantic Beach areas of the shoreline. The median grain sizes for the three typical beach models are 0.21 to 0.22 mm, which are classified as fine sand based on the Wentworth Classification.

46. Analyses were performed to compare offshore borrow material with the three native beach material models to determine the overfill and renourishment factors. Borrow areas were selected based on the compatibility of the material with the native beach sand. Detailed evaluation to determine beach and borrow area compatibility is presented in Appendix B of the 1995 Feasibility Report and has been updated as shown in Appendix B Engineering and Design of this report. The analysis shows that the median grain size of the sand pumped onto the beaches in the project area is very close to the existing native sand.

47. Shoreline Changes. Shoreline changes between 1835 and 1990 are shown in Appendix B (Figure 2-3 and Figure 2-3a [Figure A-5] from the 1995 Feasibility Report]). During this time period the barrier island/inlet system evolved to its present configuration. The magnitude of shoreline change, which has historically ranged from as erosive as -23 ft/yr at the eastern end of the barrier island to as accretive as +51.0 ft/yr in the west end (following the construction of the East Rockaway Inlet jetty), indicates the great potential for sediment movement that exists along the entire Long Beach Island shore. Stabilization efforts, namely construction of inlet jetties, groin fields, and seawalls, as well as periodic beach fill, have reduced the observed rates of

accretion and erosion, except in the area just west of Point Lookout, where erosion rates remain high in spite of human efforts.

48. Recent and Predicted Shoreline Changes. Since 1990 significant accretion has taken place in the eastern portion of the project area, especially in the area of the ebb shoal attachment point, the weldment (see Figure 13). In addition, numerous beach fills have been placed in the Point Lookout and Hempstead Beach areas. Both Hempstead Beach and Lido Beach have benefited significantly from the beach fills. Since 1993, Lido Beach has experienced a noticeable degree of shoreline accretion as sand from the ebb shoal attachment point and the beach fills has been transported to the west. The Technical Reanalysis Report (USACE 2000) noted that only in the extreme western portion of Lido Beach has there been slight shoreline recession since 1990. The numerical modeling performed in this limited reevaluation effort has been validated to reproduce those historical trends.

49. Long-term shoreline erosion rates between 1963 and 1990 are summarized in Table A11 of the 1995 Feasibility Report. Assuming material dredged from Jones Inlet Channel is placed at Point Lookout, estimated erosion rates were -1.7 ft/yr to -2.7 ft/yr in Point Lookout/Lido Beach and -4 ft/yr in the City of Long Beach. Updating shoreline changes to include the 1963 to 2010 mean high water lines and including fill placement volumes from channel maintenance dredging for recent years resulted in revised long term erosion rates as follows: Point Lookout - 7.0 ft/yr; Lido Beach 0.0 ft/yr; and the City of Long Beach -2.1 ft/yr.

50. Sediment Budget - Existing Condition. An existing condition sediment budget was developed for the study area based on comparison of beach profiles between 1963 and 1988, and records of beach fills placed in that time period. This sediment budget was prepared for the 1995 Feasibility Report. The pattern observed alongshore is one of alternating erosive and accretive zones. Transport during this time period is net westerly, with an overall erosive trend, losing an estimated 80,000 cy/yr over the entire Atlantic shoreline of Long Beach Island. Accretion at the western end of the island can be attributed in part to impoundment by the East Rockaway jetty. The most erosive zone is located adjacent to Jones Inlet, although significant losses are found mid-island as well. Material eroded migrates westward over time along the length of the island, contributing to accretionary zones further downdrift. As seen from the historic shoreline comparisons, the location of accretive and erosive zones shifts alongshore over time, so that any given location will experience cycles of both deposition and loss.

51. Sediment Budget-Projected 50-Year. A sediment budget was prepared during the Feasibility Study for a 50-year projection, to reflect the without-project condition. Measured erosion rates were averaged over relatively long reaches to capture the effects of migrating erosive and accretive zones. Measured erosion rates from 1963 to 1988 were increased to account for several trends. First, it was estimated that the East Rockaway jetty will reach capacity early in the 50-year projection, and that impoundment in western Atlantic Beach will cease. Second, deterioration of groins alongshore will result in increased sediment movement. Third, sea level change over a 50 year period will cause an increase in erosion rates for the entire shoreline. Additionally, the 1963-1988 time period contained relatively few severe storm events, indicating that greater losses of material are likely to occur in the future. Projected average erosion rates range from -5 cy/yr/ft of shoreline to zero. The net transport direction is westerly. Overall predicted future losses for the Long Beach Island shoreline are estimated at 195,000 cy/yr.

52. The growth of the ebb shoal weldment constitutes a change of existing condition since completion of the Feasibility Report. This change was summarized and examined in Section III,

Without Project Conditions, in the 2000 Reanalysis Report, which indicated beach erosion east of the weldment has continued to occur. Since 1933 Lido Beach has experienced a noticeable degree of shoreline stability and has accreted in some areas as sand from the ebb shoal attachment point and beach fills has been transported west. Based on these trends, it is anticipated that beach erosion will continue to the east of the weldment and shoreline stability will continue in Lido Beach. Erosion in the City of Long Beach may be reduced as a result of increased transport westward. However, because this is a relatively recent change in the overall sediment transport regime, estimated renourishment volumes calculated in the 1995 Feasibility Report were retained in the HSLRR Recommended Plan. Future renourishment needs may be reduced by sediment transport onshore due to ebb shoal welding, and if so, renourishment will be modified to reflect actual shoreline conditions at the time of each renourishment.

53. Beach Characteristics. At the time of the Feasibility Report preparation, dunes were present on 14 out of 33 profile surveys. The average maximum dune elevation measured on the beach profiles was +16.75 ft NAVD88, with a range of maximum elevations from +12.5 to +19 ft NAVD88. Average dune crest width was 17.12 ft, ranging from no flat crest to 160 ft of crest width. Dune side slopes ranged from 1V:4H to 1V:12.5H. Flat berm features were not present on all profiles. Those without well defined berms sloped continually downward. Of 18 profiles showing well defined berms, the average elevation was +8.82 ft NAVD88, with a range between +6 and +13 ft NAVD88. Average berm width was 93.5 ft, ranging between 0 and 600 ft. Offshore slopes were steeper on the eastern end of the island from Jones Inlet extending approximately 7,500 feet westward, averaging 1V:21.75H. The remaining offshore slopes averaged 1V:34.52H. Subsequent to the Feasibility Report an additional 10 surveys taken between 1991 and 2010 indicate that offshore slopes in the City of Long Beach/Lido Beach area average 1V:30H. The Point Lookout offshore slope averaged over all surveys was 1V:20H following Hurricane Sandy. There was a composite survey prepared with the most recent data (LIDAR, CPE's survey collected for the City of Long Beach, etc.) since Hurricane Sandy. However, berm width and slopes have not yet been tabulated to fully discuss impacts to beach characteristics.

54. Existing Coastal Structures. A total of 40 groins are present in the study area, 32 of which are located in the project area: three groins in Point Lookout, four groins in Lido Beach, 23 groins in the City of Long Beach, and two groins within the area of the taper of beach fill in East Atlantic Beach. The remaining eight groins are located in the stretch of East Atlantic Beach, no longer included because the town opted out of the project. Each of these groins was evaluated as to structural condition, sand trapping effectiveness and planform holding effectiveness. The results of the survey are discussed in the "Design Change – Existing Groin Rehabilitation" section below. An update to the groin condition survey was conducted in 2003 to review the structure dimensions and approximate elevations, the types of structure and construction materials, the armor stone sizes and interlocking conditions for stone groins, and the sand trapping effectiveness of the groins. A new conditions survey of the existing groins reflecting post Hurricane Sandy conditions will be conducted during the development of plans and specifications.

55. Interior Drainage Structures. All storm-water interior drainage structures have their outlets in Reynolds Channel. Project improvements to the Long Beach Island ocean front will have no impact on the function of the interior drainage systems on the island.

B. Economic Conditions

56. Population. Population in the City of Long Beach has decreased from a 1990 total population of 33,510 to a 2010 total of 33,275. The Town of Hempstead has shown an increase in population from 725,639 (1990) to 759,757 (2010). The Lido Beach Community's population has increased from 2,786 (1990) to 2,897 (2010). Overall, the population of Nassau County has increased from 1,287,348 (1990) to 1,339,532 (2010). The population trend for the project area is expected to be stable in the future.

57. Income. Per capita income is an indicator of the economic strength of a community. The per capita income in the City of Long Beach has increased during the period from 2000 to 2010 from \$31,069 to \$43,377. Per capita incomes have also increased for the Town of Hempstead from \$28,153 (2000) to \$37,211 (2010), Lido Beach from \$47,604 (2000) to \$74,449 (2010) and Point Lookout from \$39,953 (2000) to \$79,146 (2010). This rate of increase is higher than the overall rate for Nassau County.

58. Transportation. The study area is accessible to major population and commercial centers, through an extensive network of highways, roads and railways. Direct access from the major corridors to the barrier island is provided by three vehicular bridges from: Loop Parkway on the eastern end of the barrier island; the Atlantic Beach Bridge on the west; and the Long Beach Causeway in the center. The communities are also served by the Long Island Railroad, which provides passenger rail service from eastern Long Island and New York City directly into the City of Long Beach. There is a public bus which runs east-west along the major artery of the barrier island from Point Lookout to Atlantic Beach (Lido Boulevard in Point Lookout and Lido Beach and Park Ave in Long Beach).

59. Beach Usage. The south shore of Long Beach Island is a continuous strip of sand beach serving the year-round inhabitants as well as the great influx of summer visitors and vacationers. Most visitors to Long Beach are from Nassau, Kings, Queens, and New York Counties. From 1999 to 2002 an average of 500,000 people visited the beach in the City of Long Beach, and from 1994 to 2002 an average of almost 500,000 in the eastern beaches of Point Lookout, Nassau County and Lido Beach. It is noted that due to the erosion, which has most severely affected the use of the Point Lookout area, beach attendance has substantially declined. For example, the attendance in this area in 1984 was 523,065 while the average attendance from 1993 to 2002 was approximately 130,000.

60. Shore Ownership and Use. The majority of the beaches within the study area are publicly owned and publicly accessible. Within the Town of Hempstead there are several privately owned properties and several special park districts, which are discussed further in the formulation section below. There is public transportation to the majority of the beaches as well as sufficient parking areas along the project shorefront. There is full lateral beach access along the entire study area shorefront, and a public bus, which provides drop-offs along the main artery of the barrier island. As prescribed by USACE policy and regulations, costs of improvements in those areas that are not open to the public would be 100% non-Federal, unless coastal storm risk management to such areas is incidental to the project. The State has submitted a Public Access Plan, which is intended to conform with Federal policy. To allow for full public access and yet offset the levies that residents are charged for beach maintenance, several of the beach areas have adopted differential fees, which include higher fees for non-residents than residents.

C. Environmental Resources

61. The project shoreline has been highly modified as a result of human development. Upland areas within the project area have been committed to residential, commercial, and recreational development.

Aquatic and Terrestrial Habitats

62. Oceanfront beach and deepwater ocean habitats constitute the majority of the Project area. The beach community includes upper, intertidal, and nearshore subtidal areas. Except for beachgrass, scattered herbs, and sparse low-growing shrub communities associated with the upper beach/dune area, most of the Project area is devoid of vegetation and is significantly impacted from human use of the area for recreational activities and significant development that abuts the upper beach zone in most of the Project area. The only undeveloped areas in the Project area, besides the beach itself, occur at Silver Point, and Lido Beach/Point Lookout.

63. The upper beach zone extends from dune areas to just above the high water line and includes dunes and supratidal areas of the beach. The area is predominately covered with sand. However, patches of herbaceous vegetation are found in the upper beach zone and are dominated by American beach grass (*Ammophila breviligulata*), other species found in this zone include spurge (*Euphorbia polygonifolia*), beach plum (*Prunus maritima*), seaside goldenrod (*Solidago sempervirens*), and sea rocket (*Cakile edentula*). The upper dune portion of this zone typically includes scattered patches of the herbs described above and stunted shrub species such as beach heather (*Hudsonia tomentosa*). In areas of low human disturbance, these areas can provide nesting and foraging areas for birds.

64. The intertidal zone extends from the low tide line to the high tide line and is submerged and exposed according to daily tidal cycles. Species diversity in this zone is relatively low due to limited ability of species to withstand the daily submersion and exposure. Micro and macro-invertebrates known to inhabit this zone include crabs, shrimp, bivalves, and worms. The intertidal zone provides key foraging habitat for shorebirds.

65. The affected near shore subtidal zone extends from the low water line down to 25 feet below mean low water (MLW) and is nearly continuously submerged. The area contains a rich diversity of aquatic micro and macro-invertebrates including crabs, shrimp, bivalves, worms, and finfish. In addition, numerous man-made groins extend from the intertidal zone into the subtidal zone from 200 to 600 feet (USACE 1995). These structures provide habitat for numerous fish, macro-invertebrates, and birds.

66. The offshore subtidal zone is located approximately 1.5 miles south of Long Beach Island between 25 feet MLW and to about 60 feet MLW. The area contains a diversity of benthic organisms and phytoplankton and diverse assemblages of shellfish, gastropods, amphipods, isopods and crustaceans. The area also provides a migratory pathway and spawning, feeding and nursery area for many common mid-Atlantic fish species.

67. Based on USFWS National Wetland Inventory (NWI) maps, the Project area includes approximately 50% intertidal habitat, 30% subtidal habitat and 20% upland/upper beach habitat. The wetland/deepwater areas are devoid of vegetation and are considered non-jurisdictional (*i.e.*, unregulated) wetlands.

68. Finfish and Shellfish. Both the nearshore and offshore waters of the Project area support seasonally abundant populations of many recreational and commercial finfish (USFWS 1989, 1995, USACE 1995). Primary fish species include black sea bass (*Centropristis striata*), summer flounder (*Paralichthys dentatus*), winter flounder (*Pseudopleuronectes americanus*), weakfish (*Cynosion regalis*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), striped bass (*Morone saxatilis*), and Atlantic mackerel (*Scomber scombrus*). In addition, other common species in near shore waters include tautog (*Tautoga onitis*), northern puffer (*Sphoeroides maculatus*), windowpane (*Scophthalmus aquosus*) and American eel (*Anguilla rostrata*). A number of migrant anadromous and catadromous species are found throughout the Project area. Common migrant species include the Atlantic sturgeon (*Acipenser oxyrinchus*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), Atlantic silverside (*Menidia menidia*), striped bass, and American eel (Woodhead 1992). The primary shellfish with important commercial or recreational value in the near shore portion of the Project area are the, hardshell clam [Quahog] (*Mercenaria mercenaria*), softshell clam (*Mya arenaria*), bay scallop (*Argopecten irradians*), American lobster (*Homarus americanus*), and blue crab (*Callinectes sapidus*) (MacKenzie 1990). Surf clam (*Spisula solidissima*), razor clam (*Ensis directus*) and tellin (*Tellina agillis*) occur in the vicinity of the offshore borrow area. Surveys conducted by the USACE in 2003 and by the NYSDEC in 2012 indicate that the borrow area itself contains very small, to no, localized populations of surf clam. It is the intent of the USACE to conduct another survey in the borrow area prior to the utilization of the borrow area.

69. Benthic Resources. Beginning in 1966, there have been at least 17 major sediment-benthic macrofauna sampling efforts in the region. As reported in these studies, the sediment composition of the Project area consists of a silty sand, medium coarse grain sand, and hard substrate community (USACE 1995). The benthic community of the near shore portion of the Project area is dominated by polychaetous annelids, followed by malacostracans, bivalves, and gastropods (Reid et al. 1991, Ray and Clarke 1995, Ray 1996, Way 1995). The silty-sand substrates are dominated by bivalves such as the blue mussel (*Mytilis edulis*), and polychaetes such as red-lined worms (*Nephtys incisa*) (Steimle and Stone 1973). Medium coarse sand substrates are dominated by bivalves (e.g., dwarf tellin [*Tellina agilis*]), echinoidea (e.g., sand dollar [*Echinarachnius parma*]), amphipods (e.g., *Protohaustraius deichmae* and *Unicola irrorata*), and polychaetes (e.g., burrowing scale worm [*Sthenelais limicola*], lumbrinerid thread worms [*Lumbrineris fragilis*], and mud worm [*Spiophanes bombyx*]) (Steimle and Stone 1973). Hard substrates such as groins are dominated by blue mussel (Steimle and Stone 1973). Sediments in the offshore borrow area contains over 75 taxa of benthic species (Steimle and Stone 1973). The most numerous species were polychaete worms (dominated by the tube-dwelling polychaete, *Asabellides oculata*) and blue mussel (USACE 1995).

70. Reptiles and Amphibians. Due to the lack of freshwater habitats and vegetation along the beach and shoreline, no reptiles or amphibians are expected to inhabit the Project area (USACE 1995).

71. Birds. A wide diversity of bird species is likely to occur within, and in the vicinity of, the Project area. The most common species in the Project area are habitat generalists that are tolerant of development and that utilize beach habitat along the shoreline and deepwater habitats. Common species include herring gull (*Larus argentatus*), greater black-backed gull (*Larus marinus*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), barn swallow (*Hirundo rustica*), black-bellied plover (*Pluvialis squatarola*), black scoter (*Melanitta nigra*), bufflehead (*Bucephala albeola*), common grackle (*Quiscalus quiscula*), common yellowthroat (*Geothlypis trichas*), double-crested cormorant (*Phalacrocorax auritus*),

European starling (*Sturnus vulgaris*), gray catbird (*Dumetella carolinensis*), mourning dove (*Zenaida macroura*), rock dove/pigeon (*Columba livia*), sanderling (*Calidris alba*), song sparrow (*Melospiza melodia*), house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), and tree swallow (*Iridoprocne bicolor* [USACE 1998, 2003, USFWS 1992]). Permanent avian residents of the surrounding area include various species of gulls, crows, pigeons, and sparrows, which are commonly associated with developed areas and areas of high human activity (USFWS 1992, USACE 1998, 2003).

72. Mammals. The USFWS (1993) reported that the general Project area includes year-round habitat for terrestrial mammals such as the gray squirrel (*Sciurus carolinensis*), house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), Eastern cottontail (*Sylvilagus floridanus*), and feral cat (*Felis catus*) [USACE 1998, 2003, USFWS 1992]. This is consistent with results from studies conducted by the USACE on nearby Fire Island.

73. Threatened or Endangered Species. All appropriate Federal and State agencies were consulted regarding the potential for species and habitats of special concern within the Project area during the preparation of the FEIS for this project (USACE 1995). Correspondence received from these agencies and USACE responses to correspondence relating to the original Project are presented in the FEIS (USFWS 1989, 1995, NMFS 1993, USACE 1995). Subsequent recent correspondence relating to species and habitats of special concern are presented in the following EA Appendices: Appendix A (Federal and State correspondence), Appendix C (USFWS Fish and Wildlife Coordination Act 2(b) Report), and Appendix G (NMFS correspondence). Traditionally for water resource projects the FWCA report is included in the NEPA documentation, and the final FWCA report appears in the final NEPA documentation. As this project has already been coordinated with USFWS (as the project has had a ROD and has been authorized), the District has coordinated with USFWS to update and minimize impacts to wildlife resources. The final FWCA report is attached to the EA. The District gave the FWCA report full consideration and incorporated its recommendations where applicable into the final EA/FONSI.

74. Federal Species or Habitats of Concern. The eastern portion of the project area (Nickerson Beach) is within a Significant Coastal Fish and Wildlife Habitat as designated by the New York State Department of State (NYSDOS), Division of Coastal Resources. This portion of the project area has also been designated an Important Bird Area by Audubon New York, and has been identified as a Significant Fish and Wildlife Habitat by the Service. In addition to the species that utilize the beach area listed in Section 3.3.2 above, the federally-listed species including the piping plover (*Charadrius melodus*; threatened) and sea beach amaranth (*Amaranthus pumilus*; threatened), which are protected under the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) have been documented in the project area. The red knot (*Calidris canutus rufa*), a species recently listed as threatened has also been documented in the project area (USFWS, 2014). However, the extensive use of beach, dune, and near shore areas for public recreation has been limiting the potential of habitats in the Project area for successful bird nesting. The primary use of the Project area by birds is for resting and feeding activities.

75. Four species of threatened and endangered marine turtles may be present in the near shore waters of the Project area during summer and early fall. The Federally-listed endangered Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtle have foraging ranges that include the Project area (NMFS 2014).

76. The federally listed species Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) is also protected and like all anadromous fish, Atlantic sturgeon are vulnerable to various impacts because of their wide-ranging use of rivers, estuaries, bays, and the ocean throughout the phases of their life. General factors that may affect Atlantic sturgeon include: dam construction and operation; dredging and disposal; and water quality modifications such as changes in levels of dissolved oxygen (DO), water temperature and contaminants.

77. Atlantic sturgeons have been harvested for years. Many authors have cited commercial over-harvesting as the single greatest cause of the decline in abundance of Atlantic sturgeon (NMFS 2012A, 2014). Even though the fishery has been closed coast-wide since 1995, poaching of Atlantic sturgeon continues and is a potentially significant threat to the species, but the magnitude of the impact is unknown. Atlantic sturgeon may compete with other bottom feeding species for food, although there is no evidence of abnormally elevated interspecific competition, and it has been suggested by Van den Avyle that “non-selective feeding of juvenile and adult sturgeons may reduce the potential for competition with other fish species” (Van den Avyle, M.1984).

78. No Federally-protected marine habits of concern occur within the Project area.

79. State Species or Habitats of Concern. The State-listed threatened common tern (*Sterna hirundo*) and least tern (*Sterna antillarum*) are known to occur in the Project area as well as a number of other at-risk shorebird species including black skimmer (*Rhychops niger*), and American oystercatcher (*Haematopus palliatus*). These species are known to utilize coastal beach habitats similar to those found in the Project area and the species are commonly associated with nesting tern colonies.

80. Essential Fish Habitat. Pursuant to Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), Federal agencies are required to consult with the NMFS regarding any action they authorize, fund, or undertake that may adversely affect Essential Fish Habitat (EFH). For assessment purposes, an adverse effect has been defined in the Act as follows: “Any impact which reduces the quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species fecundity), site specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions.”

81. Based on a review of the National Oceanic and Atmospheric Administration (NOAA) guide to EFH designations in the Northeastern United States, designated EFH occurs in the greater Project area as identified by the 10-minute by 10-minute square that is bounded as follows: North 40° 40.0' N, East 73° 50.0' W, South 40° 30.0' N, and West 74° 00.0' (NMFS 2004). NOAA describes this square as “Atlantic Ocean waters within the square within the Hudson River estuary affecting the following: western Rockaway Beach, western Jamaica Bay, Rockaway Inlet, Barren I., Coney I. except for Norton Pt., Peardegat Basin, Mill Basin, southwest of Howard Beach, Ruffle Bar and many smaller islands.”

82. Fish occupation of waters within the project impact areas is highly variable spatially and temporally. Some of the species are strictly offshore, while others may occupy both nearshore and offshore waters. In addition, some species may be suited for the open ocean or pelagic waters, while others may be more oriented to bottom or demersal waters. This can also vary between life stages of Federally managed species. Also, seasonal abundances are highly variable, as many species are highly migratory.

83. Aesthetics and Scenic Resources. These resources in the Project area are accessed primarily by boardwalks along the shore, and encompass a view of the ocean and beach recreational facilities to the south and commercial and residential development to the north. The beach extends to the east and west for many miles, as does the boardwalk. Groins are visible along the shore throughout the project area.

D. Cultural Resources

84. To fulfill USACE responsibilities in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), the Abandoned Shipwreck Act of 1987, and the Advisory Council on Historic Preservation Regulations, *Protection Historic Properties* (36 CFR Part 800), a cultural resources survey was completed as part of this HSLRR. The Area of Potential Effect (APE) for the project area includes the off shore sand borrow source, the near shore and onshore sand placement area. An extensive history and prehistory of the Long Beach Island area was compiled and a pedestrian survey of the shore portion of the study area was completed as part of the 1995 Feasibility Study (Pickman 1993). For the APE within the waters of the Atlantic Ocean, preliminary near shore and borrow area surveys were undertaken in 1996, 1998 and 2005 (Panamerican Consultants, Inc., 1996a, 1996b, 1998, 2005).

85. Prehistoric Resources. The cultural resources study found that there were no known prehistoric or contact period archaeological sites located on Long Beach Island (Pickman 1993). Native Americans living on the main portion of Long Island may have visited Long Beach Island for brief periods of time to collect fish and shellfish (Pickman 1993). The island, however, would not have been attractive to Native Americans for permanent or semi-permanent settlement because of its exposure to the wind and weather from the Atlantic Ocean. Long Beach would have been especially uninviting to Native American occupation because there was no source of fresh water available on the island (Pickman 1993).

86. Historic Resources. The first European settlers arrived on Long Island during the first half of the seventeenth century. It was not until the middle of the nineteenth century, however, that Long Beach was occupied by Euro-Americans. According to local histories, no structures were located on Long Beach until after 1849. Residents of the mainland used the island primarily for pasturage. In 1849, a Life Saving Station was constructed on Long Beach to house surf boats, lifesaving apparatus and a crew of six to seven men.

87. Between 1849 and 1879, only a few buildings were constructed on Long Beach. In 1873, a transatlantic cable connecting New York to England, via Halifax, Nova Scotia, made its landfall at Long Beach Island, between the current Edwards and Riverside Boulevards. The development of the island began in 1880 with the construction of a railroad from Lynbrook to Long Beach and the construction of the first large resort hotel and bathing pavilion on the island. This was followed by the construction of a number of other hotels in the 1880s and 1890s and during the first two decades of the twentieth century. Summer homes and permanent residences were also built on the island during the twentieth century. The location of these structures was well north of the boardwalk and beach zone (Pickman 1993). No significant remains of the project area's history would be situated along the site of the present beach.

88. Two structures located in the vicinity of the project area, the Granada Towers and the United States Post Office, are listed on the National Register of Historic Places (NRHP). One private residence, located on Washington Boulevard and thought to be one of the first private homes on Long Beach, is listed on the historic structures inventory maintained by the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP). None of these

structures are within the project area. No other buildings or structures have been listed or determined eligible to be listed on the National Register within the Project area since the completion of the Final Feasibility Report and FEIS.

89. Shipwrecks. Several dozen possible shipwrecks were identified in the initial near-shore survey of the project area around Long Beach (Panamerican Consultants 1996 and 1998). Further testing on these sites was carried out in 2005 (Panamerican Consultants, Inc. 2005). Two shipwrecks have been documented within the near shore sand placement area. The 1837 wreck identified as the *Mexico* is situated near Lido Beach and a second wreck, known by local divers as the Marble wreck, is located near Point Lookout (Pickman 1993, Panamerican Consultants 1996a, 1996b 1998, and 2005). Both wrecks are potentially eligible for inclusion in the NRHP. Another object detected during the 1998 near shore remote sensing survey, referenced as Anomaly 18, was unknown and required further investigation to determine what it is and whether it represents a significant resource.

90. In November 2013, additional investigations were undertaken on 1) two anomalies identified in 1998 (Anomalies 18 and 29); 2) Anomalies 8, 10 through 12, which may represent the wreck of the *Mexico*; and 3) the remains of the wreck known as the Marble wreck (Panamerican 2014).

91. Anomaly 18 was a magnetic anomaly that was recommended for further investigation in 1997. It was reacquired in 2013 as three separate anomaly locations were detected in the vicinity of the original anomaly. All three locations were investigated by divers, who found no indications of structure located above the bottom were found at any of the three locations. These areas were also probed in 5-foot intervals to 25 feet in the cardinal directions to a depth of approximately eight feet. All three locations were negative for buried structures, indicating the anomalies could be isolated debris or buried deeply. No additional investigations were recommended.

92. Anomaly 29, originally identified in 1998, was relocated in 2013 and subjected to a dive inspection. No indication of structure located above the bottom was found. The target area was probed to a maximum depth of approximately 10 feet in 5-foot intervals to 25 feet in the cardinal directions. All probes were negative for buried structure, indicating the source of the anomaly may have been isolated debris, or very deeply buried. No additional investigations are recommended.

93. Anomaly 8, which was found to be three separate anomalies (8a, b and c) were inspected by divers. Anomalies 8a and 8b were found to represent the remains of a wrecked vessel or vessels, possibly the *Mexico*. No wooden structure was located during the underwater investigation. There is likely a wooden structure under the concretions identified and under the sand. Anomaly 8c was determined to be recent debris and Anomalies 10 -12 represented the offshore end of a discharge pipe. The wreck at Anomaly 8a and 8b, particularly if it represents the *Mexico*, is eligible for the National Register of Historic Places (Panamerican 2014).

94. The Marble wreck is located off the end of Point Lookout on the west side of Jones Inlet and covers an area approximately 225 feet by 100 feet. The remains consist of wooden hull remains, masses of concretions and at least one anchor. The wreck is in alignment with the western Jones Inlet jetty. This wreck has not been positively identified. It is referred to as the Marble wreck because marbles can be found in the concretions that may make up the vessel's cargo. The vessel represents a 19th century wreck of a wooden sailing vessel, although the

type could not be determined. This wreck is eligible for the National Register of Historic Places (Panamerican 2014).

95. Submerged Prehistoric Sites. During the last glacial period (approximately 110,000 to 10,000 years ago), sea level was up to approximately 400 feet lower than current levels. The shoreline at this time lay at the outer edge of the continental shelf approximately 100 miles from the present shoreline. According to area studies, sea level rose at a steady pace between circa 7000 to 3000 before present era (BPE), with a slower rate of increase after circa 3000 BPE. Cores taken adjacent to the project area indicate the presence of peat, silt, and clay deposits that are the remains of the lagoons that formed behind the barrier islands, which were located off the present Long Island shoreline at this time. The presence of these lagoonal deposits may mean that the inundation of the ground surface occurred in a low energy environment, which may have permitted these early prehistoric sites located in the near shore area to survive. These deposits would consist of organic peat and/or organic silts and clays (Pickman 1993:46).

96. The proposed borrow area may also contain early prehistoric land surfaces. The borrow site would have been available for human occupation until sometime after 7000 BPE. Two of the 15 cores taken from within the borrow site to a depth of 20 ft below the ocean floor contained either a clay layer or layer of dark gray silt (Pickman 1993). Based on data taken from cores and borings for adjacent areas, it is possible that these two cores taken within the borrow site may represent land surfaces that would lie on top of prehistoric deposits (Pickman 1993).

III. Problem Identification

A. Description of the Problem

97. Long Beach Island is low-lying and generally flat with elevations generally less than +9 ft NAVD88. Although some areas have dunes, the ocean shoreline of Long Beach Island generally consists of a continuous strip of generally low-lying beach with a series of groins along the oceanfront. The terrain gently irregularly slopes downward from the oceanside development toward the bayside of the island. The island is densely populated and has thousands of closely spaced residential, commercial, and public structures. When coastal storms occur there is little to stop the breaking waves, which ride atop the storm surge, from overtopping the existing low beach berms and intermittent dunes, damaging property and threatening lives as the storm waters cascade across the island toward the bay.

98. Severe storms in recent years, including Hurricane Sandy, have caused a reduction in the overall beach height and width along the barrier island, and accelerated deterioration of the locally constructed stone groins, which makes the densely populated communities along the barrier island increasingly susceptible to storm damage. A study by Coastal Planning and Engineering of NY, PC for the City of Long Beach (CPE 2012) to quantify beach loss and storm damage showed that as a result of Hurricane Sandy approximately 294,000 cubic yards of sand were lost from coastal beaches in the City of Long Beach. The continuing erosion combined with the low elevation of the protective beach berm exposes Long Beach Island to a high risk of catastrophic damage from ocean flooding and wave attack. As a result of Hurricane Sandy there was overwash, flooding from both the ocean and the bay resulting in the connection of the ocean and the bay, extensive damage to property, including the loss of the Long Beach boardwalk, as well as dune and beach erosion. Based on the USGS Hurricane Sandy Storm Tide Mapper, Long Beach Island was inundated by storm surge during Hurricane Sandy.

99. The rate of erosion is most severe at the eastern end of the barrier island, where recurring damages have been most evident. During the December 1992 Nor'easter, in the Town of Hempstead, the concrete sidewalk in front of the lifeguard stations collapsed and the lifeguard stations were undermined. The Town has consistently refilled the area with stone and concrete rubble as armament to protect these facilities from further storm damage.

100. The problems encountered in the Long Beach study area also include the deterioration of the existing coastal storm risk management structures. Many of the groins fronting the barrier island, including the terminal groin (Groin #58), have been severely battered by storms and have not been repaired or maintained since the 1950's when most of these structures were constructed. The deterioration of these structures decreases the risk management capability of the beach and increases the vulnerability of the communities along the barrier island to storm damage.

101. The barrier island is also subject to flooding, though at lower stages and less frequently, from the bay side of the island. However, this report, as did the 1995 Feasibility Report, concentrates on the coastal storm risk management of the barrier island from direct ocean storm damage, and is not intended to consider coastal storm risk management from tidal inundation from the bay side of the island.

IV. Without Project Future Conditions

102. Without Project Future Conditions (WOPFC) is by definition the projection of the most-likely future conditions in the study area in the absence of a proposed project from the current study. The WOPFC serves as the base conditions for all the alternative analyses, including the engineering design, economic evaluation of alternatives, comparison of alternatives, as well as environmental, social and cultural resources impact assessment.

103. The WOPFC is a forecast based upon what has actually occurred, is currently occurring or is expected to occur in the study area if no actions are taken as a result of this study. As it is impossible to predict specifically what may occur, future activities that impact the without-project condition must be representative of what is most likely to occur, and as such must be based upon historic practice and trends, unless there is definitive evidence of new actions or policies scheduled for implementation that would influence past practices. The goal is to choose the most likely future scenario (not the only future scenario), based upon reasoned, documentable forecasting. This section provides a summary of the elements within the WOPFC, followed by a description of the likely effects of this condition.

104. In the WOPFC, it is anticipated that the project area will be subject to the same erosive forces and other storm effects which have been experienced in the past. It is projected that storms will become more frequent and more intense. Coastal storms of various frequencies will continue to occur and inundation, wave attack, and erosion will continue unabated resulting in further reduction in beach height and width. The average erosion rate across the barrier island shoreline ranging from approximately 0 ft/yr to 7 ft/yr is anticipated to continue, based on surveys from 1835 to and 2010. Increased water levels due to sea level change will contribute to greater damages in the future. The analysis in this HSLRR incorporates a historic rate of sea level change of 0.7ft/50 yr or 0.014 ft/yr.

105. Long term erosion would further diminish the coastal storm risk management capability of the beach and existing dunes, therefore making the barrier island structures increasingly more vulnerable to storm damage from erosion, wave attack and inundation. As the long-term erosion diminishes the width of the beach, the recreation portion of the beach will be similarly diminished.

106. In the WOPFC, it is anticipated that local municipalities would allow erosion to continue until the shoreline reached the seaward toe of the existing dunes or boardwalk before taking remedial action to restore the beach. The City of Long Beach, Town of Hempstead, Nassau County and the NYSDEC have corroborated this assumption. For example, erosion continually diminishes the easternmost beaches in the Town of Hempstead between the dredging cycles for Jones Inlet. The Town and the State have attempted emergency measures aimed at preserving the cabanas, lifeguard stations, bathhouses and parking lot by placing concrete rubble, sta-pods and other similar structures on the Point Lookout section of the beach.

107. To reduce the effects of long-term erosion, which would occur without any coastal storm risk management project in place, it is anticipated that the State and local government officials would request beach placement of the material dredged from the Federal navigation channel at Jones Inlet, as they have in the past. Beach placement of sand dredged from Jones Inlet was most recently conducted in 2008 and was re-initiated in January 2014. The material removed from Jones Inlet will be placed to the west of the inlet, on the beach in Point Lookout. This material will be stockpiled and used as part of the Long Beach project, which will decrease the amount of material removed from the borrow area. The recent dredge history of Jones Inlet has

shown that the frequency at which maintenance dredging of the Inlet is required is variable and cannot be relied upon for beach fill, but if available, would be used to complement this project to ensure that the design profile is maintained.

108. During coastal storms, some of the damages incurred along the barrier island come from inundation of the bay structures on the north side of the barrier island. The alternative plans considered are solely intended to provide coastal storm risk management from erosion, wave attack and inundation due to the oceanic forces. With the implementation of a storm damage coastal storm risk management project for the barrier island of Long Beach, it is anticipated that the range of bay elevations will not change from the elevations observed in the without project condition. Therefore it is anticipated that in the with and without project conditions, flooding will continue in the back-bay areas. Note that the Town of Hempstead and other sub-county jurisdictions have taken measures to ameliorate bayside flooding, including road raising, modification of drainage, and modification of bulkheads.

V. Plan Formulation

A. Planning Needs, Objectives, and Constraints

109. This section of the report is provided to summarize the development of alternatives that was undertaken for the Feasibility Report and the design refinements that have been incorporated into this HSLRR. Section A provides the summary of the Feasibility process; Section B provides a review of the design refinements.

110. Current Needs. Over the years erosion has seriously reduced the ability of the shoreline in the project area to provide adequate coastal storm risk management of the barrier island. Continuation of this historic trend will increase the potential for economic losses and the threat to human life and safety. The Feasibility Report evaluated and recommended an implementable plan which provides coastal storm risk management to the barrier island of Long Beach against ocean storm damage, by considering various alternative means of reducing storm damage within the project area. This HSLRR does not reanalyze alternatives, but updates the recommended plan by incorporating changes in field conditions and several designs. The costs, benefits, and environmental effects of these changes are presented in this HSLRR.

111. Planning Objectives. The planning objectives for the HSLRR were identified based on the problems, needs and opportunities as well as existing physical and environmental conditions present in the project area.

112. In general, the prime Federal objective is to contribute to the National Economic Development (NED) account consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders and other Federal planning requirements. Accordingly, the following objectives have been identified.

- Reduce the threat of potential future damages due to the effects of storms, with an emphasis on inundation and recession.
- Mitigate the effect of or prevent the long term erosion that is now being experienced.
- In accordance with the limits of institutional participation, maximize NED net excess benefits.
- In developing plans of improvements, use a systems approach, which considers the barrier island as a system.

113. Planning Constraints. Planning constraints are technical, economic, environmental, regional, social and institutional considerations that act as impediments to successful response to the planning objectives or reduce the range of possible solutions.

a) Technical Constraints

- Plans must represent sound, safe, acceptable engineering solutions.
- Plans must be in compliance with USACE engineering regulations.
- Plans must be realistic and reflect state-of-the-art measures and analytical techniques. They must not rely on future research and development of key components.

- Plans which consider elimination of a segment of the project area must ensure that the elimination of such areas do not adversely affect the protected areas or the areas which have been eliminated.

b) Economic Constraints

- Plans must be efficient. They must represent optimal use of resources in an overall sense. Accomplishment of one economic purpose cannot unreasonably impact another economic system.
- The economic justification of the proposed project must be determined by comparing the average annual economic benefits that would be realized over the economic life of the project with the average annual project costs. The average annual benefits must equal or exceed the annual costs.
- Federal participation in coastal storm risk management projects requires that the project be economically justified primarily on benefits associated with coastal storm risk management. Federal funds are not used to support coastal storm risk management projects for which benefits associated with coastal storm risk reduction are less than 50 percent of the total benefits. Up to 50 percent of the total benefits can be from incidental recreation benefits to achieve the threshold economic justification of a benefit cost ratio of 1. Once unity has been achieved with no more than 50 percent recreation benefits, then all recreation benefits can be added to the total benefits to calculate the net benefits and determine the NED plan to more fully account for all the benefits to be provided.

c) Environmental Constraints

- Plans cannot unreasonably adversely affect environmental resources.
- Where a potential impact is established plans must consider mitigation or replacement and should adopt such measures, if justified.

d) Regional and Social

- All reasonable opportunities for development within the study scope must be weighed one against the other and state and local public interests' views must be solicited.
- The needs of other regions must be considered and one area cannot be favored to the unacceptable detriment of another.
- Public access plans must be obtained for those areas where sand is proposed to be placed, unless such placement is purely incidental to project function or for cost savings to the Government.

e) Institutional

- Federal and State participation must be contracted for a period of up to 50 years.
- Plans must be consistent with existing federal, state, and local laws.
- Plans must be locally supported to the extent that local interests must, in a signed cooperation agreement, guarantee all items of local cooperation including cost sharing.
- Local interests must agree to provide public access to the beach in accordance with all requirements of Federal and state laws and regulations.
- The plan must be fair and find overall support in the region and state.
- A project will be designed that conforms with Federal and State regulations in that the State is unable to participate in plans not conforming to its Coastal Zone Management

(CZM). NYS Coastal Zone Management Plan regulations state that beach erosion projects must have a reasonable probability of controlling erosion for at least 30 years.

114. Summary of Feasibility Study. During the early phases of the feasibility, the plan formulation process involved identifying possible solutions, which would meet the objectives of providing coastal storm risk management to the Long Beach Island. The preliminary alternatives considered in the initial phases of that plan formulation are as follows:

- No Action
- Beach Restoration
- Beach Restoration with Groins
- Seawall
- Seawall with Beach Restoration
- Bulkhead with Beach Restoration
- Breakwater with Beach Restoration
- Perched Beach with Beach Restoration

115. These preliminary alternatives were evaluated based on designs that provide similar coastal storm risk management with the exception of the No Action alternative. It should be noted that non-structural methods in the form of a buyout plan were considered in the reconnaissance phase and that plan was deemed to be not economically justifiable. Additionally, due to the institutional constraints off such a plan, it would not likely be implementable; therefore, a buyout plan was dropped from further consideration.

116. Based on the evaluations of preliminary alternatives for providing coastal storm risk management, the most cost effective alternative considered was determined to be beach restoration with groins. The study then considered different beach restoration configurations or plans to economically optimize the project design level. Nine beach fill alternatives were analyzed to achieve project optimization. These were:

- Plan 1: no dune with 50 ft advance nourishment only,
- Plan 2: no dune with 110 ft berm and nourishment,
- Plan 3: no dune with 160 ft berm and nourishment,
- Plan 4: +14 ft NAVD88 dune with 50 ft advance nourishment,
- Plan 5: +14 ft NAVD88 dune with 110 ft berm and nourishment,
- Plan 6: +14 ft NAVD88 dune with 160 ft berm and nourishment,
- Plan 7: +16 ft NAVD88 dune with 50 ft advance nourishment,
- Plan 8: +16 ft NAVD88 dune with 110 ft berm and nourishment,
- Plan 9: +16 ft NAVD88 dune with 160 ft berm and nourishment.

117. Plan 5 was identified as the NED plan (maximized net annual benefits) in the 1995 Feasibility Report; it was an implementable design and it was the selected plan for providing storm damage protection for the Long Beach barrier island. This plan met all of the planning objectives and was also the locally preferred plan. A description of the selected plan is provided in the following section.

118. The selected plan in the 1995 Feasibility Report incorporates a beach berm at an elevation of +9 ft NAVD88, a dune system with a top elevation of +14 ft NAVD88 and a transition of the beach berm in the western end for closure of the project into East Atlantic Beach (which opted out of the project following authorization of the plan recommended by the

1995 Feasibility Report). At the eastern end of the project, a similar closure was selected at Point Lookout. Rehabilitation of the terminal groin and the adjacent revetment was included in the plan. A series of six new groins were proposed west of the existing easternmost three groins, which would provide stabilization of the shoreline fronting the Town of Hempstead and Lido Beach. This additional groin field would also significantly decrease the volume and cost of material required in the renourishment of these areas, and therefore was determined to be economically justified.

B. Design Changes

119. There are minor design refinements that are within the parameters of the authorized project being made to the project to account for changed conditions and to be consistent with the North Atlantic Coast Comprehensive Study. These changes are depicted in Figure 14 through Figure 27 HSLRR Proposed Beach Fill Plan Sheets 1 through 14, and are discussed in the following paragraphs.

1. Reduction in Project Length (associated with East Atlantic Beach)
2. Proposed Groin Field
3. Beach fill configuration
4. Bird Nesting and Foraging Area
5. Point Lookout Terminal Groin Rehabilitation and extension
6. Rehabilitation of Existing Groins

1. Reduction in Project Length

120. Following completion of the 1995 Feasibility Report, the community of East Atlantic Beach withdrew from participation in the coastal storm risk management project. The HSLRR Recommended Plan length was shortened accordingly, with the dune line ending at Nevada Avenue, the border of the City of Long Beach and East Atlantic Beach. The berm tapers to closure with the existing shoreline west of the end of the dune line (approximately 1,500 ft into East Atlantic Beach at Malone Avenue) shown on Figure 14, Plan Sheet 1 of 14.

121. The dune is shortened by about 6,000 ft and the berm is shortened by 4,500 ft. Although not a separable constructible area, East Atlantic Beach was the most downdrift of the communities within the project area. This location made it possible to remove the recommended beach berm and dune and not adversely affect the functioning of the rest of the project. Also the degree of coastal storm risk management for the nearest adjacent community, the City of Long Beach, is not significantly affected. The economic evaluation for the rest of the project, which is discussed later in this HSLRR shows that there is no effect on the project's economic feasibility.

2. Proposed Groin Field

122. A modification to the proposed groin field is required based on the results of circulation and sediment transport modeling contained in the Technical Reanalysis and subsequently modified to be consistent with the current authorization. The modification consists of 6 groins with the first groin constructed 800 ft west of existing Groin 55 in Point Lookout and the second through fourth groins constructed further west with tapered lengths at intervals of 800 ft (shown on Figure 26 and 27, Plans Sheets 13 and 14). The remaining 2 groins would be constructed further west at 1,200 ft intervals with tapered lengths.

123. The four easternmost groins provide the coastal storm risk management (through erosion control) for the severely eroded shoreline area in Point Lookout. The remaining 2 groins would be mostly buried in the existing weldment area if constructed under current conditions; therefore, these structures are proposed for deferred construction if and when the stability of the weldment area changes. The costs and benefits of the deferred tapered groins are included in the overall plan to address the possibility that the weldment may migrate westward, possibly due to changes in the characteristics of Jones Inlet, creating erosional pressure to the east as the weldment moves. Deferring these two groins is recommended because the weldment area is currently stable and is not expected to change. The stability and position of the weldment will be monitored, as described in the following section. If the weldment changes and the two groins are deemed necessary an analysis will be performed to verify they are still economically justified and technically feasible.

124. The role of the proposed groin field is to address the problems that are occurring east of the weldment, which lie inside the Jones Inlet ebb tidal shoal. Areas to the west of the weldment presently benefit from sediment moving westward along the ebb tidal shoal. Based on the reanalysis, it is concluded that the flow of sand toward areas to the west would not be changed by the modified groin field. The construction of the new groins will not induce down drift erosion due to their location inside the shoal. Additionally, the groins were designed to taper in length, shorter groins to the west, which will act to further minimize down drift impacts. Modeling and measurement show that the groinfield extends to a point where the shoreline is accreting. Shoreline to the east of the weldment is isolated from incoming sediment transport by the ebb shoal feature. The proposed groin field will help stabilize sand in the areas receiving minimal transport.

125. Physical Criteria For Initiating Construction of Deferred Project Elements. Construction of deferred plan elements, the 2 westernmost groins and beach fill in the bird nesting and foraging area at Lido Beach, may be triggered at a future date within the 50-year project life based upon physical monitoring data. The criteria for construction will include a change from the accretive or stable condition to an eroded condition in the area where the deferred structures are to be located. The criteria include field measurements and analysis. The "trigger" for implementing the construction of the deferred project components (including design fill, and renourishment) in this area is a berm width of 250 ft or less (berm defined as the distance between the dune toe and the seawardmost +6 ft NAVD88 contour) which persists for one year. If this 250 ft or less berm were to occur, an Engineering Documentation Report (EDR) would be written to document constructing the deferred project components.

126. Any major change in the weldment would likely take place over a long period of time (year or more) that should be adequate to accomplish the construction of the deferred groin structures. This assumes that appropriate monitoring (as outlined in the Monitoring Section) and analysis are performed to first, recognize the effect and, second, to identify the cause(s). A reduction in sand supply to the weldment, and subsequent narrowing of the beach, will be noticeable over a one- to two-year period of monitoring, primarily through a constant trend in the reduction of the beach width. Because the weldment and ebb shoal are submerged and difficult to quantitatively measure, weldment dissipation or migration (along with any corresponding changes to the ebb shoal) would be noticeable over a 3-5 year period. The rate at which the beach is narrowing should determine the schedule for construction of the beach fill and/or deferred structures so that the protective nature of the project is not compromised. Details of this analysis are presented in Appendix B.

3. Beach Fill Configuration

127. The HSLRR Recommended Plan includes a beach fill component. The berm configuration was modified in the City of Long Beach and Lido Beach to include a step to reduce scarping at the water line. Berm configuration within the groin field in Point Lookout is unchanged. Details of the HSLRR Recommended Plan are shown on Figures 14 through 27.

128. The HSLRR Recommended Plan includes the same beach fill cross-section as the 1995 Authorized Plan and includes refinements to the fill offshore slope west of the ebb shoal weldment location and the incorporation of a stepped berm. Additionally, the bathymetry has been updated to current, post-Hurricane Sandy conditions and has been incorporated into the HSLRR fill layout and quantity estimates. While there was beach volume loss as a result of storms such as Hurricane Sandy, overall since the 1995 Authorized Plan, there has been accretion to the west of the Weldment in Long Beach and erosion to the east of the Weldment towards Point Lookout. The components of the 2015 HSLRR Recommended Plan beach fill include:

a) Berm fill from Point Lookout west to the western boundary of the City of Long Beach where the plan tapers into the existing shoreline in East Atlantic Beach (approximately 35,000 lf); it is noted that a 4,950 ft long area (Nickerson Beach) about a mile west of Point Lookout has ephemeral pool areas. Sand will only be placed behind these ephemeral pool areas. Design level of coastal storm risk management is maintained due to the existing dune and berm system in this section.

b) Berm: Fronting the dune, a berm width of 110 ft at elevation +9 ft NAVD88 with a shore slope of 1V: 20H will extend along the easternmost 5,000 lf of the project area (Point Lookout), and a 1V:30H shore slope for the remaining 30,250 lf (Nickerson Beach, Lido Beach and Long Beach) of the project area. It is noted that the 4,950 lf, the Nickerson Beach reach situated between these two areas, has existing shore slopes of between 1V:20H at the eastern segment of this reach to 1V:30H at the western segment. This area is designated as a bird nesting and foraging area. The beach fill template for the Lido/Long Beach reach was modified from 1V:35H (1995 Authorized Plan slope) to 1V:30H to better replicate the long-term averaged upper slope. Offshore slope for the Point Lookout reach was changed from 1V:25H to 1V:20H, to account for the steepening affect of the new groins. The fill placement template was modified to a stepped configuration to better replicate existing geometry and to reduce post-storm scarping of the berm. The fill template for the Lido/Long Beach reach was changed from a 110-ft flat berm at +9 ft NAVD88 to a 40-ft wide flat berm at +9 NAVD88, sloping on 1V:10H over 20 ft to +7 ft, extending 130 ft seaward at +7 ft NAVD88 and then sloping to meet existing bottom at 1V:30H.

c) Dune: There will be a crest elevation of +14 ft NAVD88 for a crest width of 25 ft with a 1V:5H side slopes on the landward and seaward sides of the dune (1V:3H side slope on the landward side in from of the boardwalk in the City of Long Beach). The dune extends approximately 35,000 lf from Point Lookout to the western boundary of the City of Long Beach.

d) A total sand fill quantity of 4,720,000 cy for the initial beach fill placement, including the following:

- +1.0 ft tolerance
- overfill factor of 2.5%

- advanced nourishment width of 50 ft
- e) The dune construction includes the planting of 34 acres of dune grass and the installation of 75,000 lf of sand fence for dune sand entrapment as well as the construction of dune crossing structures.
- f) Dune crossing structures included in the 1995 Recommended Plan required modification to incorporate impacts of Hurricane Sandy, provision of ADA compliant access for disabled persons, and compliance with the NY State Coastal Erosion Hazard Act (CEHA) which precludes at-grade pedestrian crossovers. At-grade crossovers are still permissible under CEHA for emergency vehicular access. All but one relocation of structures required in the recommended plan have been eliminated due to destruction of facilities by Hurricane Sandy, and their subsequent reconstruction by the City elevating them from the berm to the repaired boardwalk deck. The remaining relocation is to comfort station facilities currently located under the boardwalk deck at National Avenue in Long Beach. The existing building will be modified for access from the north, and to maintain ADA access. Modified accessways are described below and are listed from west to east, with approximate locations for each of these structures on Figure 14 through Figure 27. Plan views and cross-section views of the beach pedestrian and vehicular access structures are shown on Figure 28 and 29.
- g) A total of 38 pedestrian and vehicular accessways over the dune to the berm will be provided in the City of Long Beach in approximately the same locations as in the pre-project condition. Two (2) gravel surface vehicle and pedestrian accessways will be constructed, one east and one west of the boardwalk. Five timber (5) ADA compliant and eleven (11) non-ADA compliant timber pedestrian dune walkovers will be provided east and west of the boardwalk. Two (2) timber vehicular and pedestrian accessways off of the boardwalk will be provided at Riverside Blvd. and Franklin Blvd. Thirteen (13) ADA compliant timber pedestrian accessways off of the boardwalk will be provided.
- h) One relocation will be provided in the City of Long Beach. This will consist of modifications to the existing comfort station underneath the boardwalk at National Ave. required to maintain pre-project functionality impacted by construction of the dune.
- i) A total of 21 accessways over the dune in the Town of Hempstead will be provided. This includes construction of seven (7) ADA compliant and nine (9) non-ADA compliant new timber dune walkovers, and five (5) gravel surface vehicle and pedestrian accessways.
- j) A total of 6 accessways over the dune for Nassau County property will be provided. Two (2) gravel surface vehicle and pedestrian accessways, one (1) timber ADA pedestrian dune walkover, and three (3) timber non-ADA walkovers will be constructed.
- k) The proposed locations for each of these structures are shown as a component of the Recommended Plan in Appendix B Figure 8-1 to Figure 8-14. Typical plan, elevation and cross-section views of the beach access structures are shown on Appendix B Figures 6-1 to Figure 6-3.
- l) Renourishment of approximately 1,770,000 cy of beach fill from the offshore borrow area every five years for the 50-year period of analysis. Note that Jones Inlet may also be used as a sand source depending on the Inlet's maintenance dredging schedule.

4. Bird Nesting and Foraging Area

129. Physical Description of Bird Nesting/Foraging Area and Representative Profile. The HSLRR Plan to accommodate an area of the beach which, due to existing width and berm height, is a prime area for ephemeral pool formation and, as such, is a prime shorebird nesting and foraging area, as shown in Figures 24 – 25 (Plan Sheets 11 and 12) and Figure 30. The ephemeral pool encompasses an approximately 95 acre area and the plover and least tern nesting area encompasses an approximately 40 acre area. This plan provides coastal storm risk management using the existing berm profile and allows for the continued unimpeded use of this area as shorebird nesting and foraging areas. The area will be monitored to ensure that the existing profile is maintained; affording a consistent level of coastal storm risk management. If it is determined the profile is not being maintained, the area will be recommended for renourishment.

130. Evaluation of Equivalent Coastal Storm Risk Management. An analysis of the existing coastal storm risk management afforded by the low wide beach was performed. A representative beach profile was developed for the bird nesting/foraging area using available survey data collected from 1995 and 2002. Using this profile, the coastal storm risk management capability of the existing beach in the bird nesting/foraging area was evaluated for an equivalent level of coastal storm risk management using the Storm-Induced BEAch CHange Model (SBEACH). Details of this evaluation are presented in Appendix B. This analysis identified that the existing beach width is adequate and there is no beach fill required in this area to achieve design-level coastal storm risk management if the berm is over 250 ft (the berm defined as the distance between the dune toe and the seawardmost +6 ft NAVD88 contour). Accordingly, the adjacent beach fill areas will be tapered into the existing berm width and height, in areas where the present berm width exceeds 250 ft.

5. Point Lookout Terminal Groin Rehabilitation and Extension

131. The 175-foot long terminal groin (Groin #58) is situated within Point Lookout. The rubble-mound terminal groin and the adjacent 2,800-ft long rubble-mound revetment were constructed in 1953 by the State of New York as initial attempts to stabilize Jones Inlet and manage risk to the Point Lookout shoreline from further erosion. The recent deterioration of the groin and its decreased effectiveness at retaining sand has prompted the development and implementation of a design refinement for the rehabilitation and extension of the groin. Details of this design are presented in Appendix B. A summary of the design refinement is presented in the following paragraphs.

132. Determination of Extension Length. Presently, sediment is being transported from the southwest direction past the tip of the terminal groin into the inlet where the sediment is distributed between the northwest edge of the inlet and the flood shoal located at the northern extent of the navigation channel. The sediment is transported into the inlet from a combination of mechanisms, consisting mainly of wave- and tidal-induced currents. Wave-induced currents are generated from oblique incoming waves. The longshore component of motion produced by the obliquity of the waves generates a longshore current. This current, which generally occurs between the breaker zone and the shoreline, transports sediment toward the east. During prevailing conditions (non-storm conditions), the terminal groin is able to arrest the majority of longshore transport from entering the inlet as evidenced by the small change in beach plan within the two groin compartments over the past eight years.

133. Based on the Technical Reanalysis, the terminal groin will be extended 100 ft in order to maintain the design cross section in this area. Extending the terminal groin would decrease the amount of sediment lost toward the inlet after the beach fill project and has been designed to retain additional alongshore sediment transport without causing large changes in inlet dynamics. Approximately 30,000 cy/yr to 80,000 cy/yr of sediment annually bypasses the terminal groin and enters the inlet. The groin extension will retain the beach fill (after its equilibrium state) and trap a portion of alongshore sediment quantity, so that the shoreline in the eastern groin compartment will remain stable or increase slightly.

6. Rehabilitation of Existing Groins

134. A condition survey of the existing groins was conducted in September 2003. The purpose of this on-site inspection was to evaluate the current structural condition of the groins to evaluate the current functioning of the structures, specifically the sand trapping effectiveness. Details of this survey are presented in Appendix B. A summary of the survey results and recommendations are discussed in the following paragraphs and is presented in Section 4 of Appendix B.

135. This survey was conducted on September 29-30, 2003 and included on-site review of the structure dimensions and approximate elevations, the types of structure and construction materials, the armor stone sizes and interlocking conditions for stone groins, and the sand trapping effectiveness of the groins. A new conditions survey of the existing groins will be conducted during the development of plans and specifications.

136. The results of the existing condition survey are presented in Appendix B Table 4-1 along with the evaluations from the condition surveys in 1988 and 1993. All groin numbers are consistent with the 1993 survey lists to facilitate comparison. Design of alternatives assumed existing groins to be part of the design, with a future functional level similar to functional levels at the time of design. Four (4) out of 30 existing groins were evaluated as 'totally ineffective' and were not included as project elements. Twenty-six (26) existing groins had sufficient functionality to be retained in the recommended plan, with eighteen (18) total scheduled for rehab or rehab/extension during initial construction. All 26 functional groins are included in annual major rehabilitation cost estimates and have been included in annual groin maintenance estimates. The results of the 2003 existing condition survey and recommendations are as follows:

- Long Beach. There are 23 groins in this stretch of beach, between (and including) Groin #24 at the west end of Long Beach and Groin #48 at the east end of Long Beach. Each of these groins was evaluated as to structural condition, sand trapping effectiveness and planform holding effectiveness. Any groin rated as poor in all three of these categories was considered to be deteriorated to such a point that they have ceased functioning and therefore not candidates for rehabilitation. Based on this evaluation, 15 of the 23 groins are recommended for rehabilitation as shown in Table 4-1. The proposed rehabilitation consists of repositioning existing armor stone and adding additional armor stone along the seaward 100-330 feet of each of the groins. A minimum constructible crest width of approximately 13 ft was selected with side slopes of 1V on 2H. A primary armor weight of 5 tons was selected in order to approximately match the existing armor stone. A typical profile and cross-section of a rehabilitated groin are shown in Figure 4-1 and 4-2, respectively.
- Lido Beach. There are four groins on this length of shoreline, Groins #51-54. Each of these groins is in poor condition and considered to be deteriorated to such a

point that they have ceased functioning and therefore are not candidates for rehabilitation.

- Point Lookout. There are three stone groins on this length of shoreline, Groins #55, 56 & 58. Groins #55 & 56 are generally in good condition except for a 100 ft length of each of the head sections which requires rehabilitation by repositioning and adding additional armor stone. It is recommended that Groin #58, the terminal groin, be rehabilitated and extended 100 ft in accordance with the design proposed in the report (USACE 1999).

VI. With Project Conditions

A. Physical Conditions

137. Design Performance Unchanged from 1995 Feasibility Report. The existing condition within the project area provides a relatively low level of coastal storm risk management against storm events. The beach fill design for the HSLRR recommended plan will increase coastal storm risk management against profile recession due to storm-induced erosion, increase coastal storm risk management against inundation due to high levels of ocean storm water elevations, and increase coastal storm risk management against wave attack damages due to wave run up and wave impacts. Because the design dimensions of the beach fill in the recommended plan presented in the HSLRR are comparable to the dimensions for Plan 5, (the 1995 Authorized Plan), the same level of coastal storm risk management is provided. A discussion of the level of coastal storm risk management is presented in the following paragraphs.

138. The beach fill design will provide increased coastal storm risk management against oceanfront inundation. The improvements will not, however, lessen the storm water inundation from the back-bay side, which will continue to occur during storms. The back-bay inundation is from Reynolds Channel, over the existing bulkheads or through existing storm drains. The canals on Reynolds Channel have elevations as low as +3.5 ft NAVD88, and the design improvements will not decrease the likelihood of flooding in these locations where there will still be the potential for frequent flood damage. The existing condition level of coastal storm risk management against inundation from the Atlantic Ocean is approximately a storm event with a 10 percent chance of being equaled or exceeded in any one year. The HSLRR with-project condition designs, which include dunes, are estimated to give a level of coastal storm risk management against inundation, wave attack and erosion for ocean surges from storms that have a 1 percent chance of being equaled or exceeded in any one year. If the 2015 HSLRR Recommended Plan design level were exceeded, there would be varying risks based on the severity of the storm. Storm impacts could include lower dune crest, loss of dune volume, increased height of wave run up, farther landward wave run up and more inundation. However, these potential impacts with the designed project in place would provide greater coastal storm risk management than current without project conditions.

B. Environmental Conditions

139. Aquatic and Terrestrial Habitats. Construction of the HSLRR Plan would impact shoreline intertidal, subtidal, and upper beach and dune habitats. However, when compared to the original approved project, the Project modification will affect 110 fewer acres in the upper beach zone, 39 fewer acres in the intertidal zone, and 35 fewer acres in the sub-tidal zone. The upper beach zone and dunes represent terrestrial communities in the Project area. These areas are dominated by sand and beachgrass, therefore some impacts to the dunes and associated vegetation are anticipated primarily due to construction of permanent vehicle and pedestrian access ramps and walkways and placement of the sand barrier (i.e., dune) adjacent to the existing boardwalk in the city of Long Beach. As such, some permanent long-term impacts to the vegetated beach and dune communities are anticipated. However, impact are not deemed significant because the existing vegetated beach and dune communities are currently of relatively low overall value as a result of recreational use of the area and close proximity to high density development. Placement of groins would result in a small loss of intertidal beach and subtidal aquatic habitats located within the groin footprint. However, overall habitat within the intertidal zone would increase as the beach is widened as a result of proposed beach fill activities. In addition, groin structures themselves would reduce the rate of beach loss

in the Project Area and would provide vertical habitat for many marine organisms. The physical characteristics of the intertidal habitat will not be altered since the grain size of fill material will be the same as that of native sand in the Project area.

140. Finfish and Shellfish. Impacts during construction of the HSLRR Plan may include the mortality of clams, benthic fish communities (e.g., toadfish), and other invertebrates present in the sandy habitat of the Project area during placement of fill material and construction/extension of groins (Reilley et al. 1978, Courtenay et al. 1980, Naqvi and Pullen 1982). However, once constructed, the groins would improve habitat for some intertidal organisms (Carter 1989). For example, the crevices between the groin stones would provide protection from larger predators for the young of many species of finfish and shellfish.

141. Benthic feeding fish species (e.g., windowpane, summer and winter flounder) would experience temporary displacement until appropriate food sources recolonize the Project area (Courtenay et al. 1980). However, these and other fish that are present at the time of construction are expected to feed in the surrounding area and therefore will be unaffected by the temporary localized reduction in available benthic food sources.

142. The HSLRR Plan would impose minimal impacts during construction and for each renourishment for the local shellfish species within the Project area. No new natural resources or endangered species have been identifying within the project area since the 1995 FEIS. Most sessile species present directly underneath the Project footprint would be buried during construction. Motile shellfish species would be able to relocate temporarily outside of the immediate Project area. Based on surveys conducted in 2003 and 2012, there are only small populations of surf clam in the offshore borrow area. Therefore no significant impacts to surf clam populations are expected from the Project. Some species, such as rockweeds (*Fucus* spp.), oysters, and barnacles (*Balanus* spp.) would flourish on the newly constructed groins (Carter 1989).

143. In addition to the temporary impact to the fish and shellfish species of the Project area, a slight temporary increase in turbidity is also expected near the Project area during construction (Reilley et al. 1978, Courtenay et al. 1980, Naqvi and Pullen 1982). Increases in turbidity could affect the settling rate of shellfish ova and larva, and can clog and damage the gills of fish species (Uncles et al. 1998). However, the churned sediment would settle quickly and any impacts to the benthic fish and shellfish community would be minimal. The Project would result in a long-term beneficial impact to both fish and shellfish species of the Project area. The groins would create areas suitable for recruitment and protection for numerous shellfish species. In addition, the groins would provide habitat and food source locations for fish species.

144. Benthic Resources. The HSLRR Plan would cause short-term negative and long-term beneficial impacts to the benthic communities in the Project area (USACE 2001). Negative impacts to the benthic community would include the smothering of existing sessile benthic communities within the groin area and adverse effects to benthic organisms as a result of increased turbidity during construction. Beneficial impacts to the benthic community include the increase in food source, spawning beds, and shelter of the Project area (Reilley et al. 1978, Naqvi and Pullen 1982). No new natural resources or endangered species have been identifying within the project area since the 1995 FEIS.

145. The sessile benthic community beneath and in close proximity to the proposed groins would experience direct impacts. These species will be buried and some mortality of shellfish and polychaetes is expected for individuals that cannot escape during the construction process.

In addition, a short-term impact to the existing benthic habitat would result from burial of the benthic floral and faunal community, which would cause a temporary and local decrease in food availability for the surviving benthic community.

146. The construction and extension of groins would cause a transient increase in turbidity within the Project area. One study performed in 1995 found that increased turbidity resulted in increased biological oxygen demand (BOD) (Uncles et al. 1998). No long-term impacts to BOD would occur because sediment would settle quickly upon completion of construction.

147. The construction and extension of groins would provide living spaces for the floral and faunal benthic species. Benthic resources would begin to recolonize the Project area immediately following Project completion. Infaunal organisms are likely to recolonize the area from nearby communities and re-establish to a similar community within a 1 to 2-year period (USACE 1995). It is possible that the species composition of the benthic community that reestablishes would be slightly different than the pre-construction composition (USACE 1995). Various floral species such as rockweed and spongomorpha (*Spongomorpha spp.*), and faunal species such as barnacle, oyster, and blue mussel, are expected to move into the area and colonize living space on the groin (Moore and Seed 1986).

148. Rockweeds are known to support numerous organisms, including both autotrophs and heterotrophs. In addition, rockweeds provide shelter, moisture at low tide, and food especially for the sessile epifaunal and epiphytic groups (Oswald et al. 1984). Gastropods, bivalves, and crustaceans are all common inhabitants of rockweeds. Thus, the benthic floral and faunal species increase throughout the Project area, the food source availability for the fish species, would also increase (Carter 1989).

149. In addition to creating living spaces and increasing food availability of the Project area, the proposed Project would provide shelter from wave attacks for the existing and surrounding benthic communities. Carter (1989) found that by orienting and streamlining, some bivalves and gastropods have reduced drag coefficients and increased the capability of resisting force.

150. Reptiles and Amphibians. No reptiles or amphibians are expected to occur within the Project due to lack of suitable habitat. Therefore, there will be no long-term impacts to reptiles and amphibians as a result of the Project.

151. Birds. The shoreline of Long Beach Island provides feeding and resting areas for birds that pass through the area along the Atlantic flyway during annual migration in early spring and late fall (USACE 1998, 2003, 2004a). Heavy machinery and the increased noise levels may temporarily affect birds in the Project area during construction activities. These effects may indirectly result in displacement of individuals and/or disruptions to nesting near construction activities. In addition, proposed vehicle and pedestrian access areas will promote access to and use recreational use of beach areas. Several proposed access ramps would be located in close proximity to known shorebird nesting and foraging areas. Avian species are mobile and are expected to avoid direct mortality. In addition, in accordance with recommendations by the USFWS, most of the Project activities in the area of active nesting plovers will occur from September through April, outside the key spring and fall migration periods (Piping plover) to avoid disruption of migration activities (USFWS 2014b). Recreational use of the Long Beach shoreline is currently relatively high. Birds have adapted to human use of the area and birds have continued to use the upper beach/dune area for nesting and foraging. Impacts to birds from the additional access areas to the beach are expected to be minimal.

152. Mammals. Although there is potential for HSLRR Plan construction activities to temporarily displace any mammals present in the area and limit access to feeding or nesting habitats, these species are mobile and are expected to avoid direct mortality (USACE 2004a). In addition, the sparsely vegetated terrestrial habitats impacted by the project (upper beach and dune) typically provide low quality habitat for mammals and are used only for foraging activities. Mammals are expected to utilize other suitable areas for foraging.

153. Threatened and Endangered Species and Habitats. USACE coordinated with USFWS, NYSDEC and NMFS to assess potential impacts to threatened and endangered terrestrial and aquatic species and habitats as a result of the Project. Comments from agencies have been incorporated into the EA and were taken into consideration during Project re-evaluation and during development of Project species monitoring and adaptive management plans. The Fish and Wildlife Coordination Act 2(b) report for this Project is available in Appendix C.

154. Federal Species or Habitats of Concern. Federally listed species known to occur in the Project area include the Federally-threatened bird species, piping plover and red knot, the Federally-threatened plant, Seabeach amaranth, and transient Federally-listed threatened loggerhead, as well as the endangered Kemp’s ridley, leatherback, green turtles and Atlantic sturgeon. The remaining federally listed species that may occur in the project areas are: the endangered North Atlantic right whale (*Eubalaena glacialis*); the endangered humpback whale (*Megaptera novaeangliae*); and the endangered fin whale (*Balaenoptera physalus*).

155. The Project would potentially result in direct and/or indirect disturbances to nesting shorebirds and their broods, if any are present in the Project vicinity for this purpose at the time of construction. The USFWS submitted a Biological Opinion (BO) in November 2014 which contained Reasonable and Prudent Measures (see chart below) to ensure the project would not likely to jeopardize the continued existence of the piping plover. These measures restrict construction activities to September 1 through March 31 in areas with nesting plovers to avoid direct adverse impacts to the shorebirds (USFWS 2014b). USACE has incorporated these measures into its Project plans.

Long Beach 2015 Biological Opinion Reasonable and Prudent Measure	
Piping Plovers	<ul style="list-style-type: none"> • Conduct surveys during the spring and summer prior to construction activities to identify nesting plover (linked to initial construction and nourishment – would occur every 5 years). Devise a restoration plan in coordination with the towns (one time). Develop a biological monitoring program to evaluate plover populations and behavioral responses to habitat changes in action area from construction of hard structures and construction of the adjacent dunes and berm (would occur annually for 5 years). • Erect symbolic fencing around nests and brood rearing areas (would occur annually for 5 years). • No construction from April 1 – September 1 to avoid nesting period (initial construction and nourishment- every 5 years). • No beach fill will be placed within 1000 meters of known plover populations. • Implement a 200 meter work zone around terminal groin 58 (initial construction

and nourishment; every 5 years).

- Monitoring of invertebrates in the intertidal zone berm and backshore.
- Set up a predator management program (annual for 5 years).
- Fly LIDAR and imagery each year for a period of 5 years.
- Plant the dune from Jones Inlet to groin D and from Lidos Beach Town Park East to western extent with a mix of native dune plants species with uniformed spacing. No planting west of Groin D, except in front of the residential areas (initial construction and nourishment; every 5 years).
- No sand fencing west of groin D through Lido Beach East Town Park. But allow planting in Lido Beach Towne House Condominiums and from Prescott Street to Allevard Street (initial construction and nourishment; every 5 years).
- Cover sub aerial groins A-D with sand during construction and maintenance phases to minimize habitat fragmentation (every year).

Seabeach Amaranth

- Conduct surveys in July and August for the presence or absence in the project area (initial construction and nourishment; every 5 years).
- Erect symbolic fencing around plants (initial construction and every nourishment).
- Restrict construction no major activities in know areas June 1 – November 1 (initial construction and every nourishment).

Red Knot

- Monitor pre-concurrent and post construction for Red Knot. Devise a restoration plan in coordination with the towns (initial construction and every nourishment).
- LIDAR (use the plover LIDAR for Red Knot).

156. The Federally-listed threatened loggerhead, as well as the endangered Kemp's ridley, leatherback, and green turtles may utilize coastal resources in the Project vicinity for foraging). In accordance with the latest NMFS recommendations (NMFS 2014) , if hopper dredges are used in the inlets or offshore borrow area between mid-June and mid-November, NMFS-approved observers will be onboard the vessels to monitor the removal of the dredge material.

157. Dredging offshore areas has the potential to impact the Federally-Listed species Atlantic Sturgeon habitat by removal/burial of benthic organisms, increased turbidity, alterations to the hydrodynamic regime. Hydraulic dredges can directly impact sturgeon and other fish by entrainment in the dredge. Dredging may also impact important habitat features of Atlantic sturgeon if these actions disturb benthic fauna. (Alteration of rock substrate, often a concern for Atlantic sturgeon, is not an issue here as these do not occur in the project area). Indirect impacts to sturgeon from either mechanical or hydraulic dredging include the potential disturbance of benthic feeding areas, disruption of spawning migration, or detrimental physiological effects of resuspension of sediments in spawning areas.

158. Although little is known about natural predators of Atlantic sturgeon, there are several documented fish and mammal predators, such as sea lampreys, striped bass, common carp, minnow, smallmouth bass, walleye, grey seal, and fallfish. There are some concerns that

predation may adversely affect sturgeon recovery efforts in fish conservation and restoration programs, and by fishery management agencies. USACE has coordinated with NMFS to ensure the latest protective BMPs are incorporated into the project's Plans and Specifications detailing specific construction measures to be undertaken to minimize potential adverse effects to protected aquatic species under their jurisdiction. The requirements of Section 7(a)(2) of the Endangered Species Act have been satisfied through extensive coordination with NMFS under the emergency provisions of 50 CFR 402.05. The District continues to coordinate with NMFS to provide the latest, updated project information and current science consistent with the emergency procedures established for this action.

159. The planned construction methods will enable most work to be staged and performed from the land and the groins, thereby reducing the temporary water quality impacts and general disturbances resulting from in-water construction activities. Additionally, transient listed species are expected to avoid the Project area during construction activities. Therefore, the project is not likely to adversely affect these protected species.

160. State Species or Habitats of Concern. No State-listed threatened or endangered species of reptiles, amphibians, mammals, or vegetation were identified in the Project area, although several State-listed bird species are known to use habitats similar to those found in the Project area. Impacts and considerations that offset the impacts to the State-listed least tern, roseate tern, and common tern and special concern species black skimmer, would be similar as described for Federally-listed species.

161. Other State-listed threatened species that occur in the general area include the northern harrier, osprey, and the transient peregrine falcon and bald eagle. Construction and operation of the Project is not expected to significantly impact these species because the Project would not affect their preferred nesting habitat, and other foraging habitat is readily available in the vicinity of the Project.

162. Essential Fish Habitat. Temporary impacts on EFH are predicted during periods of active construction and would be the same as those described in EA Section 4.3.2 (Finfish and Shellfish, and Benthic Resources impact sections). Habitat would be temporarily degraded during groin construction and beach fill placement, as elevated suspended sediment levels would temporarily lower dissolved oxygen and visual feeding efficiency, and irritate gill tissue. Although sessile benthic invertebrates would likely be smothered during construction, and aquatic habitat would essentially be unavailable to motile species during construction, implementation of the proposed Project is predicted to enhance EFH over the long term. The groins would create areas of recruitment and protection for numerous shellfish species, which would also provide habitat and food source locations for fish species.

163. Aesthetics and Scenic Resources. The Project would result in the addition of several groins in the viewshed and some reconstructed/extended groins would be larger than the existing groins. However, these changes do not significantly reduce the aesthetic and scenic resources, because groins are already part of the viewshed in the Project area

C. *Air Quality Compliance*

164. The HSLRR Plan for Long Beach will comply with the Clean Air Act General Conformity (GC) requirement (40CFR§90.153) through the following options that are under coordination with the New York State Department of Environmental Conservation (NYSDEC) and the Environmental Protection Agency, Region II (EPA): emission reduction options, Surplus NOx

Emission Offsets (SNEOs) generated by the Harbor Deepening Project, the purchase of Environmental Protection Agency (EPA) Clean Air Interstate Rule (CAIR) or other available ozone season oxides of nitrogen (NOx) allowances, State Implementation Plan (SIP) accommodation. This project, as scheduled, is not de minimis under 40CFR§90.153, therefore one or a combination of these options, as feasible, will be used to meet the GC requirements. The project specific option(s) for meeting GC is detailed in the Statement of Conformity (SOC), which is required under 40CFR§90.158, and which is appended to the EA for this project.

D. Cultural Resource Impacts

165. In accordance with the Advisory Council on Historic Preservation regulations for implementing the National Historic Preservation Act (NHPA), 36 Code of Federal Regulations [CFR] Part 800, the New York District has identified two National Register eligible resources, the remains of what may likely be the *Mexico* and the *Marble* wreck. Based on the underwater investigations conducted around these wrecks in comparison with project activities, it was determined that the rehabilitation of Groin 58 or sand placement should not have an adverse effect on these two historic properties. The NYSOPRHP has concurred with the determination of no adverse effect. All correspondence with the NYSOPRHP can be found in Appendix F of the EA.

166. Historic Resources. No historic structures will be affected by the proposed project. A transatlantic cable dating from 1873 may be located within the near shore portion of the project area (USACE 1999). However, deposition of sand during construction would help to protect the cable. No adverse impacts to the cable are expected from the project (NYSOPRHP 1993).

167. Shipwrecks. Based on the remote sensing survey and underwater investigation, a wreck, possibly the *Mexico* is located approximately 300 feet from the underwater toe of the sand placement offshore of Groins 28 and 29. The *Marble* wreck is also located at least 300 feet from the sand placement area. The terminal groin, Groin 58, will be rehabilitated and extended several hundred feet to the west, moving it further away from the *Marble* wreck. Both wrecks are eligible for the National Register of Historic Places. The project activities will not have an adverse effect on either wreck. Both wreck sites will be noted on the project plans as environmentally sensitive areas. In addition, the specifications will state that no anchoring, dragging, pipe laying or other activities that could disturb the ocean bottom will be conducted in these areas. In addition, anomalies 18 and 29 are located away from the current sand placement area and are likely buried such that the project will not have an adverse effect on these potential resources (Panamerican 2014)

168. Submerged Sites. Based on cores taken at the proposed borrow area, potential lagoonal deposits occur at 20 feet depth. Submerged prehistoric sites would occur below this depth (Pickman 1993). Thus, dredging activities for the project would have no impact on submerged prehistoric sites. Should dredging depth exceed 20 feet, additional studies would be required to determine whether prehistoric deposits exist within the borrow area.

E. Economics

169. Introduction. The recommended plan would provide coastal storm risk management to the island's highly developed communities that are subject to wave attack and flooding during major storms and hurricanes. As a part of the HSLRR, an update of the project benefits was conducted to confirm the viability of the recommended project with the recommended modifications.

170. The updated cost of the project (\$209,267,000 Oct-14 price levels) was deflated to the price level of the last approved report (\$111,889,000 Oct-93 price levels) using the CWCCIS and compared to the original benefits at that time. The deflated annual average cost was \$9,456,000 and the updated BCR based on the last approved report using this updated cost value was 1.8 confirming that the project is still economically justified. To further confirm the economic justification of this project in light of changes that have resulted since the last updated benefits estimate and as a result of the storm, the team updated the structure inventory and reanalyze the benefits based on current coastal conditions. In this update, benefits were considered for the design alternative put forward by the 1995 Feasibility Report as the NED Plan, which was originally referred to as Plan 5. This plan generally provides a 110-foot wide berm backed by a dune system at an elevation of +14 ft NAVD88. Based on 1994 price levels, the NED Plan provided almost \$17 million in annual benefits and annual net excess benefits of \$8.03 million over the period of analysis of 50 years, with an overall benefit cost ratio of 1.8. The recommended plan in the HSLRR includes approximately 35,000 lf of berm backed by dune vs. 41,000 lf of dune and berm for the 1995 Authorized Plan and would provide the same level of coastal storm risk management as the NED plan.

171. The communities benefiting from the project are the City of Long Beach and the non-incorporated communities of Point Lookout and Lido Beach, both within the Town of Hempstead in Nassau County. The predominant land use in Long Beach is moderate to high-density residential development consisting primarily of single-family units, with areas of high-density residential development consisting of high-rise apartments and condominiums along the oceanfront. There are occasional areas of moderate to high density commercial and other non-residential development, particularly in the City of Long Beach. The eastern end of the island is less urbanized, with substantial recreational areas separating the Lido Beach and Point Lookout communities.

172. The populations of the various communities affected by the project are presented in Table 3. Contrary to the downward trend in the first half of the 1990s, there is now an overall upward trend in the County population figures.

Table 3: Community Populations

Census Listed Community	1990	2010
Nassau County	1,287,348	1,339,532
City of Long Beach	33,510	33,275
Town of Hempstead	725,639	759,757
Lido Beach Community	2,786	2,897

(Source: Census 1990 and 2010, US Census Bureau, US Department of Commerce)

173. Original Project Benefits. The estimates of all economic benefits were originally based on January 1994 price levels and reflected the economic condition of the floodplain as of 1992. A 50-year period of analysis and a discount rate of 8% were used. In the Feasibility Study, the benefits to be derived from the improvement were listed as:

1. Reduction of damage associated with long-term and storm-induced erosion to structures
2. Reduction of wave attack to structures
3. Reduction in inundation of structures
4. Reduced emergency response and cleanup costs

5. Reduced costs for stabilizing the existing shoreline
6. Maintenance of existing recreation value
7. Increased recreation value
8. Prevention of loss of land

174. The first five of these categories were considered coastal storm risk management benefits, and the original distribution of annual benefits for the NED plan are summarized in Table 4:

Table 4: Benefits of 1995 Authorized Plan

Coastal Storm Risk Management Benefits	Annual Benefit	% of Total
Residential Structures		
Physical	\$10,088,840	59.42
Emergency	\$558,490	3.29
Commercial Structures		
Physical	\$3,361,030	19.79
Emergency	\$55,420	0.33
Other Structures		
Physical	\$724,530	4.27
Emergency	\$11,350	0.07
Reduced Damage to Infrastructure		
Infrastructure Damage	\$152,750	0.90
Boardwalk/Access	\$4,400	0.03
Reduced Public Emergency Costs		
Emergency Protection	\$16,280	0.10
Sand/debris Removal	\$28,200	0.17
Future Protection Costs Foregone		
Incremental Cost Avoided to Place Sand on Adjacent Beaches	\$400,000	2.36
Existing Structure Protection	\$970	0.01
Other Benefits		
Recreation Benefits		
Recreation Enhancement	\$937,160	5.52
Recreation Maintenance	\$639,120	3.76
Loss of Land Benefits		
Loss of Land	\$1,440	0.01
Total Benefits	\$16,979,980	100

* (January 1994, Discount Rate 8%)

175. An October 2014 price level, a project base year of 2018, and a 3.375% Federal Discount Rate have been used to calculate benefits for this report. 2018 was selected as the project base year because that is the first year construction will be complete and benefits will be realized (project schedule is presented in Appendix C). Only those benefits considered to be of significant value to the overall viability of the project (i.e. the major benefits) have been updated in detail. This update included incorporating an analysis of risk and uncertainty into the estimated damages and benefits. Coastal storm risk management for structures and recreational benefits are considered to be the “major” benefits, and the process of updating

them is presented in detail in the following sections, while the other “minor” benefits have been updated by means of various update factors as appropriate. The updated project benefits reflect the elimination of coastal storm risk management for East Atlantic Beach.

176. Update of Residential Structure Benefits. For the 1995 Feasibility Study, an inventory/database of all structures in the study area was compiled, and generalized damage functions were developed for the various structure types. For residential structures, these functions took the form of curves relating flood depth to damage as a percentage of the structure’s depreciated structure value, whereas damage functions for non-residential structures were based on a dollar value per square foot of structure size. Damages were then calculated for residential and non-residential structures by identifying the type of damage causing the maximum impact at each structure for various storm frequencies.

177. Residential damages for with and without project conditions have been revised for this HSLRR by applying an update factor based on observed changes to residential structure values in the study area that could have an impact on the depreciated structure value. To determine significant changes in the residential structure database since the 1995 Feasibility Study, a resurvey was undertaken based on a randomly selected sample of approximately 100 structures, intended to represent 1% of the total number of residential structures.

178. Calculations documenting the derivation of the update factor can be found in Appendix D along with sample calculations of updated lifecycle structure damages. The resulting updated benefits are presented in the Summary of Updated Benefits section later in this report.

179. Update of Non-Residential Structure Benefits. In the Feasibility Study, replacement costs for non-residential structures (commercial, industrial, utility, and municipal) were based on the most typical construction practices within each usage, with reference to the Means Square Foot Cost Guide. These practices were determined to vary with the size of the structure and unit prices were varied accordingly. The original structure build quality was again used as an indicator of the physical depreciation.

180. Because less than 20% of the original benefits originated from damage to non-residential structures, a less detailed approach than for residential structures was used to update these benefits. Non-residential structure damages for with and without project conditions were updated by applying a cost index factor derived from Marshall & Swift valuation data, following a review of the original predicted sources of major non-residential damage.

181. Sample damage update calculations are presented in Appendix D, and the updated benefits for non-residential structures are presented in the Summary of Updated Benefits section later in this report.

182. Update of Recreation Benefits. For the estimation of recreational benefits in the Feasibility Study, simulated demand curves were developed to model the hypothetical behavior of people visiting the various beaches along the project area and their willingness to pay to use these beaches, given that the project creates the potential for an enhanced recreation experience. These curves were based on the results of a comprehensive questionnaire survey carried out in July and August of 1992, which asked beach visitors about their willingness to pay to use the beaches with and without the implementation of the project, and their visitation patterns. Beach use values were forecasted using a use-estimating model that assumed the increase in beach use would follow the projected growth of the local populations. Annual beach use and attendance data was acquired from the local authorities in various forms: For Long

Beach, the total numbers of daily and season passes sold were obtained, for beaches operated by the Town of Hempstead the attendance was derived from the number of parking tickets sold, and for Nickerson Beach attendance figures were received directly from County sources.

183. Because the recreation benefits contribute less than 10% of the overall project benefits, it was not considered necessary to conduct additional beach use surveys. It was considered sufficient for this study to recreate the simulated demand curves with the Willingness To Pay prices updated using a Consumer Price Index Factor, and more recent beach attendance data from the relevant local authorities. Recent beach attendance data received from the Town of Hempstead had been allocated to a number of separate beaches, which were then assigned to the two originally designated main beaches (Lido Beach and Point Lookout Beach), to ensure that valid comparisons with the Feasibility Report analyses could be made.

184. Table 5 presents summarized average beach attendance figures from the original analysis and for the period since the Feasibility Report, derived from data provided by local authorities.

Table 5: Comparison of Average Beach Attendance

Location	Average Attendance 1992 – 1993	Average Attendance
Long Beach		
Daily Pass	139,411	212,718 (2008-2010)
Season Pass	741,383	563,855 (2008-2010)
Lido Beach	123,567	278,649 (2008-2010)
Nickerson/Malibu Beach	340,511	466,468 (2008-2010)
Point Lookout Beach	133,896	283,332 (2008-2010)

185. Attendance at Nickerson Beach was found to have declined noticeably in recent years. Local officials attributed this to a range of factors including the deterioration of facilities and the increasing width of the beach, which discourages many older and less mobile patrons from visiting. This has been offset by an increase in attendance at Malibu Beach.

186. Attendance at Point Lookout Beach was also found to be generally declining during the 1990's, but has recovered dramatically. Hence, the forecast for Point Lookout Beach incorporated an adjustment factor to bring the predicted attendance into alignment with recorded figures, and the original assumed population growth was applied.

187. Only limited recent beach attendance data was received from Long Beach, and the figures suggested a steep decline in the use of season passes at some point between 1993 and 1996, for which no explanation has been suggested. Overall the data received was sufficient to derive estimated average attendance figures for input to the demand curves and the forecast of use model.

188. Update of Minor Benefits. Reductions in damage to infrastructure, public emergency costs and loss of land benefits have been considered to be minor benefits, because together they contribute less than 4% of the total benefits originally provided by the project.

189. For the purposes of the HSLRR, infrastructure damages, public emergency costs, and recreation benefits were revised by applying appropriate update factors to the originally

calculated benefits, as presented in Table 6, which summarizes the method of updates.

190. Summary of Updated Benefits. All updated benefits are presented in Table 6. These benefits were calculated assuming a project base year of 2018, project appraisal period of 50 years, a cost base of October 2014, and a Federal Discount Rate of 3.375%.

Table 6: Summary of Factors Used to Update Benefits

Benefit Category	Update Factor Source	Update Factor
Infrastructure Damage Infrastructure Boardwalk/Access	ENR Construction Cost Index	1.98 1.98
Public Emergency Costs Emergency Protection Sand/Debris Removal	Consumer Price Index	1.59 1.59
Future Protection Costs Incremental Cost Avoided to Place Sand on Adjacent Beaches Existing Structure Protection	Consumer Price Index	1.59 1.59
Recreation Recreation Enhancement Recreation Maintenance	Consumer Price Index and recent beach attendance data	1.59 1.59
Loss of Land	Consumer Price Index	1.59

Table 7: Summary of Updated Benefits

HSLRR Recommended Plan Benefit Categories

Category	Physical or Emergency	Amount
Residential	Physical	\$9,499,000
	Emergency	\$3,944,000
Apartment	Physical	\$7,975,000
	Emergency	\$172,000
Commercial	Physical	\$3,941,000
	Emergency	\$95,000
Industrial	Physical	\$105,000
	Emergency	\$2,000
Municipal	Physical	\$814,000
	Emergency	\$52,000
Utility	Physical	\$94,000
	Emergency	\$2,000
<i>Sub Totals</i>	<i>Physical</i>	<i>\$22,428,000</i>
	<i>Emergency</i>	<i>\$4,267,000</i>
Sub Total Structures		\$26,695,000

Category	Physical or Emergency	Amount
Damage to Infrastructure		
	Infrastructure Damage	\$302,000
	Boardwalk/Access	\$9,000
Public Emergency Costs		
	Emergency Protection	\$24,000
	Sand/Debris Removal	\$40,000
Future Protection Costs		
	Incremental Cost Avoided to Place Sand on Adjacent Beaches	\$634,000
	Existing Structure Protection	\$2,000
Recreation Benefits		
	Recreation Enhancement	\$1,486,000
	Recreation Maintenance	\$1,014,000
Loss of Land		\$2,000
Sub Total Other Benefits		\$3,513,000
Total Benefits		\$30,208,000

(October 2014 Price Level, Discount Rate 3.375%)

F. Cost Estimate

191. First Costs. This section presents a detailed cost estimate for initial construction, renourishment and maintenance resulting in total and annualized project costs for the HSLRR recommended coastal storm risk management plan (described earlier on Pertinent Data page and in Section I Introduction). The HSLRR plan provides for periodic renourishment at 5-year intervals, maintenance of the dune, monitoring and major rehabilitation to restore the design beach profile damaged by significant storm events beyond that designed for in the nourishment cycle volumes. There are no utility extensions or modifications required for this project.

192. Basis of Cost. Cost estimates presented herein are based on October 2014 price levels. The beach fill estimate is based on use of the offshore borrow area designated in the Feasibility Study. A large hopper dredge is assumed to dredge the material, travel to a pump-out location, and pump the sand to shore using a booster pump. There it will be placed and graded by a shore crew consisting of bulldozers and loaders. Groin construction is based on utilization of land-based equipment with construction proceeding from the landward end of the groin crest out to the seaward crest. Stone costs for groin construction are based on trucking stone from a New York quarry. The inshore end of the groin will require open cut excavation in order to construct the design section. The groins are to be constructed prior to beach fill placement. Construction of the shoreline structures (pedestrian walkovers, vehicle walkovers, etc) is assumed to begin after the beach fill placement begins and there are finished dune sections in place. Dune

seeding and plantings will begin after the shorelines structures have been completed in each area.

193. Estimated First Cost. The estimated project first cost includes real estate administration costs and pertinent contingency, engineering and design and construction management costs. The estimated project first cost in October 2014 prices, including the cost of the 2 groins as deferred construction, is \$209,267,000. The cost of the project without the 2 deferred groins is \$198,017,000. Details of the first cost estimate are shown on Table 8.

194. Continuing Construction Costs. Continuing construction costs consist of periodic beachfill renourishment costs, major rehabilitation costs, and coastal monitoring costs. These are discussed further in the following paragraphs. The total estimated continuing construction cost (first cost) for this project is \$ 368,655,000.

195. Engineering and Design and Construction Management. Engineering and design costs include preparation of the subsequent project design memorandum, plans & specifications, pre- and during-construction cultural, environmental and coastal monitoring and the development of the PPA. Engineering and design costs (excluding cultural, environmental and coastal pre- and during construction monitoring) are based on roughly 16% of the direct construction costs. Construction management costs are based on roughly 7% of the direct construction costs.

196. Contingency. Per Cost Engineering Regulations, an Abbreviated Risk Analysis was run for this project. The risk areas for this project are the beachfill quantity, the stone quantity, and the dredge mobilization costs. As a result of the analysis, a value of 21.92% was determined for contingency for the construction feature accounts and 14.91% for both PE&D and S&A. The results portion of the ARA can be found in Appendix C.

197. Annualized Costs. The estimates of annual costs for the economic evaluation of the Recommended Plan are based on 50-year period of analysis and a discount rate of 3.375%. The annual charges include the annualized first cost and interest during construction, the annualized periodic nourishment costs, the annualized major rehabilitation costs, post-construction monitoring costs and annual dune and new groin maintenance. Interest during construction was developed for the first cost of the project constructed over the 39 month (3.25 year) project period at a 3.375% discount rate. Annual cost is used for economic justification analysis and includes the cost of the 2 deferred groins. Total annual charges for the recommended plan are \$16,655,000 and are summarized in Table 9.

198. Periodic Renourishment. The periodic renourishment volume to be placed at 5-year cycles subsequent to commencement of construction and throughout the 50-year economic life is 1,770,000 CY per cycle. The renourishment beach fill is assumed to be placed in the same manner as the beach fill for the main contracts; with a large hopper dredge pumping the fill onto the shore, and a shore crew placing the material. Annualized renourishment costs are shown in Table 9, and more detail can be found in Appendix C.

199. Major Rehabilitation Costs. Major rehabilitation costs are for restoring the design profile due to significant storm events beyond those that were designed for in the renourishment cycle. The threshold at which major rehabilitation costs are incurred is based on the storm event that causes the erosion volume to exceed 15 cy/lf along the beachfront. This is the average nourishment volume anticipated to be available at the midpoint of the renourishment cycle because the significant storm event has a 50% chance of occurring earlier or later than the cycle midpoint. Annualized major rehab costs are shown in Table 9, and more detail can be

found in Appendix C.

200. Monitoring Costs. Post-construction monitoring costs include both coastal monitoring and environmental monitoring activities to be performed over the 50-year period of analysis. Annualized coastal monitoring and environmental monitoring costs are shown as separate monitoring activities in Table 9. Coastal monitoring consists of beach profiles, sediment samples, LiDAR, wave gauges, data analysis reports and borrow area monitoring at an annual cost of \$305,000. Environmental monitoring consists of the Biological Opinion measures (to address plovers, seabeach amaranth and red knot) and biological borrow area monitoring at an annual cost of \$309,000. A detailed breakout of the costs and timing of each coastal monitoring and environmental monitoring activity can be found in Appendix C.

201. Dune/Groin Maintenance Costs. Dune and groin maintenance costs are based on 0.5% of initial new groin, groin extension and groin rehabilitation costs from First Cost table on TPCS, plus annualized dune and beach maintenance cost estimated (by the City) to be \$100,000 (Long Beach) + \$50,000 (Hempstead). Additionally, this includes 300 CY of sand to be placed on Groins A-D every year of the project (except for renourishment years). Annualized dune/groin maintenance costs are shown in Table 9.

G. Benefit Cost Ratio

202. Recommended Plan. The first cost estimate (October 2014 price level) for the HSLRR Recommended Plan is presented in Table 8. As shown in Table 9, the annual cost for the Recommended Plan is \$16,655,000, which results in a benefit cost ratio (BCR) of 1.8 with the current annual benefits of \$30,208,000 (see Table 7).

Table 8: First Cost
Long Beach Island, NY

October 2014 Price Level

Hurricane Sandy Limited Reevaluation Report Cost Estimate Summary

Feat. Acct.	Description	Qty	UoM	Contract Cost	Subtotal	Cont. %	Cont \$\$	Total Cost
Contract 1								
01	Lands & Damages	1	LS	\$ -	\$ 125,010	20.00%	\$ 25,000	\$ 150,010
	Total Lands & Damages			\$ -	\$ 125,010		\$ 25,000	\$ 150,010
10	Breakwater and Seawalls							
	Mobilization & Demobilization	1	LS	\$ 4,304,493	\$ 4,304,493	21.92%	\$ 943,618	\$ 5,248,110
	Point Lookout - Groin Rehabilitation	1	LS	\$ 3,339,032	\$ 3,339,032	21.92%	\$ 731,972	\$ 4,071,004
	Point Lookout - Groin #58 Rehabilitation	1	LS	\$ 7,187,669	\$ 7,187,669	21.92%	\$ 1,575,659	\$ 8,763,327
	Point Lookout - New Groin Construction (Groin A)	1	LS	\$ 7,007,122	\$ 7,007,122	21.92%	\$ 1,536,079	\$ 8,543,201
	Point Lookout - New Groin Construction (Groin B)	1	LS	\$ 5,414,402	\$ 5,414,402	21.92%	\$ 1,186,928	\$ 6,601,330
	Point Lookout - New Groin Construction (Groin C)	1	LS	\$ 5,160,847	\$ 5,160,847	21.92%	\$ 1,131,345	\$ 6,292,192
	Point Lookout - New Groin Construction (Groin D)	1	LS	\$ 4,619,323	\$ 4,619,323	21.92%	\$ 1,012,634	\$ 5,631,957
	City of Long Beach - Groin Rehabilitations	1	LS	\$ 22,565,010	\$ 22,565,010	21.92%	\$ 4,946,632	\$ 27,511,642
	Additional Insurance	1	LS	\$ 586,976	\$ 586,976	21.92%	\$ 128,675	\$ 715,651
	Total Breakwaters & Seawalls			\$ -	\$ 60,184,874		\$ 13,193,541	\$ 73,378,416
	Engineering & Design	1	LS	\$ 11,300,671	\$ 11,300,671	14.91%	\$ 1,684,612	\$ 12,985,283
	Construction Management	1	LS	\$ 4,125,574	\$ 4,125,574	14.91%	\$ 615,007	\$ 4,740,581
	Total Contract #1 (WITHOUT Deferred Groins)			\$ -	\$ 75,736,129		\$ 15,518,160	\$ 91,254,289
Contract #1 - Deferred Groins								
10	Breakwaters and Seawalls							
	Groins E & F (Deferred)	2	EA	\$ 7,577,409	\$ 7,577,409	21.92%	\$ 1,661,096	\$ 9,238,505
	Total Breakwaters & Seawalls			\$ -	\$ 7,577,409		\$ 1,661,096	\$ 9,238,505
30	Engineering & Design	1	LS	\$ 1,231,329	\$ 1,231,329	14.91%	\$ 183,556	\$ 1,414,885
31	Construction Management	1	LS	\$ 519,426	\$ 519,426	14.91%	\$ 77,432	\$ 596,857
	Total Contract #1 (WITH Deferred Groins)			\$ -	\$ 85,064,293		\$ 17,440,244	\$ 102,504,537

Long Beach Island, NY

October 2014 Price Level

Hurricane Sandy Limited Reevaluation Report Cost Estimate Summary

Feat. Acct.	Description	Qty	UoM	Contract Cost	Subtotal	Cont. %	Cont \$\$	Total Cost
Contract 2								
01	Lands & Damages	1	LS	\$ -	-	20.00%	\$ -	-
	Total Lands & Damages			\$ -	-		\$ -	-
02	Relocations	1	LS	\$ 396,306	396,306	21.92%	\$ 86,877	483,183
	Total Relocations			\$ 396,306	396,306		\$ 86,877	483,183
17	Beach Replenishment							
	Mobilization and Demobilization	1	LS	\$ 4,016,702	4,016,702	21.92%	\$ 880,529	4,897,231
	Hydraulic Beach Fill	4,720,000	CY	\$ 55,057,882	55,057,882	21.92%	\$ 12,069,618	67,127,500
	Shoreline Structures	1	LS	\$ 9,425,688	9,425,688	21.92%	\$ 2,066,270	11,491,959
	Sand Fence	75,000	LF	\$ 357,713	357,713	21.92%	\$ 78,417	436,129
	Dune Grass	34	ACR	\$ 656,731	656,731	21.92%	\$ 143,966	800,697
	Total Beach Replenishment			\$ 69,514,716	69,514,716		\$ 15,238,800	84,753,516
30	Engineering & Design	1	LS	\$ 13,961,000	13,961,000	14.91%	\$ 2,081,192	16,042,192
31	Construction Management	1	LS	\$ 4,772,000	4,772,000	14.91%	\$ 711,371	5,483,371
	Total Contract #2			\$ 88,644,022	88,644,022		\$ 18,118,240	106,762,262
	Total First Cost (WITHOUT deferred groins)			\$ 164,380,151	164,380,151		\$ 33,636,400	198,016,551
	Total First Cost (WITH deferred groins)			\$ 173,708,315	173,708,315		\$ 35,558,484	209,266,799

Table 9: Annual Costs

Long Beach Island, NY

Annualized Cost Summary

First Cost ^(a)	\$	209,267,000
 Investment Cost		
Interest During Construction ^(b)	\$	15,039,000
Total Investment Cost:	\$	224,306,000
 Annual Costs		
Annualized Investment Cost ^(c)	\$	9,348,000
Annualized Scheduled Renourishment ^(d)	\$	5,598,000
Annualized Major Rehab Cost ^(e)	\$	490,000
Annual Dune & Groin Maintenance Cost ^(f)	\$	605,000
Annual Environmental Monitoring Cost ^(g)	\$	309,000
Annual Coastal Monitoring Cost ^(h)	\$	305,000
Total Annual Cost*	\$	16,655,000

*October 2014 Price Level

- (a) Total first cost without sunk PED costs.
- (b) Based on 2 construction contracts: 28 months 16 months of construction @ 3.375% (IDC E&D, RE and Sunk costs calculated separately and included in this total)
- (c) $I = 3.375\%$ and $n = 50$ yrs
- (d) From Renourishment Cost Table
- (e) From Annualized Major Rehabilitation Cost Table
- (f) Based 0.5% of initial new groin, groin extension and groin rehabilitation costs from First Cost table on TPCS Plus annualized dune and beach maintenance cost estimated (by the City) to be \$100,000 (Long Beach) + \$50,000 (Town of Hempstead). Additionally, this includes 300 CY of sand to be placed on Groins A-D every year for the life of the project - assumed to be trucked sand as dredging would not be cost effective.
- (g) Environmental Monitoring includes Biological Opinion Measures and Borrow Area Monitoring. The LiDAR taken each year will be used for both environmental and coastal engineering purposes when required.
- (h) Coastal Monitoring includes beach profiles, sediment samples, wave gauges, data analysis reports and borrow area monitoring. One post fill LiDAR in year 1 is included. LiDAR for year 2, 3, 4, 5 and every other year after that is covered by the Environmental Monitoring tasks and costs.

VII. Selected Plan

A. General

Table 10: Comparison of 1995 Authorized Plan to 2015 HSLRR Plan

1995 Authorized Plan	2015 HSLRR Plan
The plan included 41,000 linear feet of beachfill and generally extended from the eastern end of the barrier island at Point Lookout to Yates Avenue in East Atlantic Beach where the plan tapered into the existing shoreline at Oneida Avenue in Atlantic Beach. The plan consisted of:	The plan includes approximately 35,000 linear feet of project area extending from the eastern end of the barrier island at Point Lookout to the western boundary of the City of Long Beach at Nevada Avenue where the plan tapers into the existing shoreline at Malone Avenue in East Atlantic Beach. The plan consists of:
A dune with a top elevation of + 15 ft NGVD29, a top width of 25 ft, and landward and seaward slopes of 1V:5H	A dune with a top elevation of +14 ft NAVD88 (equivalent to +15 ft NAVD29)*, a crest width of 25 ft, and landward and seaward slopes of 1V:5H (1V:3H on landward slope fronting the boardwalk)
A beach berm extending 110 ft from the seaward toe of the recommended dune at an elevation of +10 ft NGVD29, thus gradually sloping approximately between 1V:25H and 1V:35H to match the existing bathymetry	a. In Point Lookout, a beach berm extending a minimum of 110 ft from the seaward toe of the recommended dune at an elevation of +9 ft NAVD88 (equivalent to +10 ft NAVD29), then sloping at 1V:20H to intersection with existing bathymetry;
	b. In the Nickerson Beach area in Nassau County and in the Town of Hempstead, dune only (no berm) placed along approximately 5,000 lf of shoreline. Existing berm provides the equivalent level of risk reduction and will remain undisturbed to allow for bird nesting and foraging area for piping plovers and least tern
	c. In Lido Beach and the City of Long Beach, a stepped beach berm with equivalent berm width extending 40 ft from the seaward toe of the recommended dune at an elevation of +9 ft NAVD88, a 1V:10H slope downward to +7 ft NAVD88, a 130 ft flat berm at +7 ft NAVD88, then sloping 1V:30H to intersection with existing bathymetry
A total sandfill quantity of 8,642,000 cy for the initial fill placement, including tolerance, overfill and advanced nourishment	A total sandfill quantity of 4,720,000 cy for the initial fill placement, including tolerance, overfill and advanced nourishment (based on 2013 post-Hurricane Sandy survey)
29 acres of planting dune grass and 90,000 linear ft of sand fence	34 acres of planting dune grass and mixed native species and installation 75,000 lf of sand fence, excluding areas identified in the Biological Opinion.
In the City of Long Beach, a total of 41 pedestrian and vehicular accessways over the dune to the berm will be provided including: <ul style="list-style-type: none"> • 16 dune walkovers and 13 timber ramps for access from the boardwalk • 12 vehicle access ramps over the dunes 	In the City of Long Beach, a total of 38 pedestrian and vehicular accessways over the dune to the berm will be provided including: <ul style="list-style-type: none"> • 21 timber dune walkovers – ADA • 13 timber dune walkovers from boardwalk – ADA • 2 timber vehicle and pedestrian accessways from boardwalk located at Laurelton Boulevard and Long Beach Boulevard • 2 gravel surface vehicle accessways located at New York Avenue and Pacific Boulevard

1995 Authorized Plan	2015 HSLRR Plan
<p>In the Town of Hempstead, a total of 18 pedestrian and vehicular accessways over the dune to the berm will be provided including:</p> <ul style="list-style-type: none"> • 11 timber dune walkovers • 7 vehicular accessways 	<p>In the Town of Hempstead, a total of 21 pedestrian and vehicular accessways over the dune to the berm will be provided including:</p> <ul style="list-style-type: none"> • 7 timber dune walkovers – ADA • 9 timber dune walkovers – non ADA • 5 gravel surface vehicle and pedestrian accessways
<p>Nassau county walkovers were originally included in Town of Hempstead totals.</p>	<p>In Nassau County, a total of 6 pedestrian and vehicular accessways over the dune to the berm will be provided including:</p> <ul style="list-style-type: none"> • 1 timber pedestrian dune walkover - ADA • 3 timber pedestrian dune walkover – non ADA • 2 gravel surface vehicle and pedestrian accessways
<p>6 new groins at the eastern end of the island</p>	<p>4 newly constructed groins at the eastern end of the island (additional 2 groins are deferred and may be built in the future if required)</p>
<p>Rehabilitation of 16 existing groins, including the rehabilitation of 640 ft of the existing revetment on the western side of Jones Inlet</p>	<p>Rehabilitation of 17 of these existing groins, plus the rehabilitation and 100 ft extension of the existing terminal groin at Point Lookout (18 structures total) to take place during initial construction plus inclusion of all 26 major rehabilitation and groin maintenance estimates.</p>
<p>Advanced nourishment to ensure the integrity of the initial fill design and periodic renourishment of approximately 2,111,000 cy of fill material at 5 year intervals for the 50-year period of analysis.</p>	<p>Advanced nourishment to ensure the integrity of the initial fill design and periodic renourishment of approximately 1,770,000 cy of fill material at 5 year intervals for the 50-year period of analysis.</p>
<p>Beach fill for the proposed project is available from an offshore borrow area containing approximately 36 million cy of suitable beach fill material, which exceeds the required initial fill and all periodic renourishment fill operations. The borrow area is located approximately one mile offshore (south) of the barrier island of Long Beach.</p>	<p>Beach fill for the proposed project is available from an offshore borrow area containing approximately 36 million cy of suitable beach fill material, which exceeds the required initial fill and all periodic renourishment fill operations. The borrow area is located approximately one mile offshore (south) of the barrier island of Long Beach.</p>
<p>Total First Cost is \$126,466,000 (updated to October 2014 Price Levels using CWICCS Index, feature account 17 – Beach Replenishment)</p>	<p>Total First Cost = \$209,267,000</p>
<p>non-Federal sponsor Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) requirements are based on the project features (beach fill, stone groins, dune vegetation and walkovers/access). These OMRR&R requirements include inspections, enforcement that project features are not damaged, operating the beach (ex: trash collection) and maintaining dune vegetation survival. Additional detail presented in EN Appendix.</p>	<p>non-Federal sponsor OMRR&R are the same because the project features basically have not changed for the 2015 HSLRR Recommended Plan.</p>

* This HSLRR reports elevation updated to the current datum, NAVD88. NAVD88 is approximately 1 ft different than NGVD29.

B. Monitoring

203. A monitoring program is proposed to collect and analyze physical data in a systematic manner to verify design parameters, check on the status of the project in providing erosion control, coastal storm risk management and recreational benefits and address environmental concerns. The components of the monitoring plan are described in the following paragraphs. The annualized cost of coastal monitoring is \$305,000 and the annualized cost of environmental monitoring is \$309,000. The detailed breakout of the costs and timing of the coastal monitoring and environmental monitoring activities can be found in Appendix C.

204. Coastal Monitoring - Beach Fill Monitoring. Beach profiles will be surveyed twice per year (spring and fall) following initial construction throughout the life of the project (50 years). A total of 20 profiles will be surveyed throughout the City of Long Beach. In addition, from Lido Beach to Point Lookout, 30 beach profiles should be surveyed at 500-ft spacing from E1085000 to E1100000 to document the evolution of the ebb shoal attachment location. Repetitive surveys of these profiles will track the movement of placed beach fill alongshore and offshore and will provide estimates of subsequent erosion and accretion. The survey will capture characteristics of the post-winter and post-summer beach and all survey activities will avoid impact to nesting birds. The frequency of beach profile surveys has increased from once per year in the 1995 Authorized Plan to twice per year in this HSLRR based upon the best available engineering techniques and the lessons learned from Hurricane Sandy and the attempt to repair damaged projects through the emergency rehabilitation work accomplished through the Flood Control and Coastal Emergencies (FCCE) Program. The experience following Hurricane Sandy demonstrated the importance of having the best available pre-storm project condition to compile accurate FCCE funding requests in an extremely timely manner.

205. Beach sediment grab samples will be collected once each nourishment cycle to define the redistribution of sediment after placement. Aerial photography will be acquired at the time of prefill, postfill, annually for five years, and every other year thereafter for a five-year period.

206. A directional wave gauge will be deployed seaward of central Long Beach. The gauge will be located west of the ebb shoal attachment point in Long Beach at a location to be determined in coordination with the City of Long Beach. The gauge will assist in quantifying the driving forces behind changes to the native and constructed beach.

207. Data analysis of beach fill response information will include profile volume change and shape readjustment, area of loss or gain on profiles, volume of beach fill remaining in the project, assessment of alongshore and cross-shore beach fill movement from beach and nearshore placement area, seasonal and storm response and shoreline change.

208. Coastal Monitoring - Borrow Area Monitoring. The Long Beach borrow area will be monitored to determine borrow area infilling rates and borrow area reusability. Hydrographic surveys, vibracores and a subbottom survey will be taken at the end of the first nourishment cycle to determine type and quantity of sediment filling in the dredged areas. Hydrographic surveys of the borrow area will be taken before construction (prefill), after construction (postfill), and just prior to each renourishment (every five years). These will be compared to determine borrow area infilling rates and patterns.

209. Every five years or when a potential trigger condition is met for construction of deferred structures, hydrographic surveys that include the inlet and the exterior of the ebb and flood shoals should be performed. The surveys, which could indicate, for example, changes in the

long-term supply of sediment to the shoreline, indicate a need for increased beach fill in the groin field.

210. **Environmental Monitoring.** Reasonable and prudent measures identified in the Biological Opinion require a number of the following different environmental monitoring activities: piping plover surveys and biological monitoring program, invertebrate monitoring in the intertidal zone, berm and backshore, setup a predator management program, fly LiDAR and imagery, conduct sea beach amaranth surveys in July and August and monitor pre-concurrent and post construction for red knot and devise a restoration plan in coordination with the local jurisdictions. Biological monitoring of the borrow area will be required each year, for five years, following completion of the beach fill activities. The detailed costs and timing of the environmental monitoring activities related to the Biological Opinion Measures and biological monitoring of the borrow area can be found in Appendix C.

C. *Public Access*

211. **Background.** The purpose of the public access plan is to describe public accessibility to the proposed dune and beach area that will be created as a result of this project. In order for the project to conform to Federal and State regulations, public access is required. The requirement for public access shall be limited to such areas that receive beach fill for the purpose of providing coastal storm risk management. Public access requirements shall not be required for areas where coastal storm risk management and restoration is incidental to the coastal storm risk management of publicly owned shores or if such coastal storm risk management would result in public benefits.

212. The geographical scope of this public access plan includes the beachfront areas, which shall be provided beach fill in accordance with the recommended coastal storm risk management plan for Long Beach Island, New York. The recommended HSLRR plan extends from the easternmost boundary at Point Lookout to the westernmost boundary of the City of Long Beach. The taper section of beach fill between Long Beach and East Atlantic Beach is considered to be incidental to the coastal storm risk management provided to the City of Long Beach, and is therefore not required to provide a plan for public access. The scope of the public access plan is limited to the areas east of the western boundary of the City of Long Beach to the terminal groin at Point Lookout.

213. **Shoreline Ownership Category and Project Benefits.** In accordance with ER 1165-2-130, all of the shores within the geographical scope of this project are considered to be under the general category of "Publicly Owned and/or Privately Owned with Public Benefits" for the purpose of Coastal Storm Risk Management. Land loss and recreation benefits are considered to be incidental for the coastal storm risk management purpose of this project.

214. **Project Access.** The HSLRR recommended coastal storm risk management plan is described earlier on the Pertinent Data page and in Section I Introduction. In order to provide and maintain coastal storm risk management values of the proposed dune, access through the dune conservation areas will be limited to public or private dune accessways. The locations of the proposed accessways are described and delineated in the plan sheets. Property owners shall have the right to construct private dune walkover structures provided that such structures do not violate the integrity of the dune in shape or dimension. Such structures shall be in accordance with NYSDEC Law and require approval from USACE.

215. The Point Lookout Civic area and the Lido Civic area (between Lido Towers and Lido Townhouses) are special park districts that lease land from the Town of Hempstead. The agreement, in its present form, between these special park districts and the Town of Hempstead, limits the public access to the beach. In order to meet Federal and New York State Public Access regulations, within these properties, additional access points are proposed. A dune crossover structure is proposed at Ocean Avenue in Point Lookout via a sand walkway from the parking area located at Point Lookout Town Park to the back of groin 55 in the Point Lookout Civic area. This walkway will be located in front of the primary dune and will connect to the Freeport Avenue entrance on Ocean Avenue. The existing dune walkover at Biaritz Street (currently identified for extension) is proposed as a public access point to satisfy public access requirements in the Lido Civic area.

216. Public Access Plans. The City of Long Beach, the Town of Hempstead and Nassau County have submitted separate plans to illustrate the public access provisions in their municipalities. The public access requirements for the receipt of federal funding for hurricane storm damage reduction projects have currently been met for this project. The public beach access points are closer than the required distance of every ½-mile between points. Adequate parking is available in the form of curbside parking open/unrestricted to the public in Long Beach, parking lots in Lido and Point Lookout and/or public transportation. The public access requirements will also be confirmed prior to award of the construction contract(s) to further ensure adherence to federal guidelines. These updated plans collectively serve as an update to the public access plan, located in Appendix F.

D. Real Estate Requirements

217. All lands required for the project are owned in fee either by Nassau County, the Town of Hempstead or the City of Long Beach, with the exception of a section of the dune and beach nourishment areas located on two privately owned parcels under two different ownerships in the Lido Beach section of the Town of Hempstead. The privately owned parcels comprise a total of approximately 4.31 acres of privately owned beach front (Lido Beach Towers 3.67 acres & Lido Beach Townhouses: 0.64) acres, where the ownership extends down to the mean high water (MHW) line. The uses of these lands are multi-family residential, with a private beach recreational component. This real estate is required for project implementation, and therefore a perpetual beach storm damage reduction easement will be used for this project.

218. A preliminary level appraisal was undertaken for the two privately owned parcels to identify the impact of acquiring these real estate interests, and the costs associated with this impact. The initial appraisal indicated that the value of the individual units on these lots is in part due to the fact that these units include access to a private beach. No damages were estimated.

219. The LERRD requirements over private properties in the project are to be acquired by the town of Hempstead, which may exercise its eminent domain authority, if necessary, to acquire the real estate. The municipal entities owning lands in the project will provide representations and warranties stating that they own the lands for use in the project and are legally capable to grant an access agreement to the sponsor. By way of the above processes, the sponsor has the resources to accomplish the acquisition of interests in the real estate necessary for the construction, rehabilitation and operation and maintenance of the project. Real estate required to build the recommended plan is described as follows.

220. Perpetual Beach Storm Damage Reduction Easement. Supporting lands for these features are mainly municipally owned beach recreation areas. These lands are owned in fee

simple by the City of Long Beach, the Town of Hempstead and Nassau County and have existing public access. Moreover, the above named municipalities will enter into written sub-agreements with the NYSDEC who is the primary non-Federal sponsor for the project. These publicly owned lands comprise a total of approximately 35,000 lf of project shoreline, which includes the perpetual beach storm damage reduction easement areas. These lands will be committed to the project by the municipalities. The sponsors' interest in these municipally owned lands will be a long term "Easement" to enter upon the lands to specifically construct, operate and maintain the project. The above interest will provide the sponsor(s) with sufficient control of the real estate so as to rehabilitate, construct, operate and maintain the dune and beach nourishment areas. The existing "as is" value of the beach lands to be acquired will be offset by the benefits provided from the project. Further, the underlying landowners' utility will be enhanced by the improved (widened) beaches. Therefore, the estimated nominal value of the required "interests" that are to be "acquired" for municipal owned property is \$10 dollars for all publicly owned lands.

221. The perpetual beach storm damage reduction easement will also be located on the two privately owned parcels under two different ownerships. These privately owned parcels comprise a total of approximately 4.31 acres (Lido Beach Towers 3.67 acres & Lido Beach Townhouses: 0.64 acres) of privately owned beach front, which includes the perpetual beach storm damage reduction easement area. The standard approach for a coastal storm risk management project, (In accordance with federal requirements) is for the necessary Real Estate to be secured with a "Perpetual Beach Storm Damage Reduction Easement", which allows for limited right to use, access, and modify these areas.

222. Work/Staging Areas. Access roads and staging areas necessary for construction as determined during the Plans and Specs phase will be provided by the Sponsor. Access will be acquired through Temporary Work Easements. This will provide the Corps with sufficient ingress and egress for accessing the project for construction.

223. Walkovers and Vehicle Access Ramps. There are neither lands nor interests in lands to be acquired specifically for these features of the project. The walkovers and vehicle and pedestrian access ramps will be constructed in the easement area which will have been previously acquired by the non-Federal sponsor.

224. Groins/Terminal Groin (new and rehabilitation of existing). There are no lands to be acquired for these features of the project. All lands supporting existing groins as well as lands for proposed groins are owned in fee simple by the municipalities including the City of Long Beach, the Town of Hempstead and Nassau County. The municipalities also own lands adjacent to and abutting the immediate supporting lands of the groins. The Perpetual Beach Storm Damage Reduction Easement areas for these lands is sufficient to access the groins and conduct the proposed construction and rehabilitation and operation and maintenance.

225. Summary. The LERRD requirements over private properties in the project are to be acquired by the Town of Hempstead with the sponsor (NYSDEC) providing its eminent domain authority, if necessary, to acquire the real estate. The municipal entities owning lands in the project will provide representations and warranties stating that they own the lands for use in the project and are legally capable to grant "Easement" to the sponsor. By way of the above processes, the sponsor has the resources to accomplish the acquisition of interests in the real estate necessary for the construction, rehabilitation and operation and maintenance of the project. The non-Federal sponsor cost is estimated to be \$125,000 for administrative costs associated with the private land acquisition. The land payments cost is estimated to be \$10 and contingency is not applied. The federal government will reimburse the non-Federal sponsor for

these costs. In addition, there is a \$25,000 cost for 20% contingency for all combined LERRD costs described.

Table 11. Summary of Anticipated Project Real Estate Costs:

Item	Cost
Land Payments	\$10
Acquisitions (administrative costs by non-Federal sponsor)	\$125,000
20% Contingency	\$25,000
TOTAL:	\$150,010

226. There are no federally owned lands within the project. The sponsor (NYSDEC) owns no lands nor do they have an interest in any real property in the project. No interests in lands below the Mean High Water Line (MHWL) are to be acquired.

227. One relocation in the City of Long Beach consisting of modifications to an existing comfort station under the boardwalk at National Avenue required to maintain pre-project functionality; one sun shelter in Point Lookout, south of Freeport Avenue, will be relocated; there are no known or potential hazardous or toxic waste problems associated with this project. Present or anticipated mineral extraction activities in the project area and vicinity are nonexistent.

E. Value Engineering (VE) Study

228. A Value Engineering (VE) study was conducted on the HSLRR by New York District's Engineering Division. The main recommendation was for the three construction contracts to be combined with the intent of reducing the duration of the overall construction schedule. The PDT considered the VE Study proposal and responded in December 2013 that they did not fully agree based on the current schedule of producing plans and specifications and the need for 53 vehicular and pedestrian walkways to be designed. The PDT could not move forward to combine the three contracts because the data to complete the plans and specs for the walkways and beachfill is not yet available. However, the PDT decided to complete more groin rehabilitations in contract 1 and to decrease the number of rehabilitations to be completed in contract 2 and therefore decrease the construction duration for contract 2.

VIII. Public Law 113-2 Considerations

229. The following sections discuss how this HSLRR has been prepared to address necessary changes in the implementation of the authorized but unconstructed project accounting for the Disaster Relief Appropriations Act of 2013 (P.L. 113-2). Specifically, this report addresses:

1. The costs and cost-sharing to support a Project Partnership Agreement (PPA).
2. Acknowledgement of the changes in the applicability of Section 902 of WRDA 1986, as amended.
3. The requirements necessary to confirm that the project remains economically justified, technically feasible, and environmentally acceptable.
4. The specific requirements necessary to demonstrate resiliency, sustainability, and consistency with the NACCS.

A. *Project Partnership Agreement Costs and Cost-Sharing*

230. The cost-sharing of the initial construction cost in accordance with the provisions of P.L. 113-2 is shown below. P.L.113-2 states that ‘the completion of ongoing construction projects receiving funds provided by this division shall be at full Federal expense with respect to such funds. This was reiterated in the 11 March 2013 First Interim Report Disaster Relief Appropriations Act, 2013 which lists Long Beach among the ‘Completion of Ongoing Construction’ projects. The 30 May 2013 Second Interim Report Disaster Relief Appropriations Act, 2013, then went on to *identify[ing] any previously authorized but unconstructed Corps project and any project under study by the Corps for reducing flooding and storm damage risks in the affected area, including updated construction cost estimates, that are, or would be, consistent with the comprehensive study...* The initial construction costs are shown at October 2013 price levels, with 100% Federal cost allocation, inclusive of real estate costs. The continuing construction costs as shown will be cost-shared 65% Federal and 35% non-Federal, since these costs are not covered by P.L. 113-2. Annualized Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) costs are also shown on the table.

Table 12: Cost Apportionment

Long Beach Island, NY			
Cost Apportionment			
Cost-Sharing	Federal Share	Non-Federal Share	Total
Project First Costs			
Cash Contribution	\$ 209,117,000	\$ -	\$ 209,117,000
Real Estate Lands & Damages	\$ 150,000	\$ -	\$ 150,000
TOTAL FIRST COST	\$ 209,267,000	\$ -	\$ 209,267,000
Continuing Construction First Cost			
Scheduled Beach Renourishment ^(a)	\$ 202,071,000	\$ 108,807,000	\$ 310,878,000
Emergency Beach Fill ^(b)	\$ 17,690,000	\$ 9,526,000	\$ 27,216,000
Coastal Monitoring ^(c)	\$ 10,164,000	\$ 5,473,000	\$ 15,637,000
Environmental Monitoring ^(d)	\$ 9,701,000	\$ 5,223,000	\$ 14,924,000
SUBTOTAL CONTINUING CONSTRUCTION COST	\$ 239,626,000	\$ 129,029,000	\$ 368,655,000
TOTAL CUMULATIVE CONSTRUCTION COST (e)	\$ 448,893,000	\$ 129,029,000	\$ 577,922,000
Annual Beach & Groin Maintenance Cost	\$ -	\$ 605,000	\$ 605,000
TOTAL ANNUAL O&M COSTS	\$ -	\$ 605,000	\$ 605,000
* October 2014 Price Level			
** Shared based on 65% Federal and 35% non-Federal for construction and renourishment			
(a) Beach Renourishment = \$34,542,000 every 5-year cycle for 9 cycles			
(b) Emergency Beach Fill = \$3,024,000 every 5-year cycle for 9 cycles			
(c) Coastal Monitoring Varies yearly and is broken down in the Coastal Monitoring Cost Table			
(d) Cumulative Costs include Total First Cost and Cumulative Construction			
(e) Cumulative Costs include Total First Cost and Cumulative Construction			

B. Section 902 of WRDA 1986, as amended

231. P.L.113-2 included language that changes the applicability of Section 902 of WRDA 1986, as amended, to projects funded by its appropriation. Specifically, it states in Title X, Chapter 4, "...*Provided further, That for these projects, the provisions of section 902 of the Water Resources Development Act of 1986 shall not apply to these funds...*" As such, there are no Section 902 limits associated with the initial construction of the project, assuming the construction is undertaken in accordance with P.L. 113-2 funding. WRDA1986 does not cite a cost for periodic nourishment. The Chief's report states that average annual costs are estimated at \$9,224,000 therefore, no renourishment Section 902 limit would be applicable.

C. Risks, Economics and Environmental Compliance

232. This HSLRR demonstrates that the recommended plan, a combination of hard structures (newly constructed as well as rehabilitated groins) and sand placement, reduces flood and coastal storm risks and contributes to improved capacity to manage such risks. Every project has some level of residual risk. It is important to note that this project will directly address inundation, erosion and wave attack along the ocean facing shoreline of the barrier island and will not address flooding caused by storm surge from coastal storms that enters the bay through Jones Inlet and directly impacts the bay side of the barrier island. Efforts like the NACCS Nassau County Back Bay Focus Area Study along with local projects funded by FEMA and the Department of Housing and Urban Development (HUD) through the State's NY Rising Program will attempt to address the flood risks along the bay side of the barrier island. It is important to understand that completion of this project is the first step to implementing a comprehensive system to address flood risks to the City of Long Beach, Nassau County and the Town of Hempstead on both the ocean and bay side shorelines. During Hurricane Sandy, there were significant impacts to the shoreline in the project area. These changes, as described previously, however, do not change the risk assessment or economic justification of the project;

233. As discussed above in Section VII.D, the recommended plan will remain economically justified for the 50-year authorized period of federal participation even with structures removed from the damage pool (residential and commercial structures that were destroyed during Hurricane Sandy) in response to post Hurricane Sandy analysis.

234. The attached EA confirms that the recommended alternative is compliant with environmental laws, regulations, and policies and has effectively addressed any environmental concerns of resource and regulatory agencies.

D. Resiliency, Sustainability and Consistency with the Comprehensive Study

235. This section has been prepared to address how the recommended alternative contributes to resiliency of affected coastal communities; how the recommended alternative affects the sustainability of environmental conditions in the affected area; and how the recommended alternative will be consistent with the findings and recommendations of the NACCS.

236. Resiliency is defined in the USACE-NOAA Infrastructures Systems Rebuilding Principles White Paper (USACE-NOAA 2013) as "the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies". The recommended plan for Long Beach includes sand placement to increase the height and width of the berm and create a comprehensive system of sand dunes. Engineered beaches, such as part of the recommended plan for Long Beach, are designed, constructed, and periodically renourished specifically to reduce the risk of economic losses arising from coastal storms. Natural recovery of a beach berm after a storm may occur over a period that ranges from days to months. Natural rebuilding of the dune, if it occurs at all, is a process that requires years to decades, given its dependence on wind transport and an adequate sand supply on the beach. Engineered beaches are sacrificial by nature, however, they provide coastal storm risk management that contributes significantly to the resilience of the community in which the project is located. If a project is exceeded, there would be varying risks based on the severity of the storm. Storm impacts could include lower dune crest, loss of dune volume, increased height of wave run up, farther landward wave run up and more inundation. However, these potential impacts with the designed project in place would provide greater coastal storm risk management than current without

project conditions. Even if a project is exceeded, with an engineered beach project in place, fewer homes, businesses, and public infrastructure elements are damaged and destroyed, and fewer lives are disrupted or lost. Transportation and critical health and public safety assets return to full function after a storm more quickly. All of these considerations lessen the duration and reduce the costs of the recovery period, and make the community more resilient than it would have been without the project in place.

237. Sustainability is defined as the ability to continue (in existence or a certain state, or in force or intensity); without interruption or diminution. The recommended plan for Long Beach includes new groin construction in Point Lookout, existing groin rehabilitation throughout the project area and extension/rehabilitation of the terminal groin in Point Lookout in addition to sand placement. These features reduce sand losses to the berm and dune system, reduce the frequency of renourishment and channel filling and therefore increase overall sustainability of the project. Periodic beachfill renourishment is included in the HSLRR project in recognition of local prevailing storm and long term erosion forces and shoreline response. The estimated periodic beachfill renourishment frequency and volume quantity are specifically designed to ensure project sustainability for a range of coastal event risk over the 50-year evaluation period.

238. As previously described, the proposed features for construction in the Long Beach community represent a resilient and sustainable solution.

239. The objectives of the North Atlantic Coast Comprehensive Study were to:

“. . . ultimately provide the risk reduction and rebuilding principles necessary to ensure a collaborative approach to the proper planning and implementation of a sustainable and robust coastal landscape system. The purpose of the North Atlantic Coast Comprehensive Study is to develop a framework to reduce risk and increase resiliency to populations affected by Hurricane Sandy and those areas vulnerable to tidally-influenced flooding and storm surge in areas within the boundaries of the USACE North Atlantic Division, that would also include a framework/principles for taking available resources into consideration in order to optimize risk reduction and coastal resiliency.

240. *The goals of the North Atlantic Coast Comprehensive Study were to:*

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

241. In assessing consistency with the NACCS, the overriding principles of NACCS have been addressed for consistency. These principles recognize that preferred plans are those that provide coastal storm risk management with the use of sand features, which are readily adaptable, and could be modified or terminated based upon future findings. NACCS acknowledges that hard structures may be necessary, and can be implemented if based upon current, state-of-the-art science and planning. The NACCS also emphasizes the need for integrated land-use planning, recognizing the need for local adoption of Flood Plain Management Regulations, based upon current understanding of risks.

242. The proposed features at Long Beach are consistent with these principles of the NACCS. The overall coastal storm risk management is to be provided with a berm and dune

system that could be readily adapted. The recommended design has also considered sea level change.

243. There is a risk associated with the potential for a future rate of sea level greater than the historic rate of relative sea level change as described in Section 2. The authorized coastal storm risk reduction project presents the most cost-effective, adaptable, and robust approach to reduce storm risk for coastal communities for at least the next several decades, under any range of relative sea level change. This project has been designed with the expectation that periodic nourishment is a critical project component performed at a 5-year interval following project construction.

244. The Life cycle cost analysis includes the cost of periodic nourishment in the annual cost of the project. Routine monitoring of the project is an essential part of each project, and assures that if changes in the rate of sea level rise occur in the future, that any changes in project performance can be evaluated. It would be a relatively simple and low-cost option to incrementally increase dune elevation or berm width, as appropriate, to assure continued delivery of storm risk reduction benefits in the manner for which such projects are designed and authorized. If such incremental increase in height or width of the project cross section is being considered, such modification shall be coordinated with the MSC to ensure that said modifications are within allowable tolerances and within the Chief's discretionary authority to implement without the need for further authorization. The relatively few USACE coastal storm risk reduction studies that have rigorously evaluated accelerated sea level rise scenarios demonstrate that project benefits increase at a greater rate than project costs with accelerated sea level rise, indicating a greater BCR than would be the case for a linear continuation of the historic rate of sea level rise.

245. . The hard structures that are part of the HSLRR plan include rehabilitated groins throughout the project area, newly constructed groins in Point Lookout and extended terminal groin in Point Lookout. These designs have been developed and analyzed using state of the science and planning and are designed to perform under a wide range of seal level change conditions. Future adaptation of these structures would be considered in a fashion similar to the sand features.

246. With respect to integrated land management, the community landward and surrounded by this project is heavily developed, which limits the focus of land management to rebuilding activities as opposed to regulating new development. There are existing land-use regulations that are in effect within the project area, including FEMA Floodplain Regulations and the New York State Coastal Erosion Hazard Area Regulations which effectively address rebuilding in the project area. The project is not designed to alter the existing floodplain regulations (or FEMA flood insurance rate maps) and is not expected to have an impact on potential future development in this area.

247. Given this statement of NACCS goals and previous discussion in this HSLRR regarding resilience sustainability, coastal storm risk reduction, economic justification, and environmental acceptability, it is evident that the Long Beach project is fully consistent with the NACCS.

IX. Project Implementation

A. Construction Schedule

248. The beach fill placement area is located within three (3) miles of the western end of the borrow area. Accordingly, it is proposed a large hopper dredge be used for all beach fill placement. The production rate of the dredge is calculated to be on average roughly 18,000 cy/day, 24 working days per month, or 429,000 cy/month.

249. Three constraints exist which affect the construction schedule. These are:

- a) No beach fill or stone work during endangered/threatened bird nesting and foraging season. Endangered and threatened bird nesting and foraging occur in the Town of Hempstead, east of the City of Long Beach, from 1 March through 31 August. No beach fill placement or work on stone groins may be accomplished in that area during those months. In lieu of working in this area, it is assumed that the Contractor would shift his resources to the groin rehabs in Long Beach, where the foraging season will not affect the work.
- b) Construction of new groins should not occur at the same time (or immediately after) as sand placement operations in the new groin vicinity (in Point Lookout). This restriction will preclude difficulty in establishing excavated grades below ocean bottom for the groin foundation construction. Sand placement operations will cause a significant amount of hydraulically placed project beach fill sand to be washed offshore by tidal and littoral currents with sand remaining suspended in the water column, just offshore. As excavation is attempted for establishment of foundation grades, this suspended sand will quickly fill the excavated area, making it extremely difficult to place stone for the groin's foundation.
- c) Beach fill will be implemented in a separate contract from stone work to reduce cost and avoid extensive subcontractor overhead costs if the beach fill and stone work are combined in one contract.

250. In light of the above constraints, two contracts will be required to construct the HSLRR Recommended Plan. A total of 39 calendar months (3.25 years) will be required for the two contracts. The construction schedule is shown in Figure 31. Contract 2 is assumed to be awarded prior to the completion of Contract 1.

- Contract 1: 17 groin rehabs (2 in Pt. Lookout, 15 in Long Beach), 4 new groins (Pt. Lookout) and terminal groin rehab and 100 ft extension (Pt. Lookout).
- Contract 2: Beach fill/dune construction with plantings and crossovers

B. Local Cooperation

251. A fully coordinated PPA package will be prepared subsequent to the approval of the HSLRR phase, which will reflect the recommendations of the HSLRR. Before the updated plan can be constructed, the PPA will be negotiated with the State of New York. According to the current schedule, the Federal Government and the State of New York plan to execute a PPA in April 2014.

252. Each Local Sponsor has passed resolutions to support completion of the HSLRR and authorizing entrance into PPAs with acknowledgement of the responsibility to provide LERRDs, Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) and public

access. The resolutions were signed by the City of Long Beach and Nassau County on 19 March 2013, and by the Town of Hempstead on 20 May 2013. The non-Federal sponsor, NYSDEC in a letter dated 24 June 2013, referenced the local resolutions and is supportive of completing the HSLRR. The cooperation between the various governments indicates a strong willingness to proceed with a potential solution to the flood and storm damage problems facing the barrier island of Long Beach. These resolutions and letter are available in Appendix A Pertinent Correspondence.

253. The non-Federal sponsor shall be required to comply with all applicable Federal laws and policies and other requirements, as applicable to the beach fill renourishment feature selected herein, including but not limited to:

- a. Provide non-Federal costs assigned to coastal storm risk management as further specified below:
 1. Enter into an agreement which identifies and provides full funding for any betterments that the non-Federal sponsor requests;
 2. Provide all lands, easements, and rights-of-way and relocations (LERR), including suitable borrow areas, and perform or ensure the performance of any relocations determined by the Federal Government to be necessary for the initial construction, periodic renourishment, operation, and maintenance of the project;
 3. Provide, during construction of each periodic renourishment 35 percent of periodic nourishment costs assigned to coastal storm risk management plus 100 percent of periodic renourishment costs assigned to coastal storm risk management of undeveloped private lands and other private shores which do not provide public benefits.
- b. For so long as the project remains authorized, to operate, maintain and repair the completed project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government. The non-Federal sponsor will be responsible for OMRR&R of the beach, dune, dune walkovers and groins;
- c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the Non-Federal Sponsor of responsibility to meet the Non-Federal Sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;
- d. Hold and save the United States free from all damages arising from the initial construction, periodic renourishment, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;
- e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the

standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

- f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction;
- g. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;
- h. Agree that the Non-Federal Sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;
- i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;
- j. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army, and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans;
- k. Provide 35 percent of that portion of total historic preservation mitigation and data recovery costs assigned to initial construction of coastal storm risk management, 35 percent of those costs assigned to periodic renourishment and 100 percent of those costs assigned to coastal storm risk management of undeveloped private lands and

other private shores which do not provide public benefits that are in excess of 1 percent of the total amount authorized to be appropriated for the project;

- l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;
- m. Within one year after the date of signing a PPA, prepare a floodplain management plan designed to reduce the impact of future flood events in the project area. The plan shall be prepared in accordance with guidelines developed by the Federal Government and must be implemented not later than one year after completion of construction of the project;
- n. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of coastal storm risk management it affords or that would hinder future periodic nourishment and/or the operation and maintenance of the project;
- o. Not less than once each year, inform affected interests of the extent of coastal storm risk management afforded by the project;
- p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with coastal storm risk management levels provided by the project;
- q. For so long as the project remains authorized, the Non-Federal Sponsor shall ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;
- r. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;
- s. Recognize and support the requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;
- t. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and advance nourishment section and provide the results of such surveillance to the Federal Government;
- u. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

254. In an effort to keep the sponsor and interested local municipalities informed, coordination throughout the design phase was maintained. Meetings were held periodically among representatives of USACE, NYSDEC, City of Long Beach, Town of Hempstead and Nassau County. Coordination efforts shall continue, including coordination of this report with other State and Federal agencies, such as NMFS, USFWS, United States Environmental Protection Agency (USEPA), NYSDEC-Region 1, and New York State Department of State (NYSDOS). It is currently anticipated that an informational public meeting will be held upon approval to release this HSLRR.

X. Conclusions

255. In light of the changes provided in P.L. 113-2 in regard to the PPA, cost-sharing, Section 902 applicability, risks, sustainability, resiliency, and consistency with the NACCS, USACE recommends that the project be implemented in accordance with this HSLRR and the provisions of PL113-2.

256. USACE has given consideration to all significant aspects in the overall public interest, including environmental, social and economic effects, engineering feasibility and compatibility of the project with the policies, desires and capabilities of the State of New York and other non-Federal interests. The project's annual benefits and annual costs were updated to October 2014 price levels and are \$30,208,000 and \$16,655,000, respectively. The updated benefit cost ratio is 1.8 (over a 50-year period of analysis at the FY15 Discount Rate of 3.375%). The project, with the minor modification to the 1995 Authorized Plan, remains economically justified and USACE recommends that the project be constructed at the updated first cost of \$209,267,000 for initial construction and a first cost of \$368,655,000 for the cumulative renourishment cost.

XI. Recommendation

Prefatory Statement. In making the following recommendations, I have given consideration to all significant aspects of this project in the overall public interest in coastal storm risk management on Long Beach Island. The aspects considered include engineering feasibility, economic effects, environmental impacts, social concerns, and compatibility of the project with the policies, desires, and capabilities of the local government, City, State, Federal government, and other interested parties.

Recommendation. I recommend that the authorized project with minor modifications described herein for coastal storm risk management to the barrier island of Long Beach, New York be designed and constructed and that implementation funds be provided. I make this recommendation based on findings that the selected plan constitutes engineering feasibility, economic justification, and environmental acceptability. These recommendations are made with such further modifications thereof, as in the discretion of the MSC may be advisable, at first cost of \$209,267,000 for initial construction, and a first cost of \$383,150,000 for continuing construction (cumulative renourishment) at October 2014 price levels; and for purposes of the PPA, a fully funded first cost of \$230,533,000 and a fully funded continuing construction (cumulative renourishment) cost of \$795,835,000, provided that non-Federal interests comply with all the requirements substantially in accordance with the PPA, which will be executed upon approval of this report.

Disclaimer. The recommendations contained herein reflect the information available at this time and current policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and/or implementation funding.



David A. Caldwell
Colonel, U.S. Army
Commander

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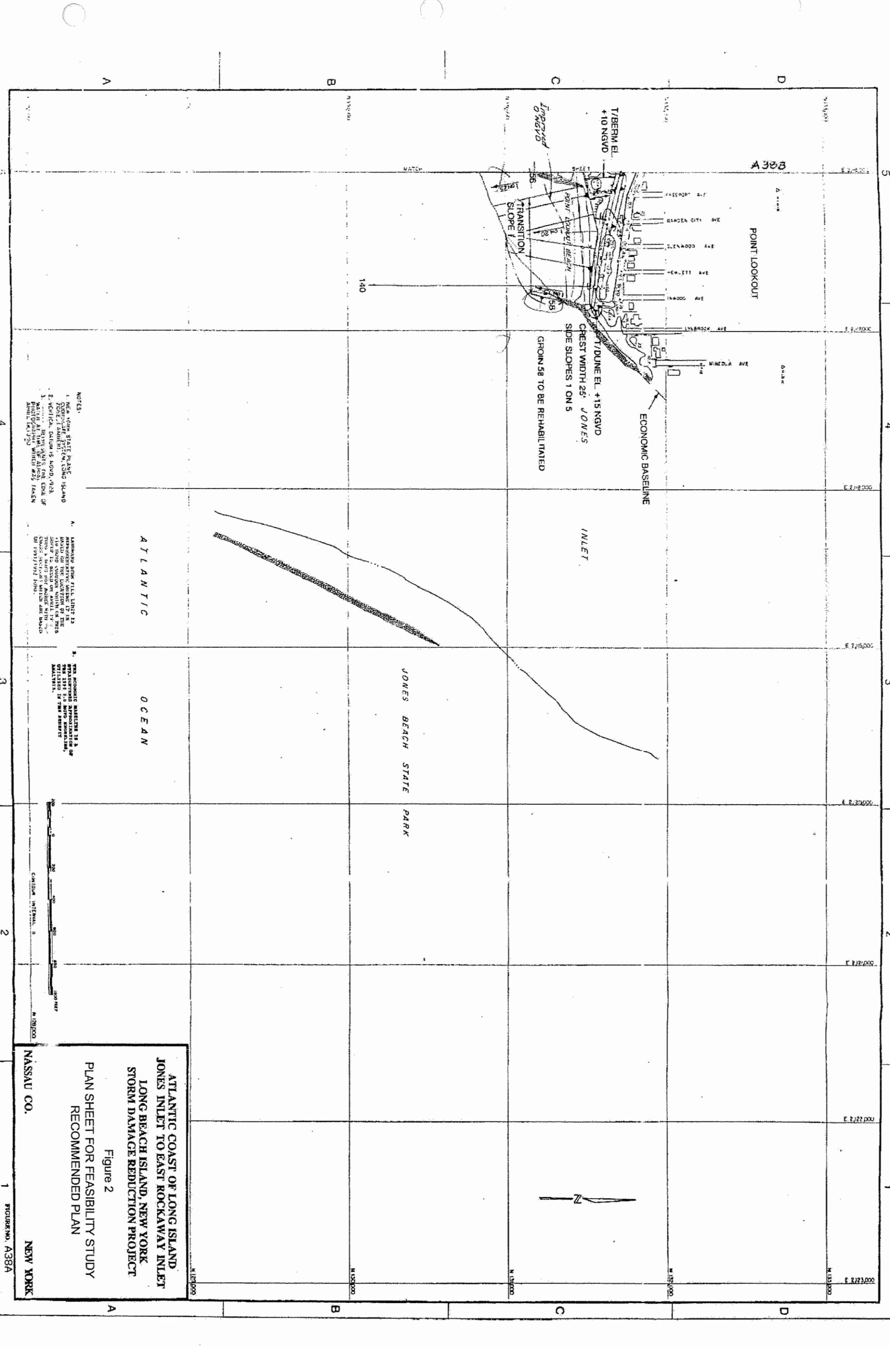
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LONG BEACH: Project Location Map

Figure 1

Scale: NTS

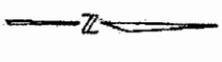
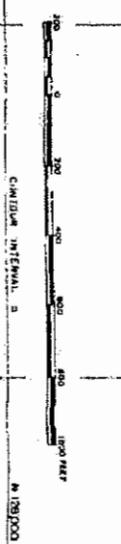


NOTES:

1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, IS USED FOR THE LOCATION OF THIS PROJECT. DATUM IS M.D. 1923.
2. VERTICAL DATUM IS M.D. 1923.
3. ALL ELEVATIONS ARE BASED ON PHOTOGRAPHIC WHICH WAS TAKEN APRIL 1953.

4. HARBOR DUNE FILL, LINES AS SHOWN, IS BASED ON THE LOCATION OF THE TIDE GAUGE WHICH WAS LOCATED IN THIS AREA IN 1953. THIS AREA IS TO BE REHABILITATED WITH THE EXISTING SECTIONS WHICH ARE BASED ON 1953 DATA.

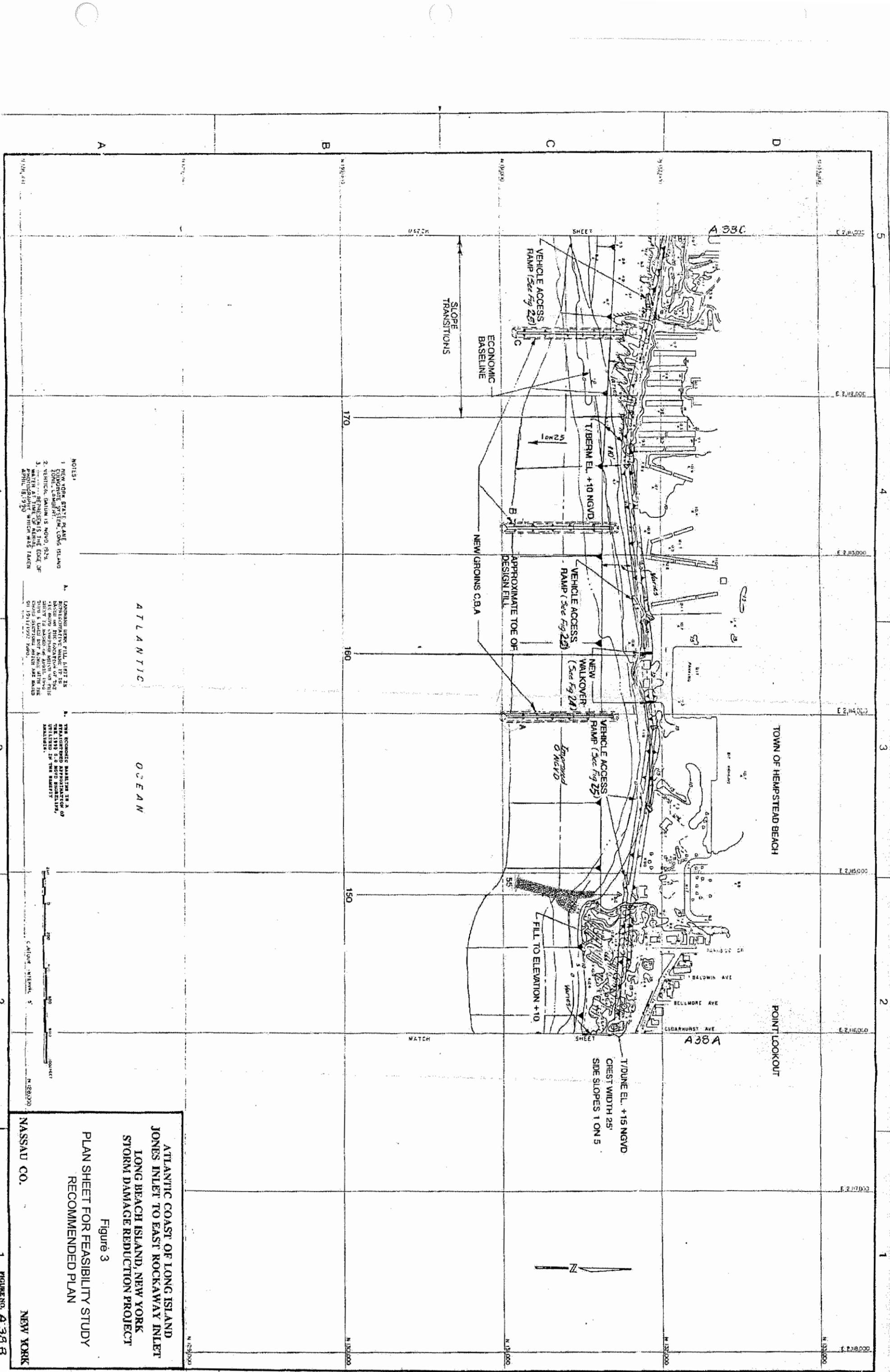
5. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1953 COASTLINE. THIS LINE IS BASED ON THE 1953 PHOTOGRAPHIC WHICH WAS TAKEN APRIL 1953.



ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 2
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK



- NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAKEVIEW.
 2. VERTICAL DATUM IS NGVD, 1929.
 3. APPROXIMATE TOE OF DESIGN FILL AND APPROXIMATE WHICH WERE TAKEN APRIL 18, 1990.

A. LANDWARD SIDE FILL LIMIT IS REPRESENTATIVE ONLY. IT IS BASED ON THE LOCATION OF THE FILL AND THE LOCATION OF THE FILL. THIS LIMIT SHOULD BE ADJUSTED TO THE ACTUAL LOCATION OF THE FILL.

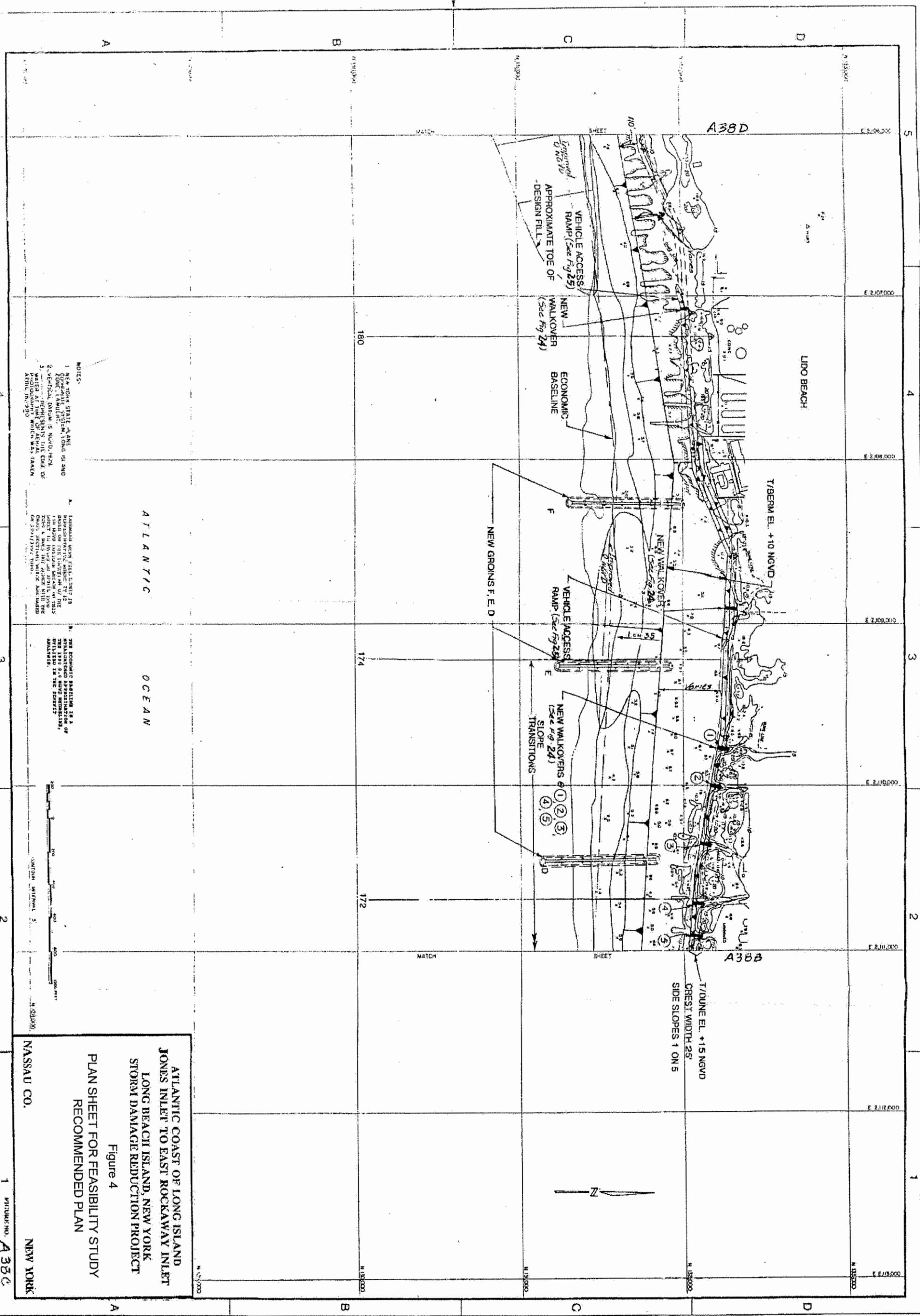
B. THE ECONOMIC BARRIER IS A STRATEGIC APPROXIMATION OF THE ECONOMIC BARRIER UTILIZED IN THE BARRIER ANALYSIS.



ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 3
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK



NOTES:

1. NEW YORK STATE ZONE 18 AND ZONE 18 ADJUTANT.
2. VERTICAL DATUM IS NGVD, 1929.
3. REPRESENTATIVE DATE OF WATER AT TIME OF AVERAGE STORM APRIL 16, 1950.

A. LANDMARK BORN FALL 1917 IS APPROXIMATELY 100 FEET TO THE RIGHT OF THE TOWER OF THE LIGHT. THIS LIGHT IS 100 FEET TO THE RIGHT OF THE LIGHT. THIS LIGHT IS 100 FEET TO THE RIGHT OF THE LIGHT.

B. THE ECONOMIC BASELINE IS A REPRESENTATIVE APPROXIMATION OF THE 1950 50' NGVD EMBANKMENT, WHICH IS THE PROPOSED EMBANKMENT.

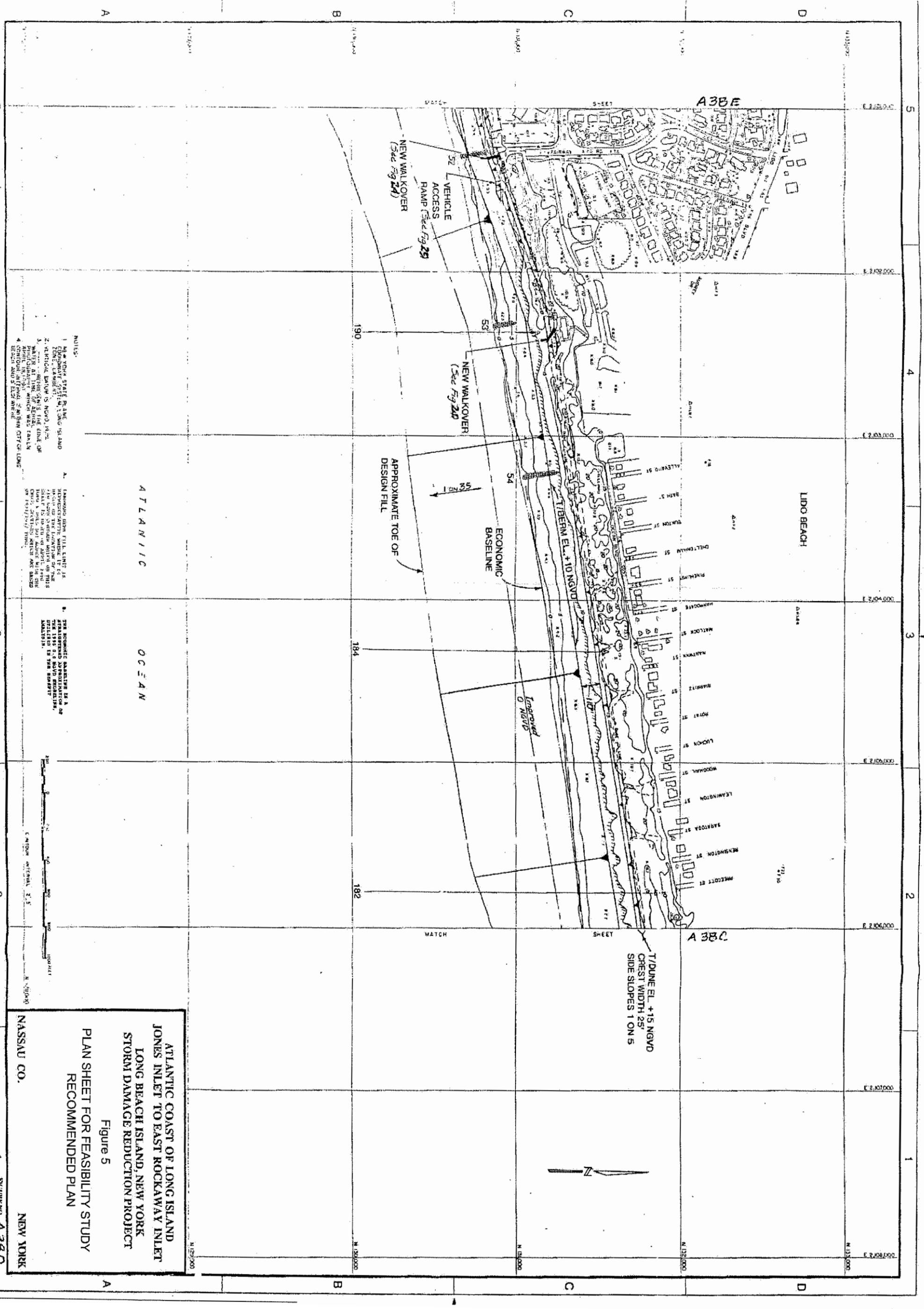
ATLANTIC OCEAN

ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 4
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK

FIGURE NO. A33C

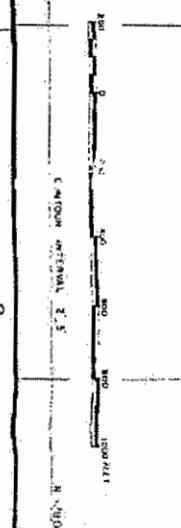


NOTES:

1. MAJOR STATE PLANE COORDINATE SYSTEM IS USED. ZONE 18N IS USED.
2. METRIC DIMENSIONS IN METERS ARE SHOWN IN PARENTHESES.
3. ALL DIMENSIONS ARE TO THE CENTER OF THE LINE UNLESS OTHERWISE NOTED.
4. CONTOUR INTERVAL 2.0 METERS (6.6 FEET).

A. EXISTING AND PROPOSED DESIGN FILL AT THE LOCATION OF THE TIDE GATE. THE EXISTING TIDE GATE IS 10 METERS WIDE AND 1.5 METERS HIGH. THE PROPOSED TIDE GATE IS 25 METERS WIDE AND 1.5 METERS HIGH. THE PROPOSED TIDE GATE IS TO BE CONSTRUCTED WITH A 1:1 SLOPE ON BOTH SIDES.

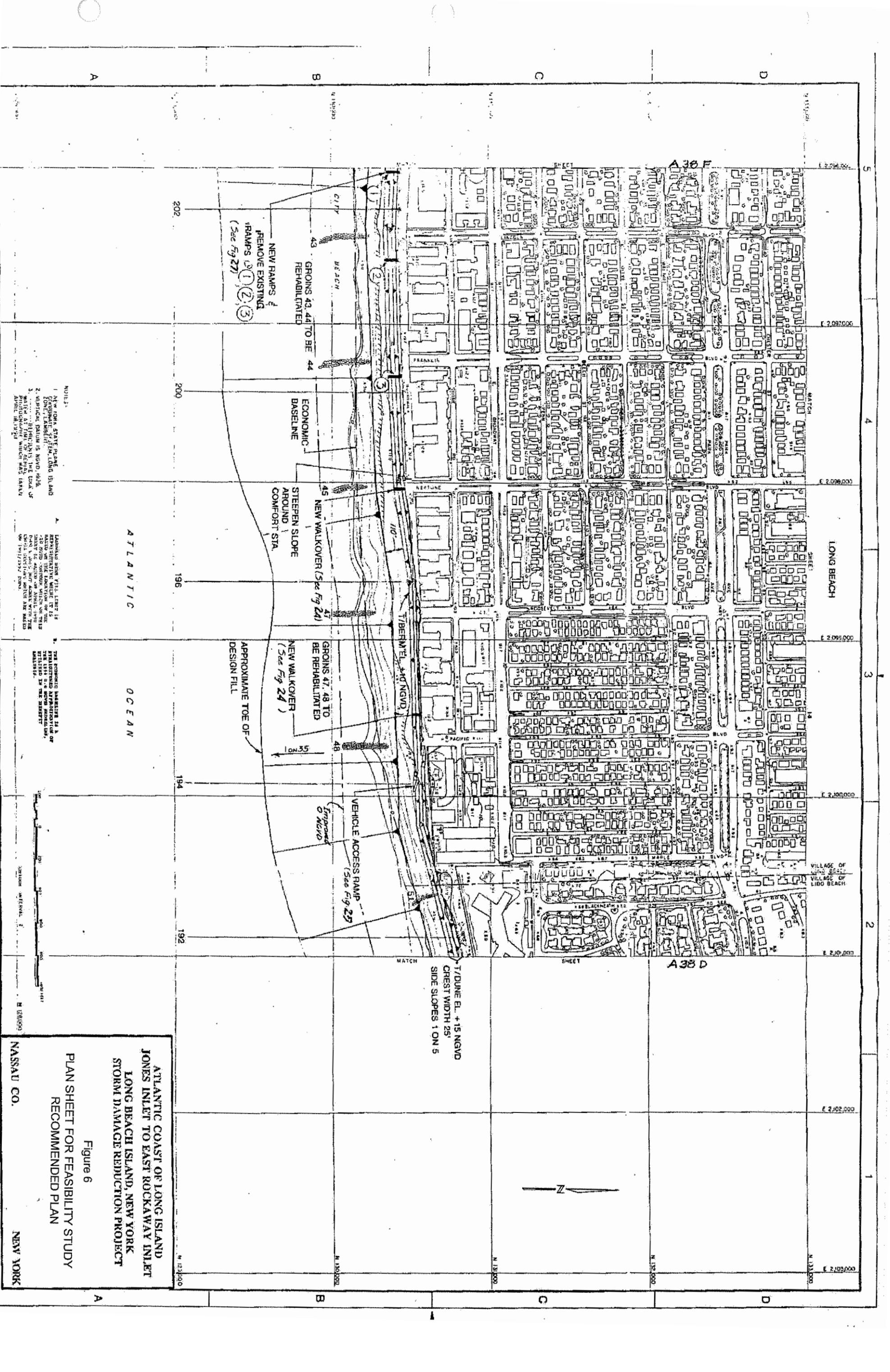
B. THE PROPOSED TIDE GATE IS A 25 METER WIDE TIDE GATE WITH 1:1 SLOPES ON BOTH SIDES. THE PROPOSED TIDE GATE IS TO BE CONSTRUCTED WITH A 1:1 SLOPE ON BOTH SIDES.



ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 5
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK



NOTES:

1. NEW YORK STATE GREAT BRITAIN 1971, LONG ISLAND COUNTY 1971, LONG ISLAND COUNTY 1971, LONG ISLAND COUNTY 1971.
2. PHYSICAL PLAN IS NOT TO SCALE. ALL DIMENSIONS ARE TO BE TAKEN FROM THE PLAN. ALL DIMENSIONS ARE TO BE TAKEN FROM THE PLAN. ALL DIMENSIONS ARE TO BE TAKEN FROM THE PLAN.

THE ECONOMIC BASELINE IS A REPRESENTATIVE REPRESENTATION OF THE 1971 5' HIGH DUNE LINE. THE ECONOMIC BASELINE IS A REPRESENTATIVE REPRESENTATION OF THE 1971 5' HIGH DUNE LINE. THE ECONOMIC BASELINE IS A REPRESENTATIVE REPRESENTATION OF THE 1971 5' HIGH DUNE LINE.

SCALE: 1" = 100'

DATE: 11/19/77

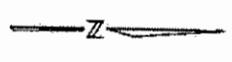
BY: [Signature]

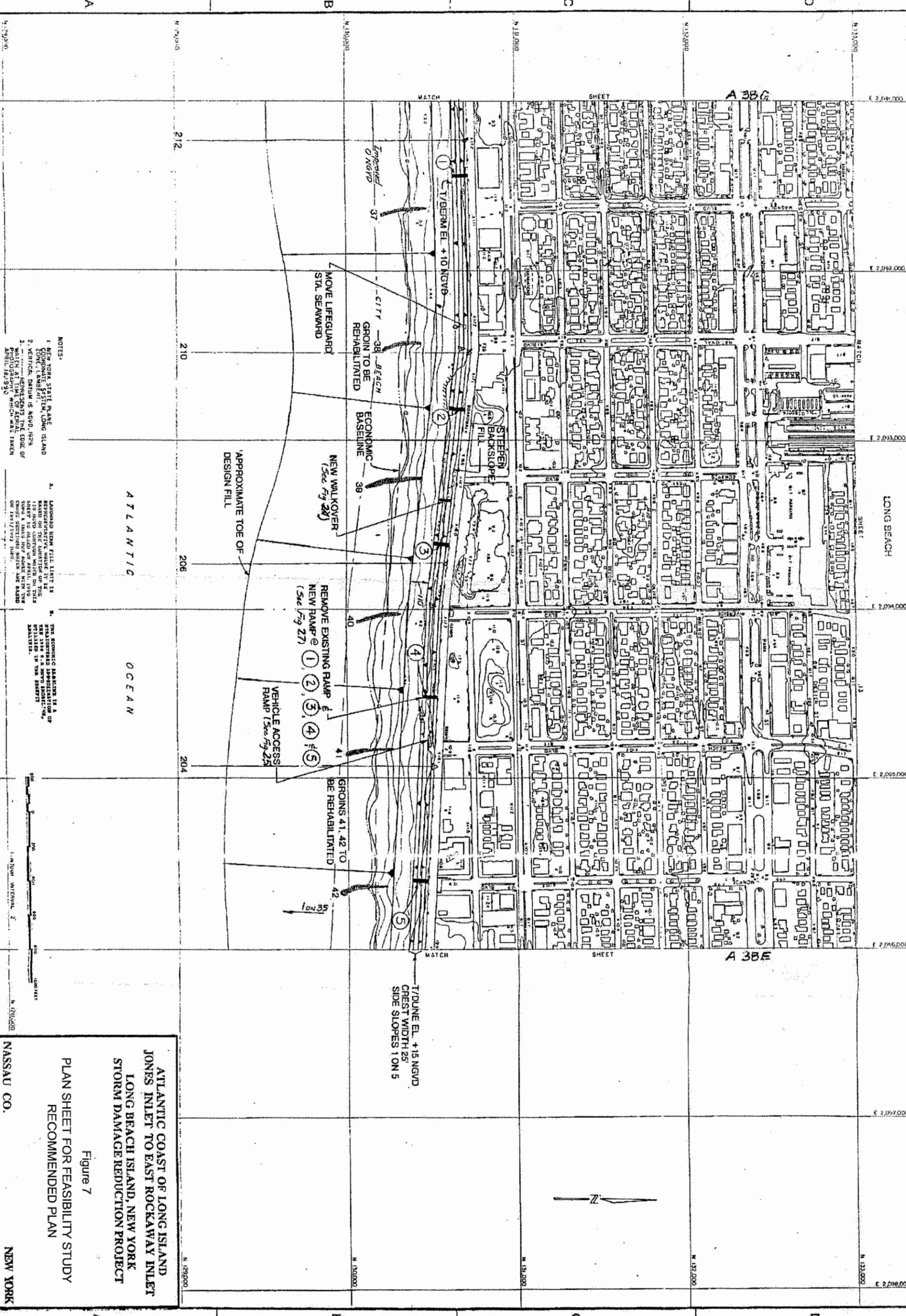
ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 6
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK

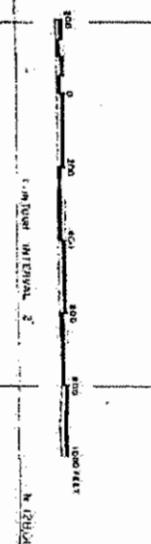
TIDE DUNE EL. +15 NGVD
 CREST WIDTH 25'
 SIDE SLOPES 1 ON 5





NOTES:

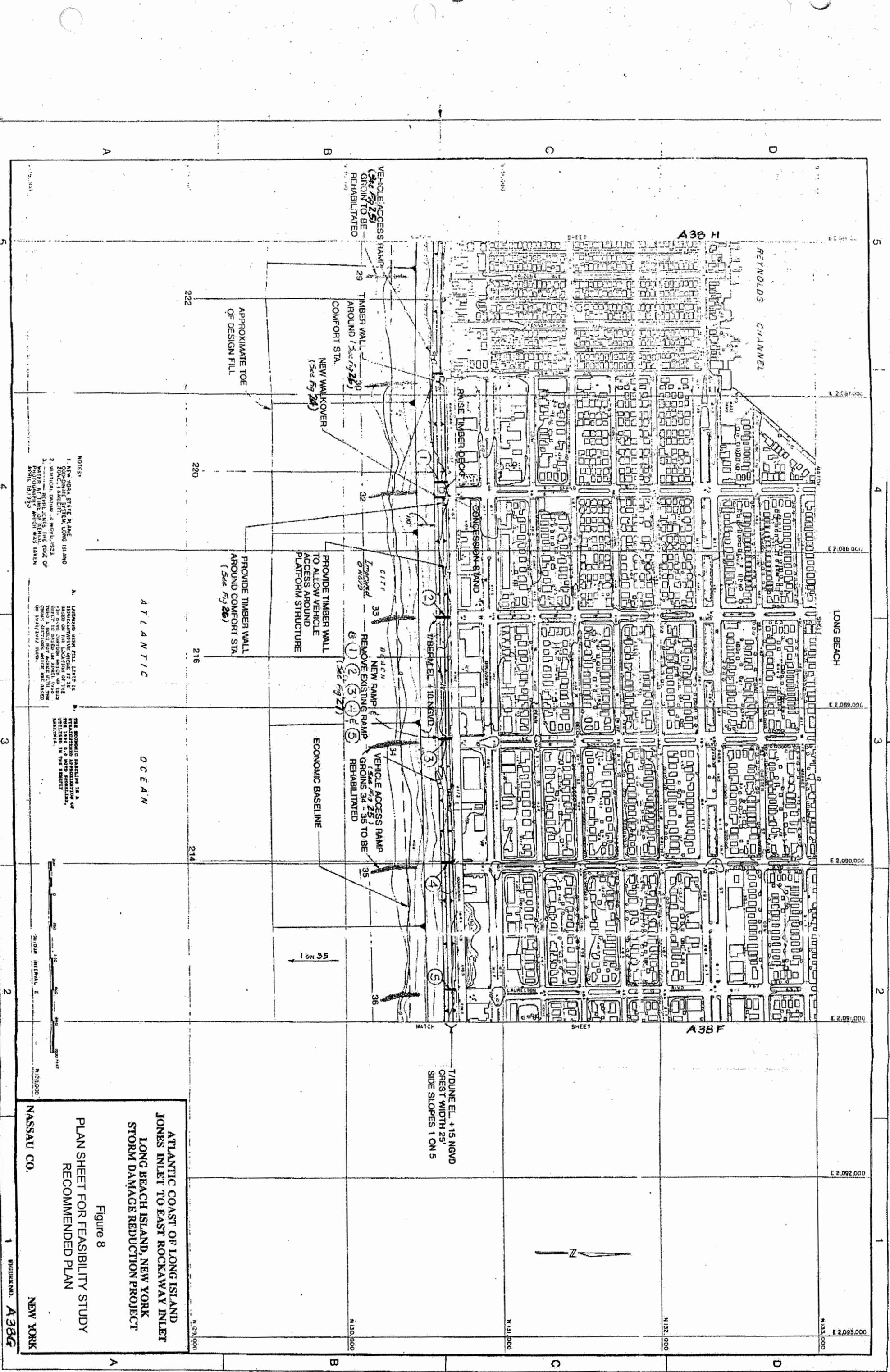
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND
2. VERTICAL DATUM IS MVD, 1929
3. PHOTOGRAPHIC REPRESENTS THE EDGE OF PHOTOGRAPHY WHICH WAS TAKEN APRIL, 1973
4. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE OF THE BERM ON THE LOCATION OF THE 170' BROAD OVERLOOK WHICH ON THIS DATE WAS THE PROPERTY OF THE STATE OF NEW YORK AND WAS CHANGING SECTIONED SHEET AND BASED ON 1971/1972 DATA
5. THE ECONOMIC BASELINE IS A REPRESENTATIVE APPROPRIATION OF THE 1978 R.O. BERM POSITION, ESTABLISHED IN THE BERM POSITION.



ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 7
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK



VEHICLE ACCESS RAMP
(See Fig 25)
GROUND TO BE
REHABILITATED

APPROXIMATE TOE
OF DESIGN FILL

29
TIMBER WALL
AROUND (See Fig 26)
COMFORT STA.
NEW WALKOVER
(See Fig 28)

PROVIDE TIMBER WALL
AROUND COMFORT STA.
(See Fig 26)

PROVIDE TIMBER WALL
TO ALLOW VEHICLE
ACCESS AROUND
PLATFORM STRUCTURE

33
CITY
BEACH
NEW RAMP
REMOVE EXISTING RAMP
(See Fig 27)

34
VEHICLE ACCESS RAMP
(See Fig 25)
GROUNDS 34 - 35 TO BE
REHABILITATED

ECONOMIC BASELINE

7' DUNE EL. +15 NGVD
CREST WIDTH 25'
SIDE SLOPES 1 ON 5

- NOTES:
1. NEW YORK STATE PLANNING BOARD APPROVED THE PROJECT ON APRIL 19, 1959.
 2. VERTICAL CURVES 3. NGVD, 1928.
 3. WATER AT TIME OF AERIAL TAKEN APRIL 19, 1959.

A. HARDWARE NEW FILL LINE IS RECONSTRUCTIVE WHERE IT IS TO BE PLACED. THE EXISTING FILL LINE IS TO BE REMOVED AND THE NEW FILL LINE IS TO BE PLACED AT THE NEW FILL LINE. THE NEW FILL LINE IS TO BE PLACED AT THE NEW FILL LINE. THE NEW FILL LINE IS TO BE PLACED AT THE NEW FILL LINE.

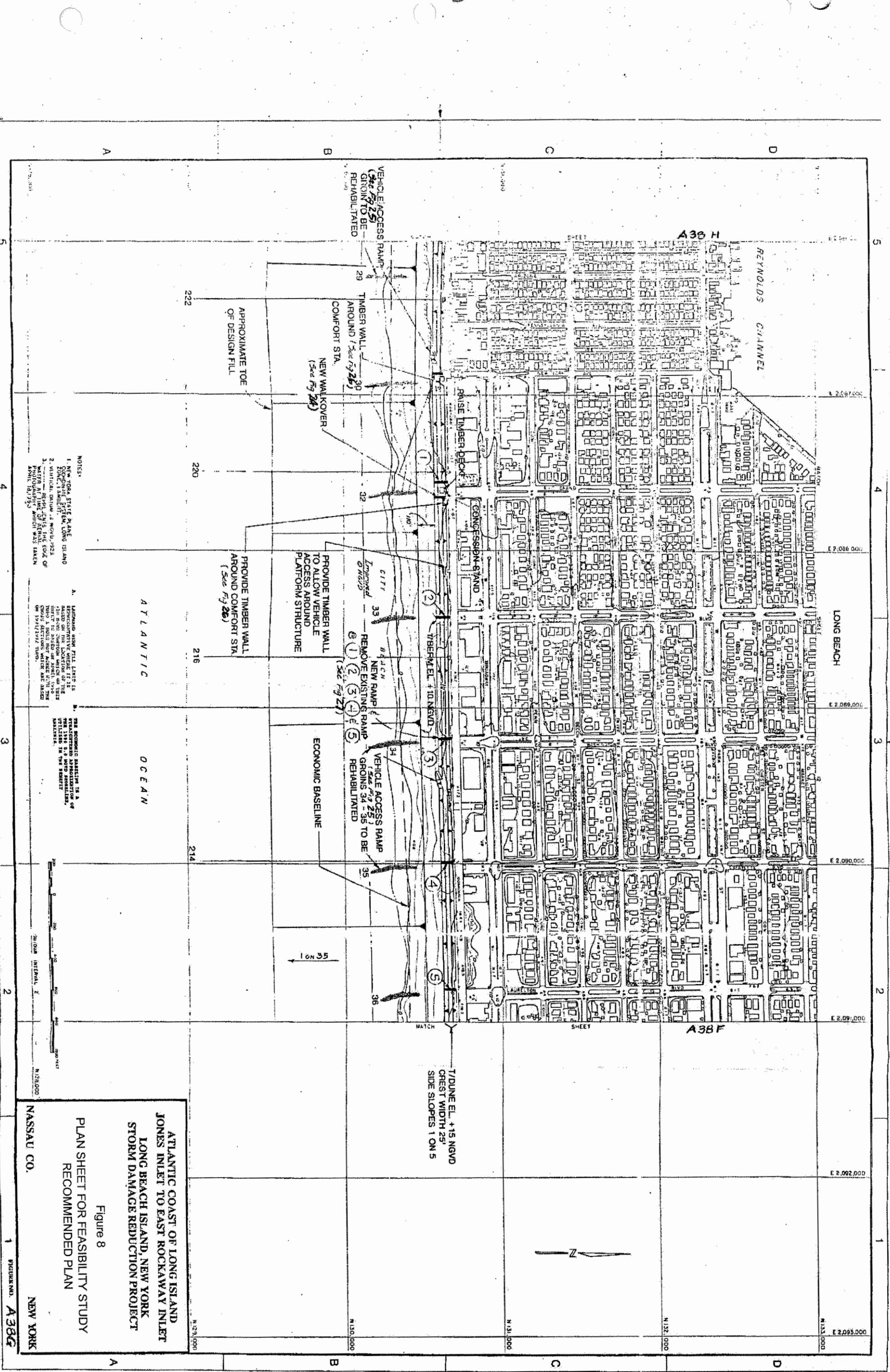
B. THE ECONOMIC BASELINE IS A LINE WHICH REPRESENTS THE ECONOMIC BASELINE OF THE PROJECT. THE ECONOMIC BASELINE IS A LINE WHICH REPRESENTS THE ECONOMIC BASELINE OF THE PROJECT. THE ECONOMIC BASELINE IS A LINE WHICH REPRESENTS THE ECONOMIC BASELINE OF THE PROJECT.

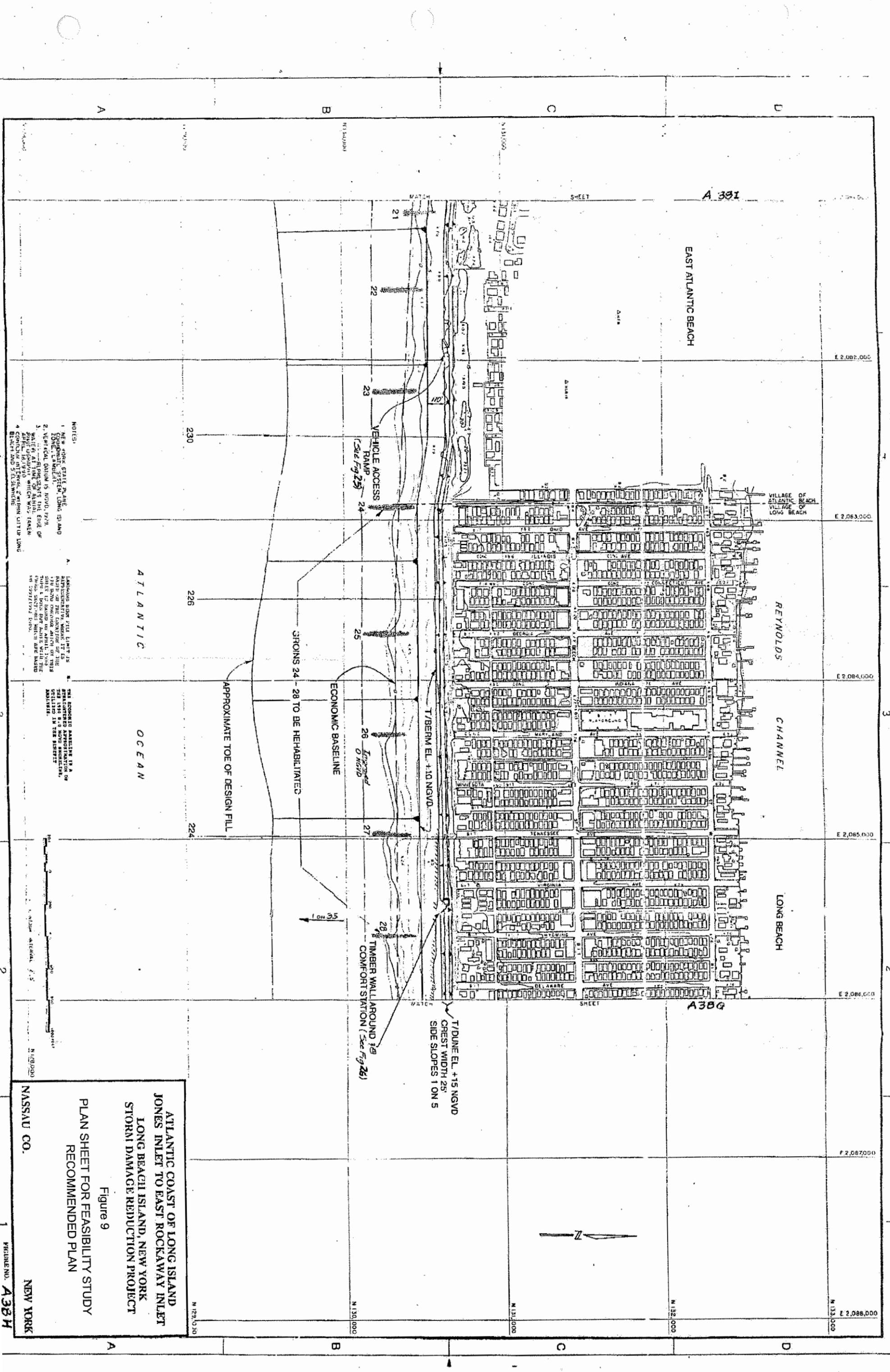


ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

Figure 8
PLAN SHEET FOR FEASIBILITY STUDY
RECOMMENDED PLAN

NASSAU CO.
NEW YORK





A 381

EAST ATLANTIC BEACH

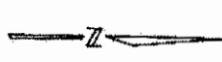
VILLAGE OF ATLANTIC BEACH
VILLAGE OF LONG BEACH

REYNOLDS

CHANNEL

LONG BEACH

A 380



- NOTES:
1. NEW YORK STATE PLANNING COMMISSION, SYSTEM LONG ISLAND ZONE, L.A. 1062-1.
 2. VERTICAL CURVE IS NOV. 1970.
 3. PLANNING COMMISSION'S THE END OF THE ROAD PROJECT WHICH WAS TAKEN APRIL 1970.
 4. CONDUCTED BY TOWN OF LONG BEACH AND S. S. SHERMAN.

LANDMARK BOUNDARY LIMIT IS SHOWN BY DASHED LINE. THE 1970 BOUNDARY OF THE AREA IS SHOWN BY SOLID LINE. THE 1970 BOUNDARY OF THE AREA IS SHOWN BY DASHED LINE. THE 1970 BOUNDARY OF THE AREA IS SHOWN BY DASHED LINE.

THE PROPOSED AREA IS A RECOMMENDED APPROXIMATION OF THE 1970 BOUNDARY OF THE AREA. THE 1970 BOUNDARY OF THE AREA IS SHOWN BY DASHED LINE. THE 1970 BOUNDARY OF THE AREA IS SHOWN BY DASHED LINE.

ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
STORM DAMAGE REDUCTION PROJECT
PLAN SHEET FOR FEASIBILITY STUDY
RECOMMENDED PLAN
FIGURE 9
NASSAU CO.
NEW YORK

PLATE NO. A38H

NEW YORK

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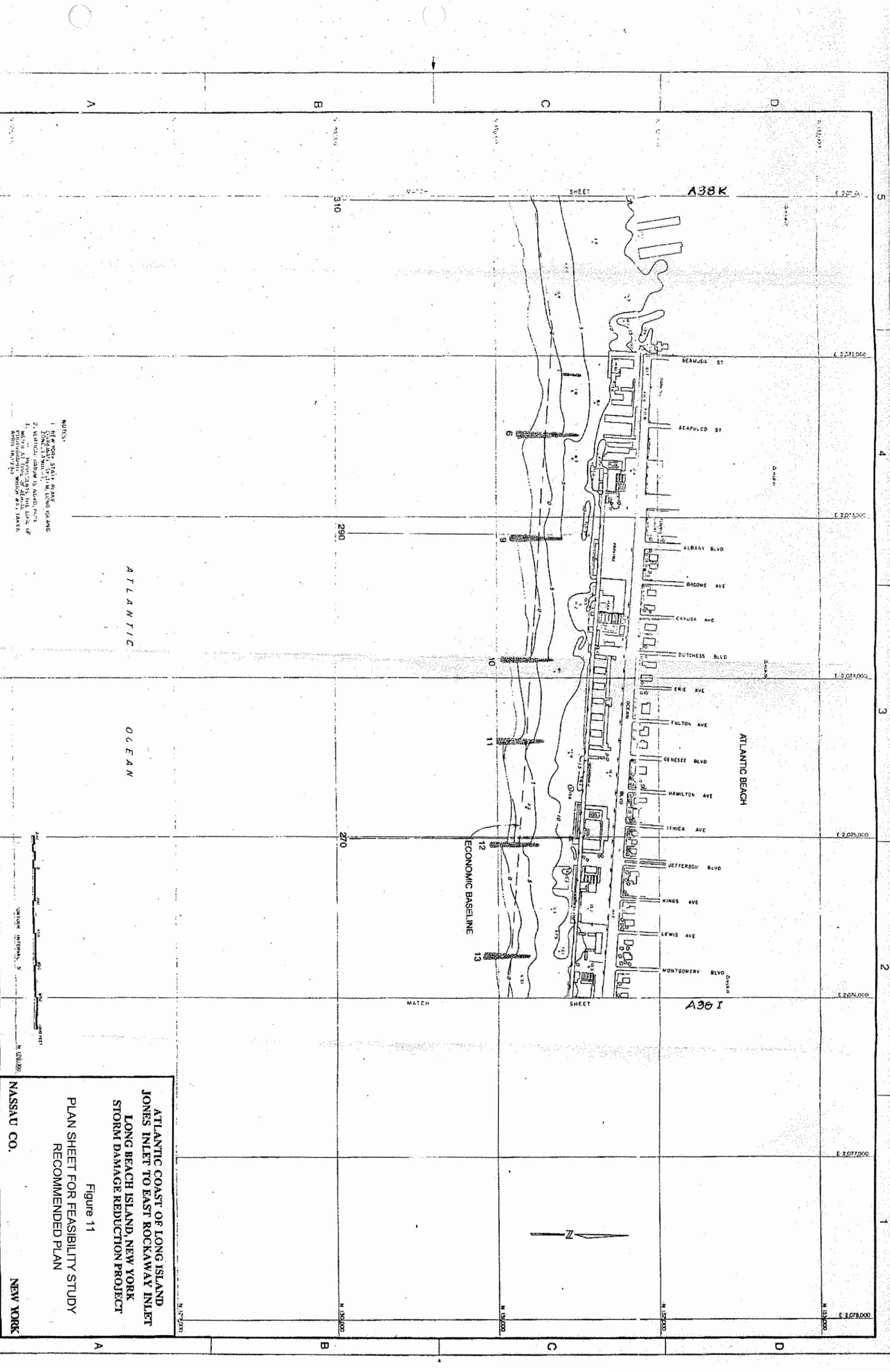
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A38K

A38I

ATLANTIC BEACH

ATLANTIC

OCEAN

ECONOMIC BASELINE

- NOTES:
1. NEW YORK STATE PLANS
 2. NEW YORK STATE PLANS
 3. NEW YORK STATE PLANS
 4. NEW YORK STATE PLANS
 5. NEW YORK STATE PLANS
 6. NEW YORK STATE PLANS
 7. NEW YORK STATE PLANS
 8. NEW YORK STATE PLANS
 9. NEW YORK STATE PLANS
 10. NEW YORK STATE PLANS
 11. NEW YORK STATE PLANS
 12. NEW YORK STATE PLANS
 13. NEW YORK STATE PLANS

ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 11
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK

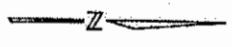
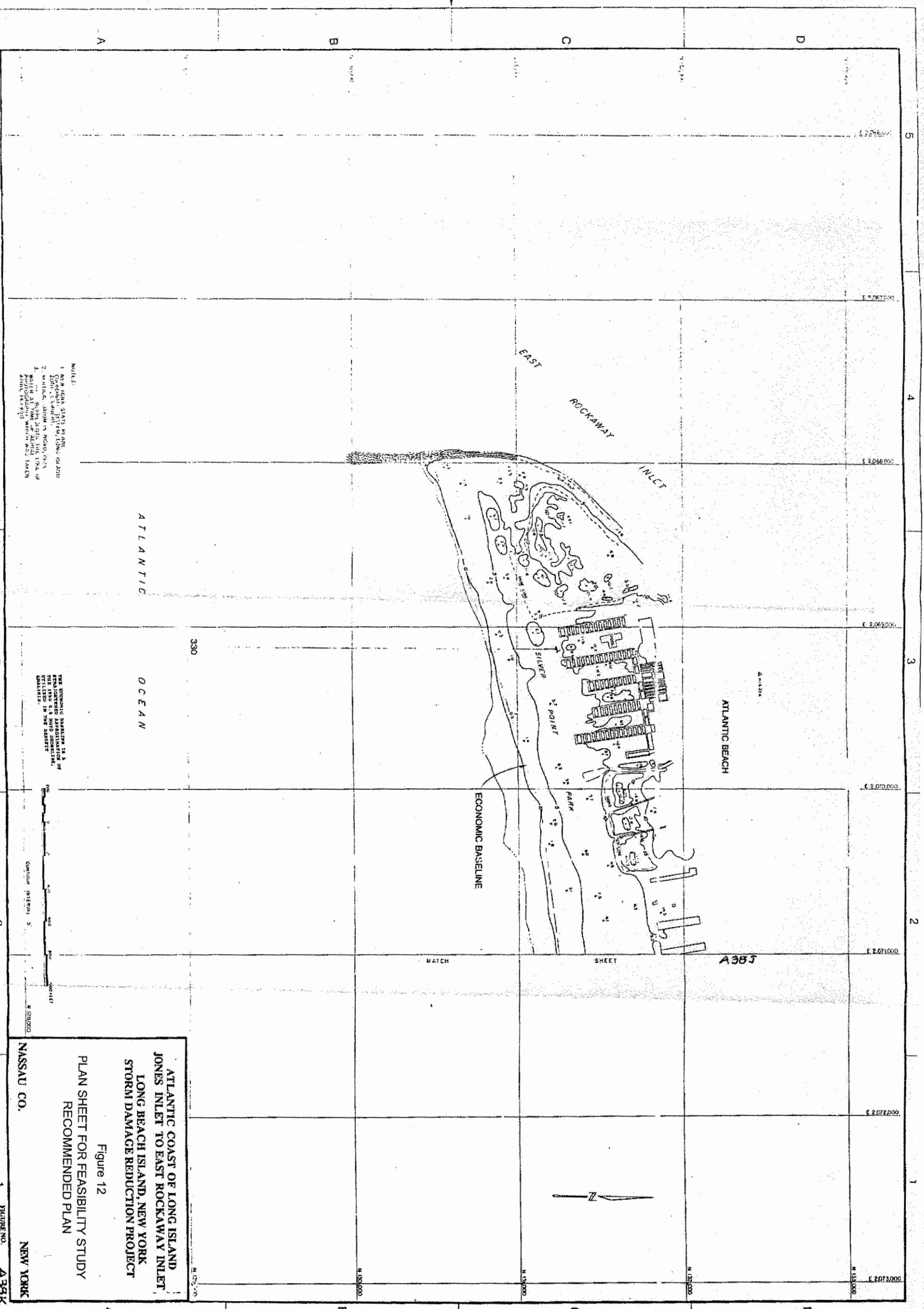


FIGURE NO. A38I



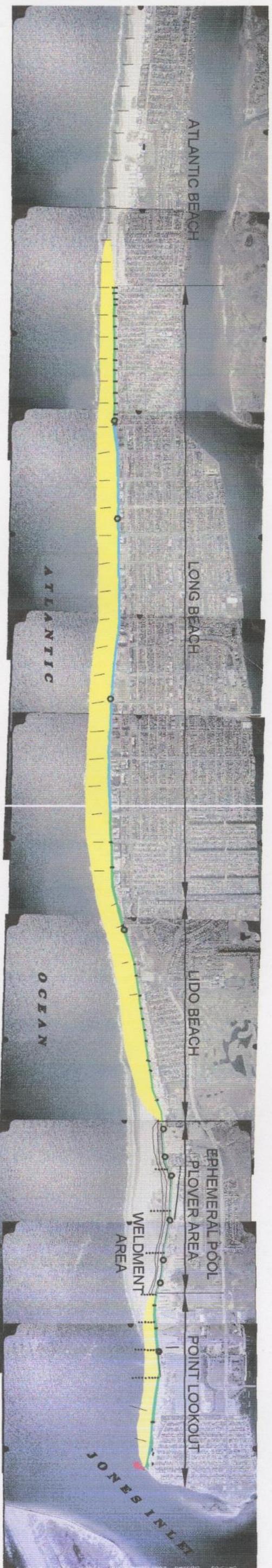
- NOTES:
1. AS PER YORK STATE PLANS.
 2. CONFORMS TO THE FEDERAL AND STATE STANDARDS.
 3. WHERE SHOWN, ADJUST TO MEAN SEA LEVEL.
 4. WATER AT TIME OF DESIGN SHALL BE PROTECTED BY A BREAK IN THE SHORELINE AS SHOWN.

THE ECONOMIC BASELINE IS A CONSIDERED APPROXIMATIVE, AND THE LINES IN THE SHEET ARE BASED THEREON.

ATLANTIC COAST OF LONG ISLAND
 JONES INLET TO EAST ROCKAWAY INLET
 LONG BEACH ISLAND, NEW YORK
 STORM DAMAGE REDUCTION PROJECT

Figure 12
 PLAN SHEET FOR FEASIBILITY STUDY
 RECOMMENDED PLAN

NASSAU CO.
 NEW YORK



LEGEND

- DUNE (WITH GRASS AND PROTECTIVE FENCING)
- SAND BARRIER
- BEACH FILL*
- NEW GROINS
- EXISTING GROINS
- DUNE WALKOVERS
- VEHICULAR ACCESS RAMPS
- TERMINAL GROIN EXTENSION

NOTE: WELDMENT AREA IS A PART OF A SAND SHOAL THAT WILL CHANGE IN POSITION FROM YEAR TO YEAR

* GROIN COVERAGE IS NOT REPRESENTATIVE OF THE PROPOSED CONDITION (SEE FIGURES 14 TO 25 FOR AN ACCURATE DEPICTION OF THE GROIN COVERAGE).

 DEPARTMENT OF THE ARMY NEW YORK DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK 10278
OFFSHORE AND COASTAL TECHNOLOGIES, INC. AND ANDREWS, MILLER & ASSOCIATES, INC. (JOINT VENTURE)
LONG BEACH ISLAND, NEW YORK STORM DAMAGE REDUCTION PROJECT LRR RECOMMENDED PLAN STUDY AREA
SCALE 1" = 3000' Figure No. 13
NASSAU COUNTY NEW YORK

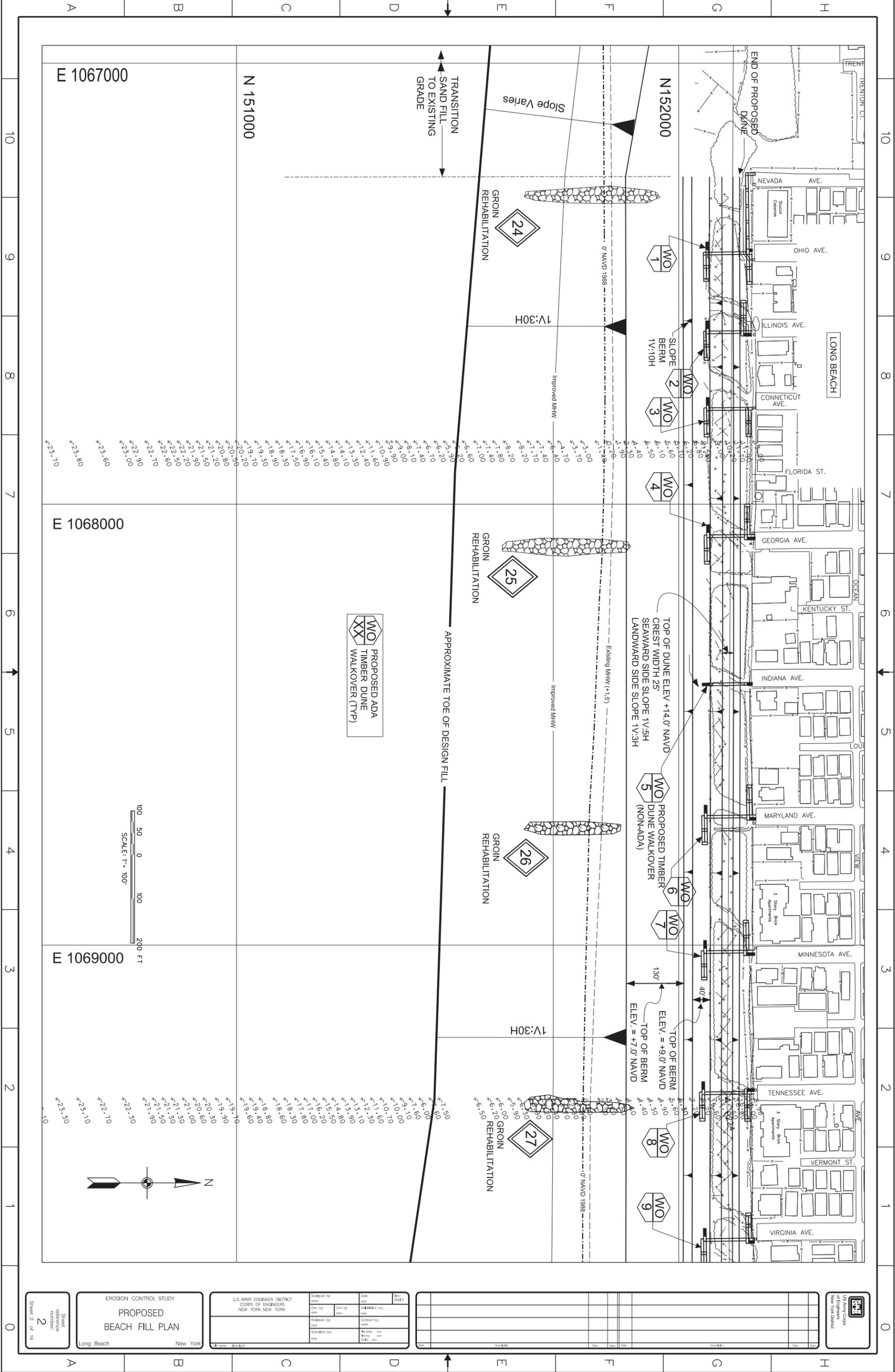
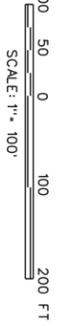
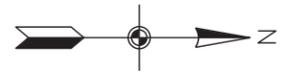
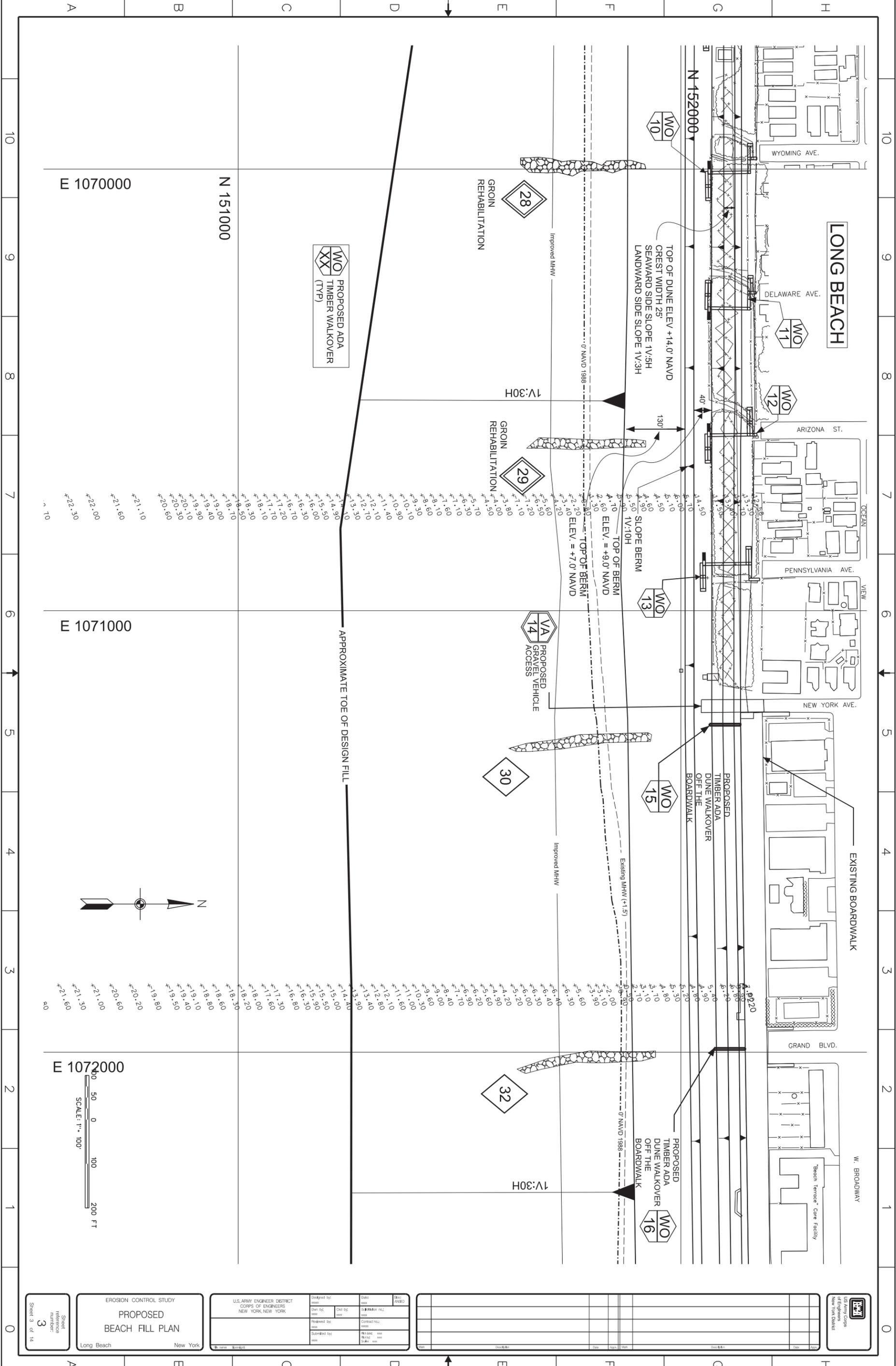
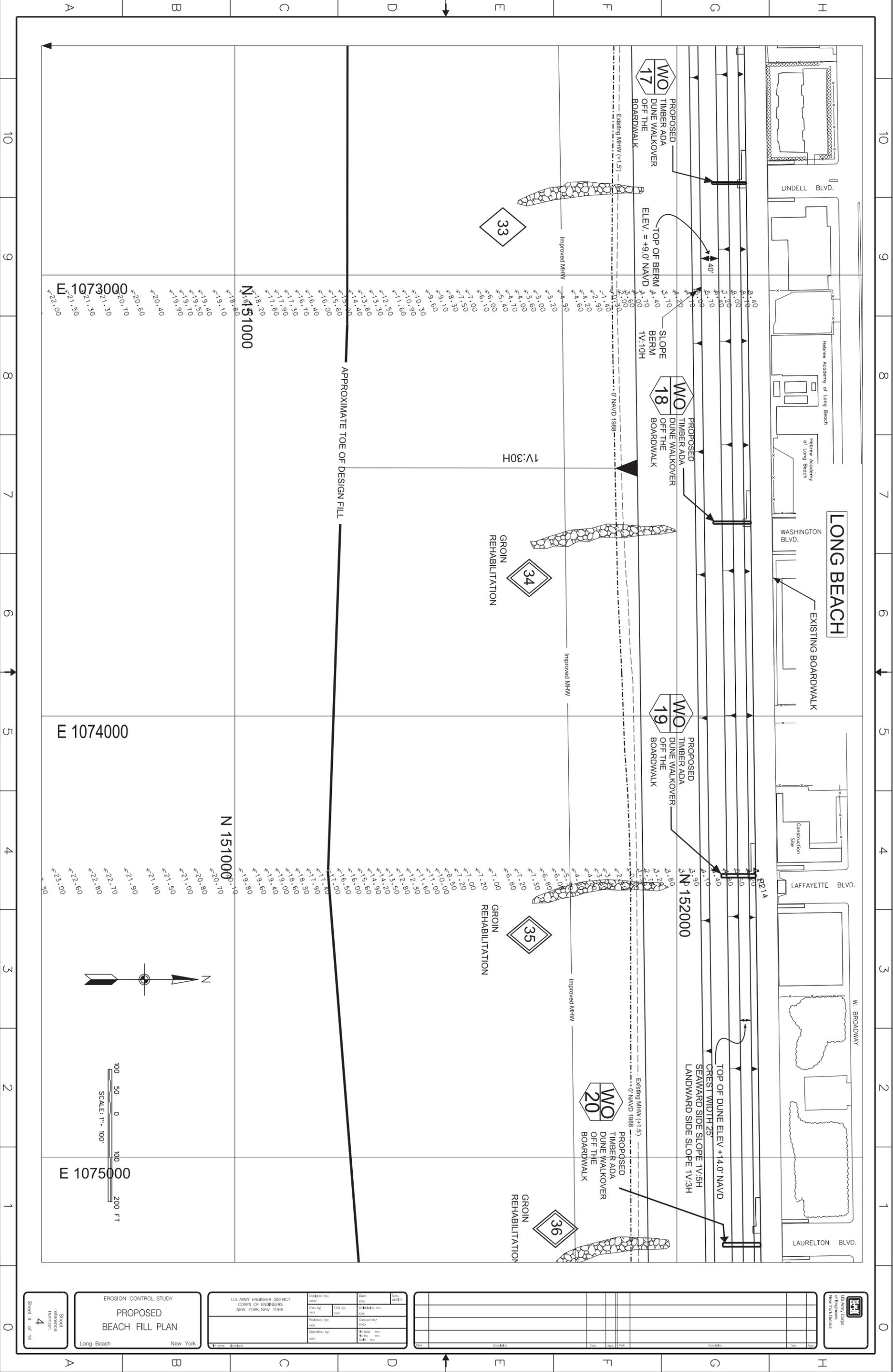


Figure 15



Sheet reference number: 3 Sheet 3 of 14	EROSION CONTROL STUDY PROPOSED BEACH FILL PLAN Long Beach, New York	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK	Designed by: [] Drawn by: [] Reviewed by: [] Submitted by: []	Date: [] Scale: [] Contract no.: [] Job no.: [] Sheet no.: []	US Army Corps of Engineers New York District
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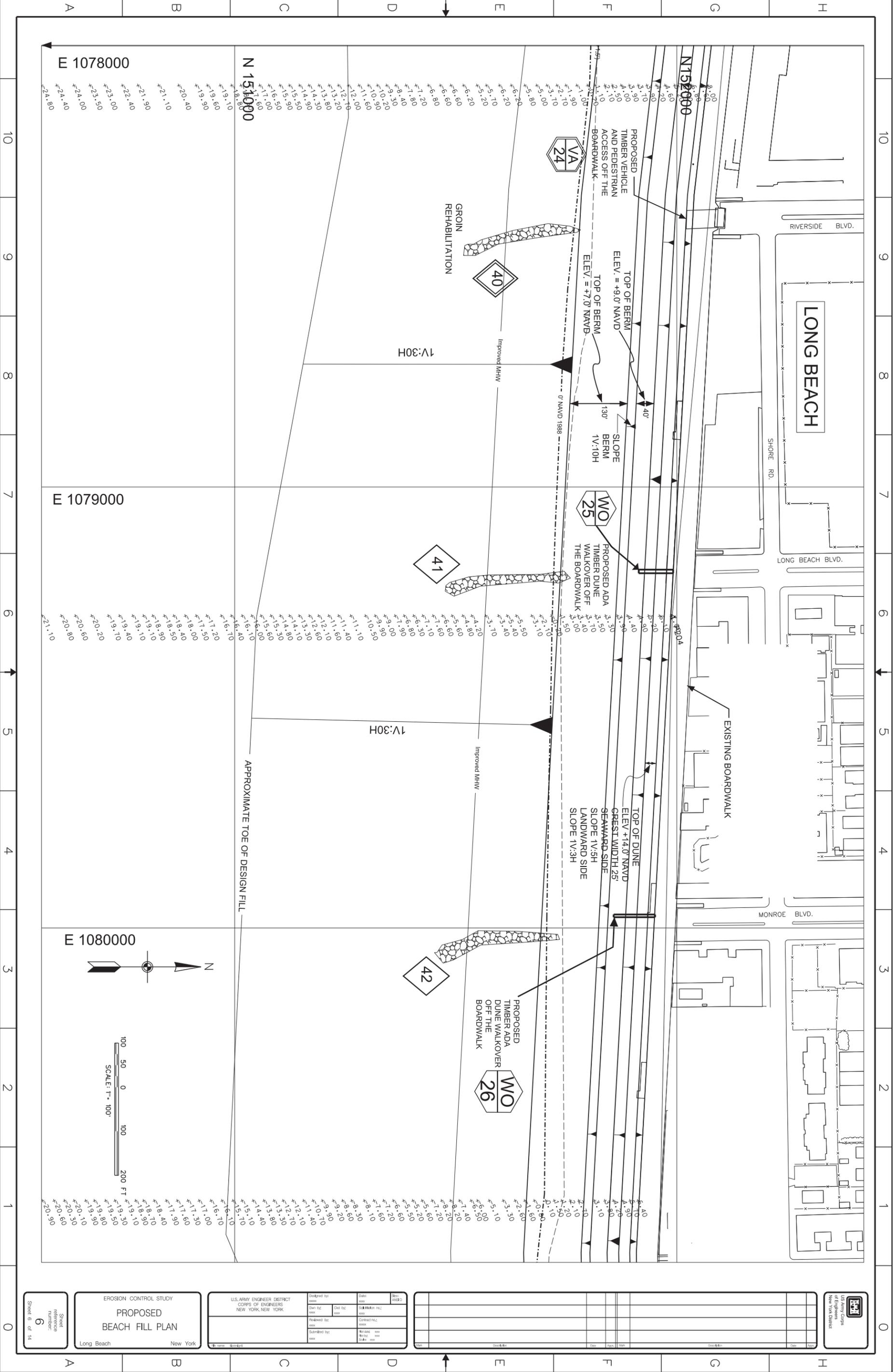
Figure 16



Sheet reference number: 4 Sheet 4 of 14	EROSION CONTROL STUDY PROPOSED BEACH FILL PLAN Long Beach New York	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK	Designed by: [] Drawn by: [] Reviewed by: [] Submitted by: []	Date: [] Scale: [] Status: [] Revision: []	U.S. Army Corps of Engineers New York District
--	---	---	--	---	---

Figure 17

Submitted by: USERNAME Plot Date: DD-MMM-YYYY HH:MM
 FILE NAME

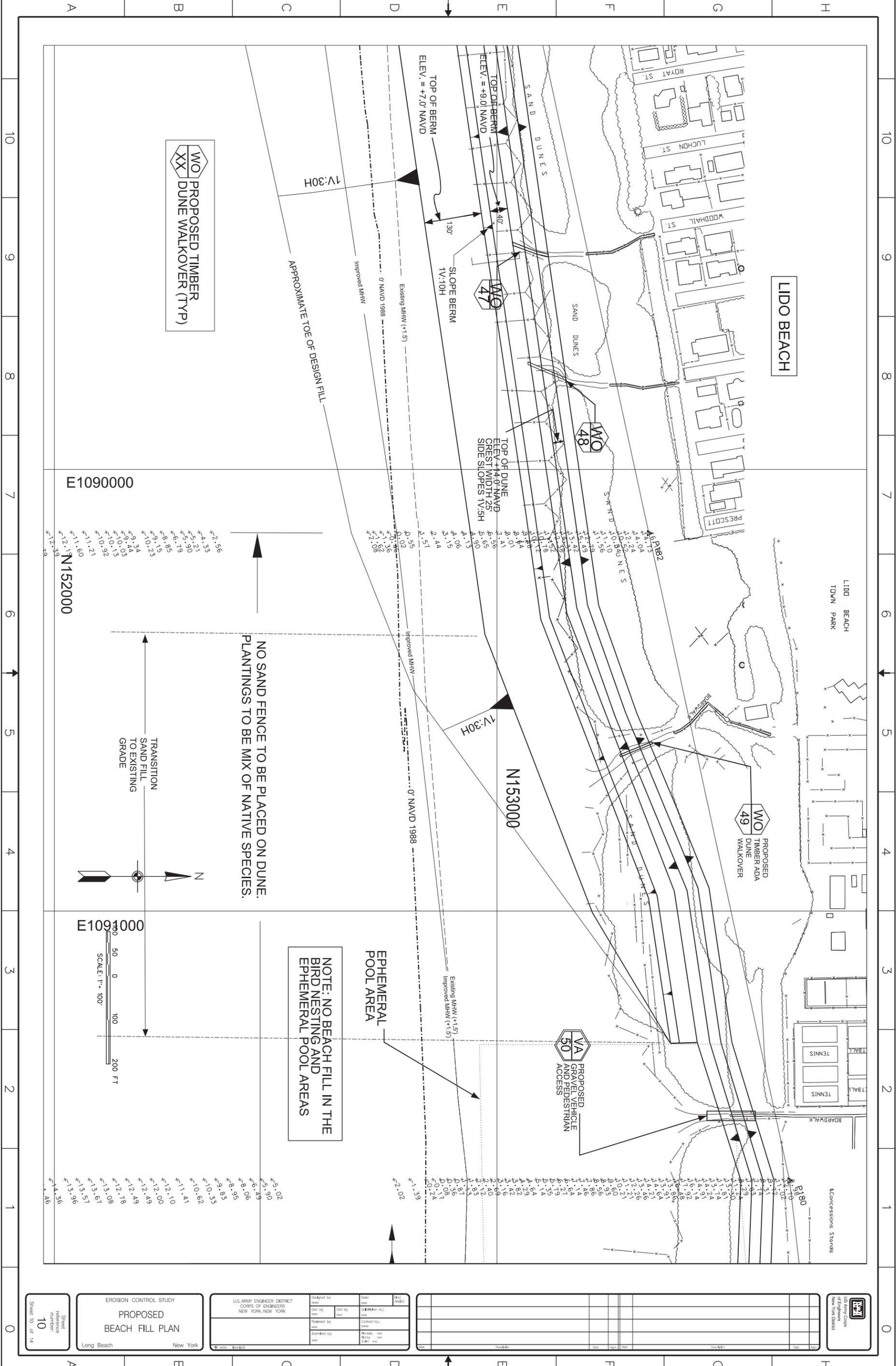


EROSION CONTROL STUDY PROPOSED BEACH FILL PLAN Long Beach New York	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK	Designed by: [] Drawn by: [] Reviewed by: [] Submitted by: []	Date: [] Scale: [] Contract no.: [] Job no.: [] Sheet no.: []	US Army Corps of Engineers New York District
---	---	--	--	---



Sheet reference number: 9 Sheet 9 of 14	EROSION CONTROL STUDY PROPOSED BEACH FILL PLAN Long Beach New York	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK	Designed by:	Date:	Date:
			Drawn by:	Contract no.:	Date:
			Checked by:	No. of sheets:	No. of sheets:
			Submitted by:	Title:	Date:

Figure 22



WO
XX
PROPOSED
TIMBER
DUNE WALKOVER (TYP)

LIDO BEACH

LIDO BEACH
TOWN PARK

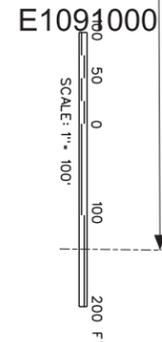
WO
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TIMBER ADA
DUNE WALKOVER
49

PROPOSED
VA
GRAVEL VEHICLE
AND PEDESTRIAN
ACCESS
50

NOTE: NO BEACH FILL IN THE
BIRD NESTING AND
EPHEMERAL POOL AREAS

NO SAND FENCE TO BE PLACED ON DUNE.
PLANTINGS TO BE MIX OF NATIVE SPECIES.

TRANSITION
SAND FILL
TO EXISTING
GRADE



E1090000

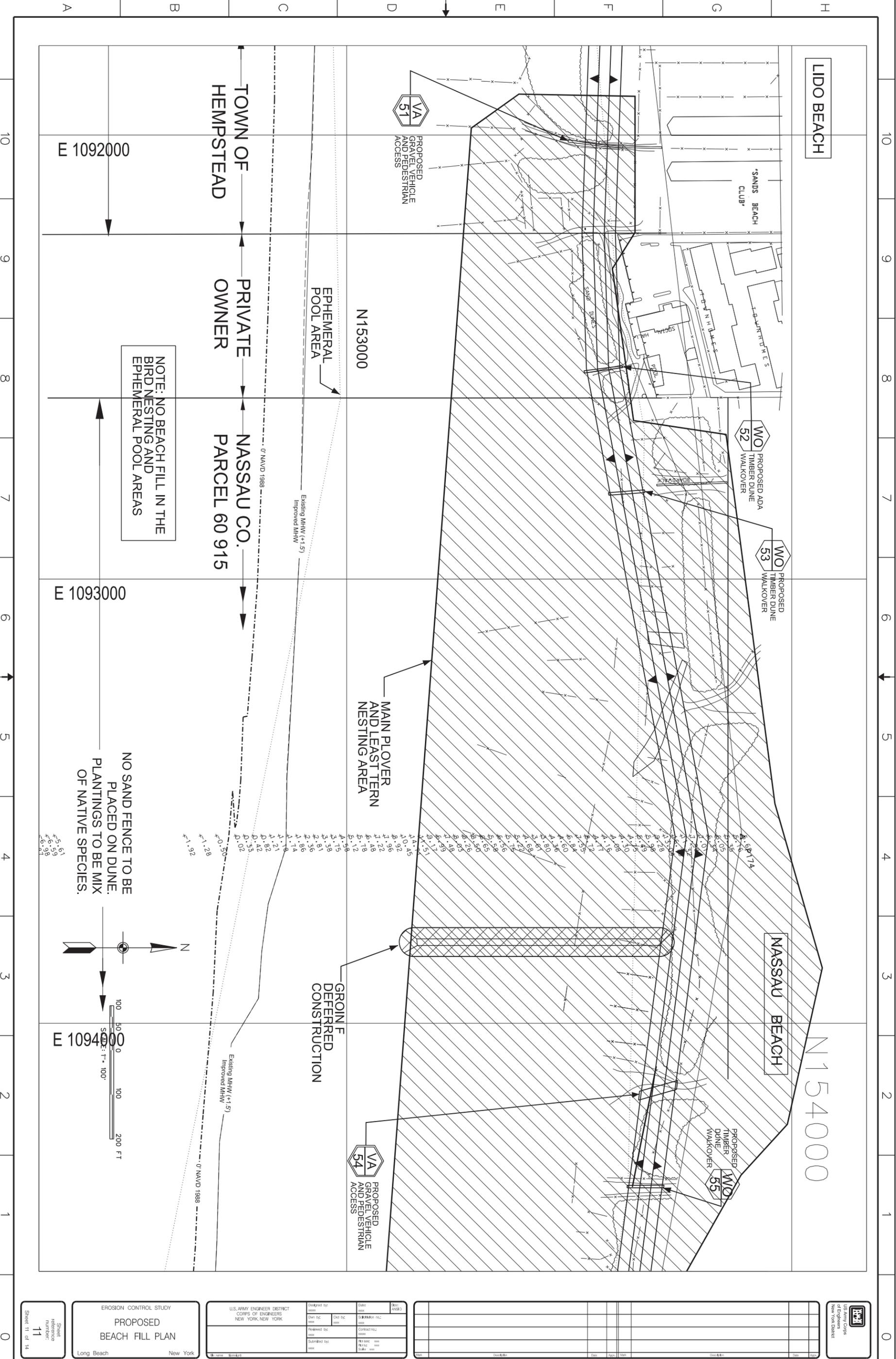
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U.S. ARMY CORPS of Engineers New York District	Designed by Date:	Checked by Date:	Drawn by Date:
	Reviewed by Date:	Contract no. Date:	Revises no. Date:
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK		Title:	
EROSION CONTROL STUDY PROPOSED BEACH FILL PLAN		Description:	
Long Beach New York		Date:	
Sheet reference number: 10 Sheet no. of 14		Date:	

Figure 23

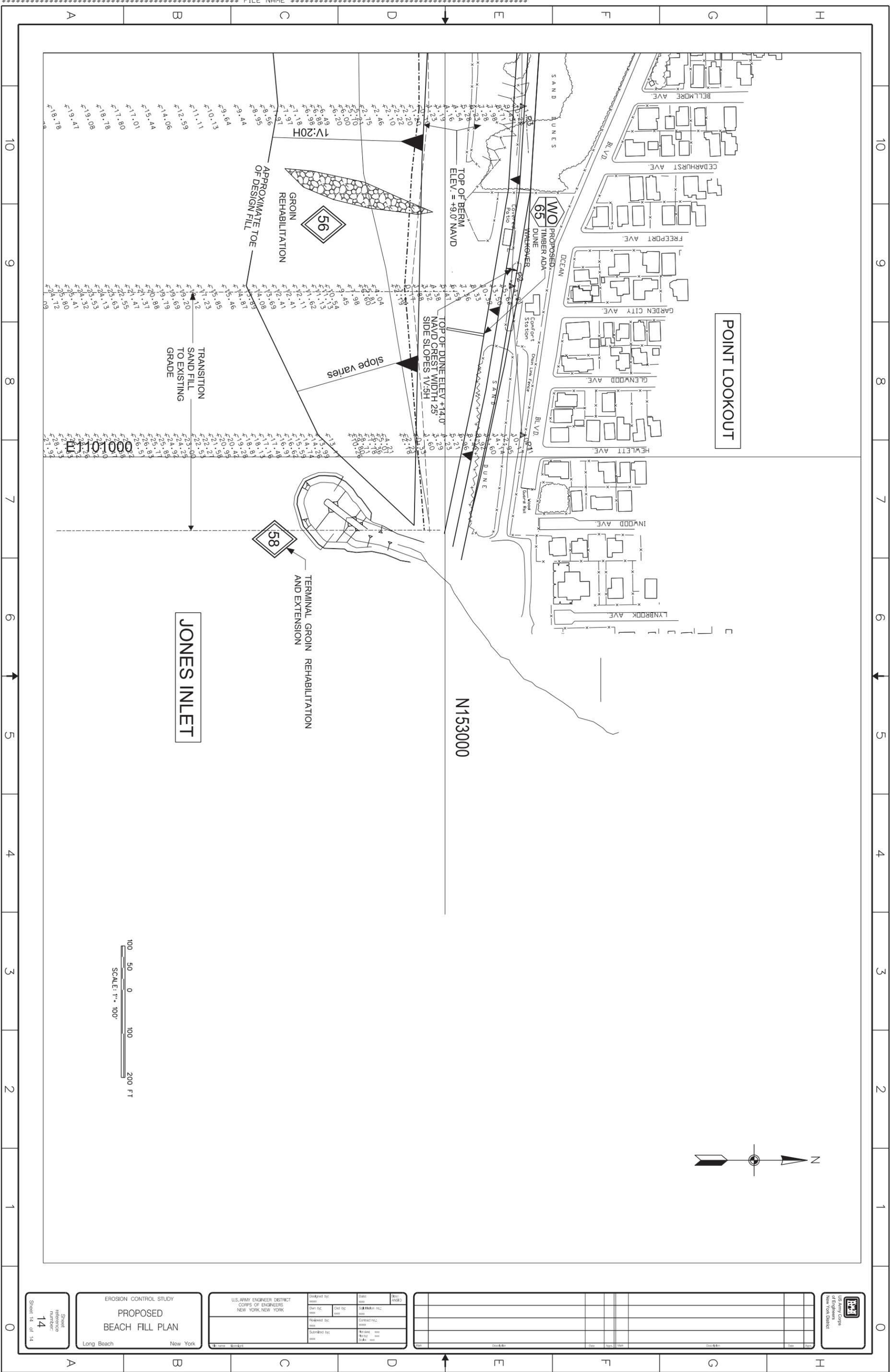


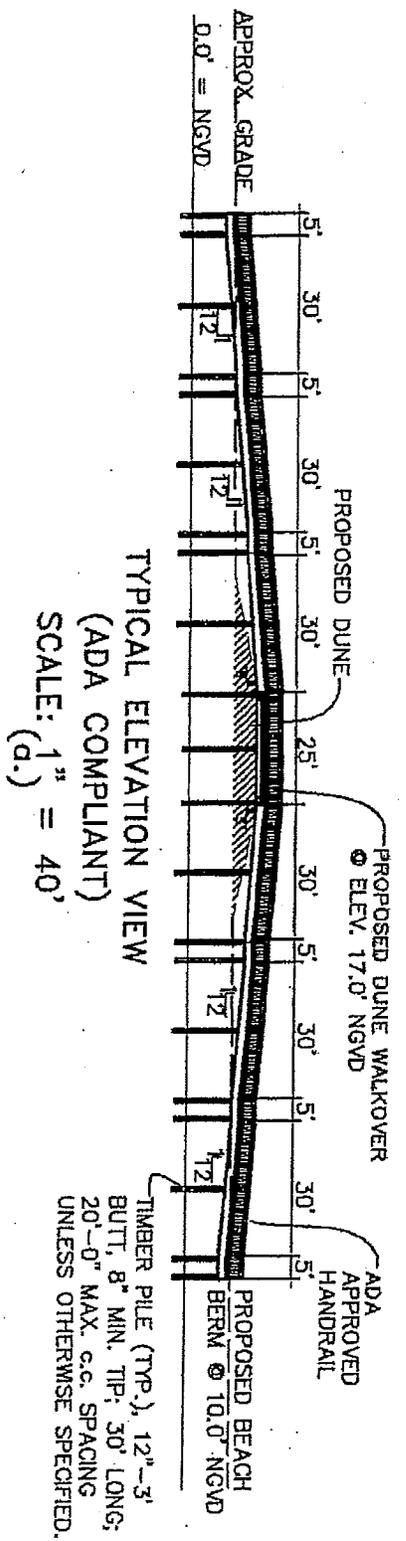
<p>US Army Corps of Engineers New York District</p>	<p>Designed by: [] Drawn by: [] Checked by: [] Date: []</p>	<p>Contract no.: [] No. of sheets: [] Sheet no.: []</p>	<p>Disc: [] Station: [] Date: []</p>	<p>Sheet reference number: 11 Sheet 11 of 14</p>	<p>EROSION CONTROL STUDY PROPOSED BEACH FILL PLAN Long Beach, New York</p>	<p>U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK</p>

Figure 24

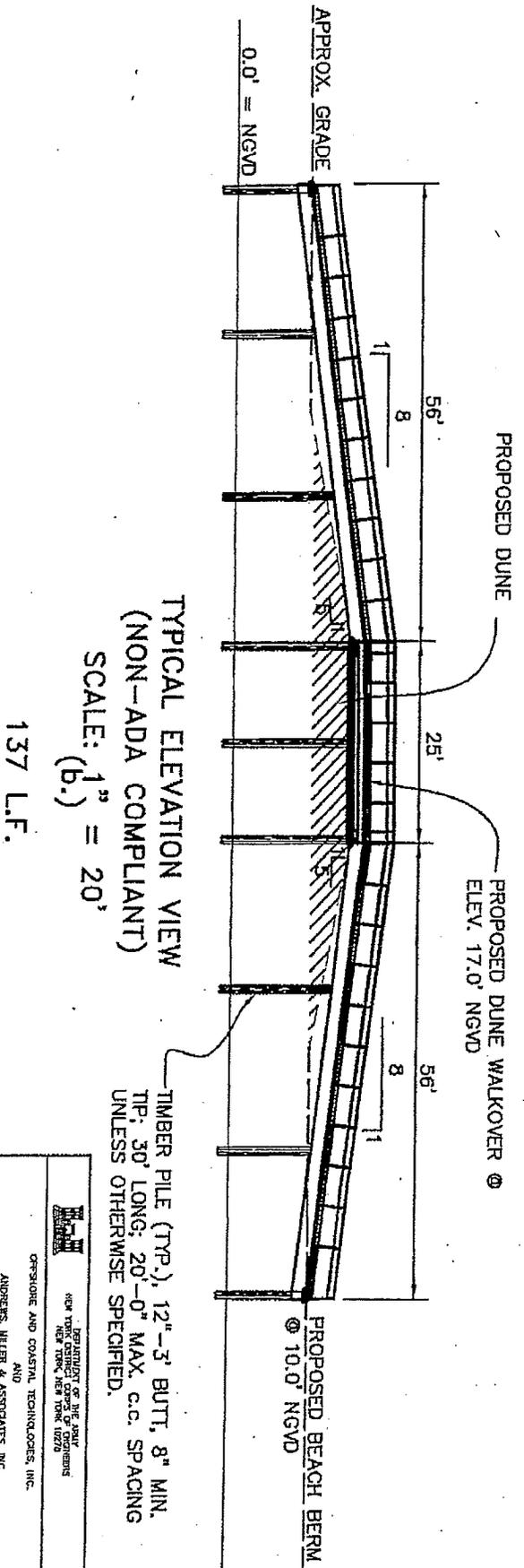
Figure 27

Submitted by: USERNAME Plot Date: DD-MMM-YYYY HH:MM
 FILE NAME



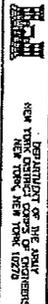


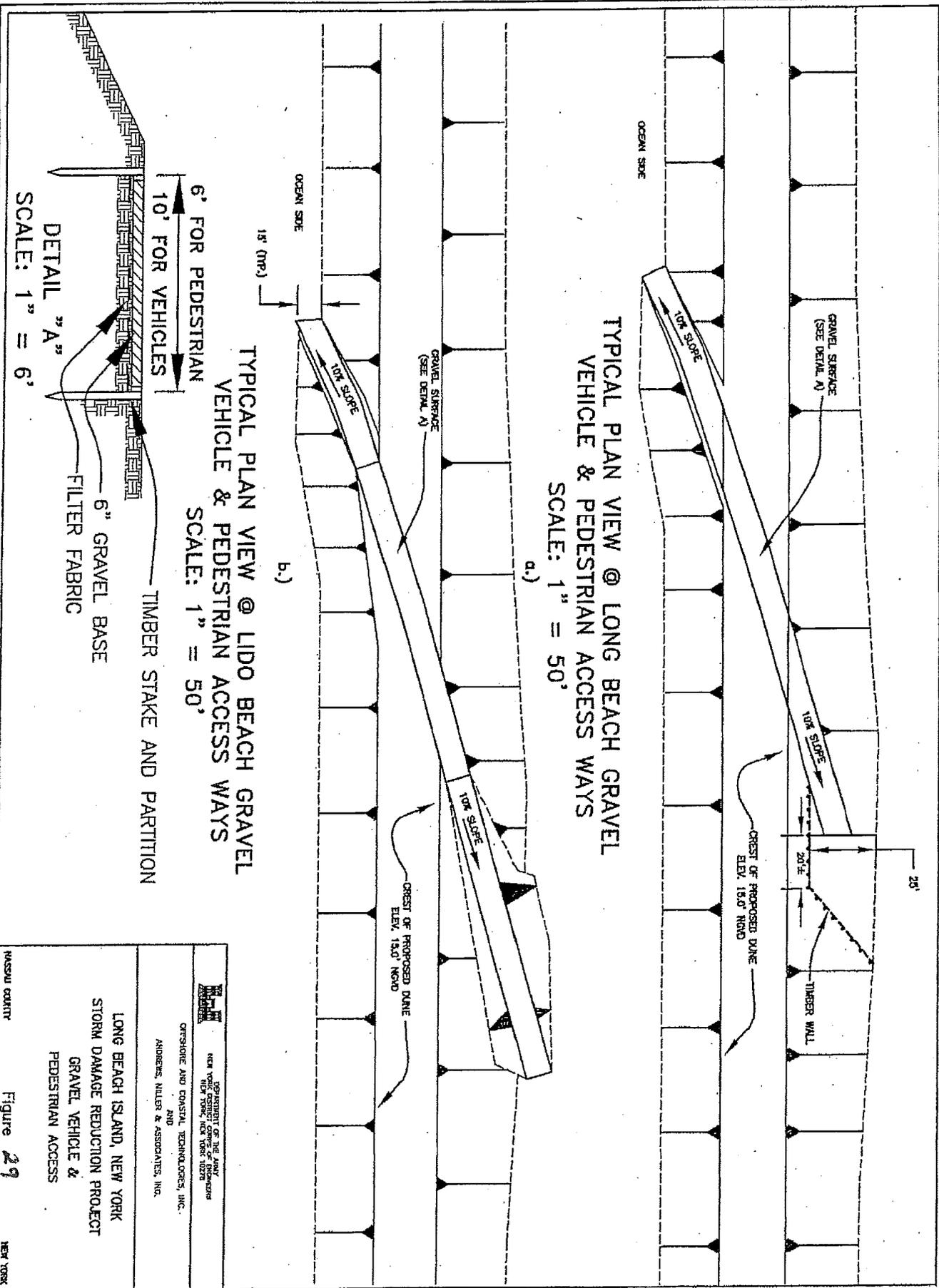
TYPICAL ELEVATION VIEW
(ADA COMPLIANT)
SCALE: 1" = 40'
(d.)



TYPICAL ELEVATION VIEW
(NON-ADA COMPLIANT)
SCALE: 1" = 20'
(b.)
137 L.F.

TIMBER PILE (TYP.), 12"-3" BUTT, 8" MIN. TIP, 30' LONG; 20'-0" MAX. C.C. SPACING UNLESS OTHERWISE SPECIFIED.


DEPARTMENT OF THE ARMY NEW YORK DISTRICT OFFICE OF ENGINEERS NEW YORK, NEW YORK 10004
OPRESHORE AND COASTAL TECHNOLOGIES, INC. AND ANDREWS, WELER & ASSOCIATES, INC.
LONG BEACH ISLAND, NEW YORK STORM DAMAGE REDUCTION PROJECT TYPICAL TIMBER PEDESTRIAN DUNE WALKOVER
HASSAU COUNTY Figure 28 NEW YORK



	DEPARTMENT OF THE ARMY NEW YORK DISTRICT OFFICE OF ENGINEERS 1015 FORT MONROE, NEW YORK 10783
	OFFSHORE AND COASTAL TECHNOLOGIES, INC. AND ANDERSON, NIELER & ASSOCIATES, INC.
LONG BEACH ISLAND, NEW YORK STORM DAMAGE REDUCTION PROJECT GRAVEL VEHICLE & PEDESTRIAN ACCESS	
HANSAU COUNTY	Figure 29 NEW YORK



50 500 Feet



100 200 300 Meters



= Main plover and least tern nesting area



= Ephemeral Pool Area
Avoid Sand Placement in this Area.
Reassess during nourishment cycles.

Long Beach Ephemeral Pool
Figure 30

